SERS
Site Environmental and Remediation Services

Detailed Site Investigation for Potential Soil and Groundwater Contamination 333 High Street/11 Montreal Street, Fremantle Western Australia

PREPARED FOR:

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Abbreviations

AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
AST	Above ground storage tank
bgl	Below ground level
BTEX	Benzene, toluene, ethylbenzene, xylenes
btoc	Below top of casing
CBD	Central Business District
CSM	Conceptual Site Model
DEC	Department of Environment and Conservation
DoW	Department of Water
DSI	Detailed Site Investigation
EC	Electrical conductivity
EIL	Ecological Investigation Level
EPA	Environment Protection Authority
GSWA	Geological Survey of Western Australia
HIL	Health Investigation Levels
IL	Investigation Levels
LOR	[Laboratory] Limit of reporting
MS	Matrix spike
NATA	National Association of Testing Laboratories
N/A	Not applicable
ND	Not detected
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measures
OC	Organochlorine [pesticide]
OP	Organophosphorus [pesticide]
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PID	Photo-ionisation detector
PSI	Preliminary Site Investigation
QA/QC	Quality assurance/Quality control
RPD	Relative percentage difference

SAP	Sampling and Analysis Plan
SERS	Site Environmental & Remediation Services Pty Ltd
SVOC	Semi-volatile organic compound
TDS	Total dissolved solids
TP	Trial pit
TPH	Total petroleum hydrocarbon
PVC	polyvinyl chloride
US EPA	United States Environmental Protection Agency
UST	Underground storage tank
VOC	Volatile organic carbon

Executive Summary

Site Environmental & Remediation Services (SERS) were engaged by Main Roads Western Australia (the client) to conduct a Detailed Site Investigation (DSI) consisting of soil and groundwater sampling and analysis at 333 High Street and 11 Montreal Street, Fremantle (the Site).

It is the intention of the client to purchase the Site from the current owner in order to facilitate the High Street Upgrade project.

The General objectives of the DSI were to:

- Determine the potential of soil or groundwater impacts at the site to exceeded relevant assessment levels and thus have the potential to result in the risk of harm to the environment or human health;
- Establish the physical distribution of contamination (if identified);
- Establish the potential for groundwater contamination to migrate off-site (if identified);
- Assess the potential risk to the environment and/or human health through the development of a Conceptual Site Model (CSM);
- Report the findings in accordance with DER reporting guidelines; and
- Identify further sampling requirements and/or remedial and management activities.

The following components were undertaken as part of this DSI:

- Review of relevant information relating to the Site
- Review of previous Site reports and documents.
- Undertake fieldworks as per the Sampling and Analysis Program (SAP) produced by SERS.
- Undertake an intrusive site investigation to establish ground conditions and facilitate the collection of representative soil and groundwater samples.
- Laboratory testing to complement the in-situ testing data obtained during the investigation.
- Characterisation of soil and groundwater.
- Assessment of the contamination status of the Site by Generic Quantitative Risk Assessment, (GQRA) and to recommend any further works or remedial requirements associated with the redevelopment of the Site.
- Preparation of a DSI report.

Summary of Field Investigation

A total of 15no. soil bores were and 3no. groundwater bores were installed and 6no near surface asbestos samples were undertaken as part of this DSI.

The ground conditions encountered in the exploratory holes are generally described as Fill generally consisting of orange brown sand to an approximate depth of 3.00m bgl underlain by natural red/brown/orange sand. Weathered limestone was recorded at various depths across the site (0.3-7.5m bgl). This variation in depth is likely to represent solution features in the form of limestone pinnacles. Groundwater was recorded within the unconfined aquifer approximately between 24.0m to 25.0m bgl to an unproven depth.

Summary of Contamination Assessment

Based upon the investigations performed to date no potential pollutant linkages have been identified within the underlying soils or groundwater which could be a risk to human health or the wider environment.

Conclusions

On the basis that pollution Linkages exist in relation to the site and the identified receptors; in accordance with Section 11 of the CS Act 2003 and DEC guidelines 'Reporting of Known Or Suspected Contaminated Sites' (DEC, 2006), it is recommended that the Site be considered as 'Not Contaminated – Unrestricted Use' by the DEC.

1 Introduction

Site Environmental & Remediation Services (SERS) were engaged by Main Roads Western Australia (the client) to conduct a Detailed Site Investigation (DSI) consisting of soil and groundwater sampling and analysis at 333 High Street and 11 Montreal Street, Fremantle (the Site). The location and boundary of the site are presented as Figure 1 and Figure 2 within Appendix A.

It is the intention of the client to purchase the Site from the current owner in order to facilitate the High Street Upgrade project.

1.1 Site Details

The Site is located on the corner of High and Montreal Streets, approximately 2km east of the Fremantle CBD. 333 High Street has been occupied by a service station for a period of 38 years, between 1966 and 2004. In 2004 the service station was redeveloped into a Muzz Buzz drive-through coffee shop and the former Service Station buildings also currently house a dry-cleaning drop off centre and a mechanical workshop. The area to the rear of the service station (11 Montreal Street) has served historically as a car sales yard and a hire business. The area currently serves as storage for a boat.

1.2 Proposed Development

The client wishes to purchase the land to expand High Street as part of the Leach Highway (High Street) upgrade project.

1.3 Objectives

The general objective of the DSI is to assess in accordance with the requirements of the DER *'guidelines for reporting on site assessments* (DEP 2001)', the potential environmental condition of the site based on current and historical land use. The specific objectives were to:

- Determine the potential of soil or groundwater impacts at the site to exceeded relevant assessment levels and thus have the potential to result in the risk of harm to the environment or human health;
- Establish the physical distribution of contamination (if identified);
- Establish the potential for groundwater contamination to migrate off-site (if identified);
- Assess the potential risk to the environment and/or human health through the development of a Conceptual Site Model (CSM);
- Report the findings in accordance with DER reporting guidelines; and
- Identify further sampling requirements and/or remedial and management activities.

1.4 Scope of Works

The following components were undertaken as part of this DSI:

- Review of relevant information relating to the Site
- Review of previous Site reports and documents.
- Undertake fieldworks as per the Sampling and Analysis Program (SAP) produced by SERS.
- Undertake an intrusive site investigation to establish ground conditions and facilitate the collection of representative soil and groundwater samples.
- Laboratory testing to complement the in-situ testing data obtained during the investigation.

- Characterisation of soil and groundwater.
- Assessment of the contamination status of the Site by Generic Quantitative Risk Assessment, (GQRA) and to recommend any further works or remedial requirements associated with the redevelopment of the Site.
- Preparation of a DSI report.

The DSI was undertaken in general accordance with guidelines published under the Contaminated Sites Act 2003.

1.5 Previous Investigations/Reports

SERS was provided with one Environmental Report concerning the Site and has previously completed a Preliminary Site Investigation for the entire Leach Highway (High Street) upgrade project.

- OTEK, 2004, Environmental Site Assessment Report (Reference: P003 Report revised.doc/V (6), [dated 2000]).
- SERS, 2013 Preliminary Site Investigation for High Street Upgrade Project (Reference: 1312_442_AH_020413_Rev1)

2 Site Identification

2.1 General

Copies of the Certificate of Titles are presented within Appendix B. A summary of the site identification information is presented within the table below (Table 2.1).

Table 2.1 – Summary of Site identification Information

Local Government Authority	City of Fremantle
Current Zoning	Local Centre
Site Location:	333 High Street/11 Montreal Street, Fremantle, WA
Title Identification:	Lot 8 on Diagram 26574: Volume 1249, Folio 554
Current Ownership:	Ludlands Nominees Pty Ltd
Site Northwest Corner	-32.050814, 115.765286
Site Southeast Corner	-32.05122, 115.765689
Current Landuse:	Coffee Shop, Drycleaners and Mechanics

2.2 Site Description

The Site layout is shown in Figure 3, Appendix A. Photographic plates of the Site are shown in Appendix C. The Site is approximately rectangular in shape. The northern section of the Site is occupied by a drive through coffee shop, dry cleaning drop-off and a mechanical workshop (Plates 1-3). It is largely covered with bitumen with minor landscaped areas. A building is present in the centre of the western portion of the Site which is occupied by the three business and a small building located under the canopy utilised by the drive-through coffee business. A narrow path is present behind the building (Plates 4).

The area to the rear of the building is elevated approximately 0.8m AHD above the front of the block with a heavy limestone wall separating the area from the main service station. There is an unsealed area vegetated with weeds behind the building (Plates 5-6). A small deserted office is present near the south-western corner of the Site and the remaining portion of the Site is sealed in bitumen (Plates 7-8).

2.3 Surrounding Land-use

The Site is bound immediately to the north and east by sealed roads and by residential properties to the south and west. Beyond this the land to the north and west is used for residential purposes while land to the east is used as a golf course, encompassing a community centre (Fremantle Environmental Resource Network [FERN]). Light industrial premises occupy land approximately 200m south of the Site.

2.4 Zoning

The site within Current planning zone of 'Residential' under City of Fremantle's Local Planning Scheme LPS4 and as Urban under the Metropolitan Regional Scheme.

The surrounding areas are zoned roads, residential, parks and recreation and development under The City of Fremantle's Local Planning Scheme LPS4.

2.5 Site Reconnaissance

SERS conducted a visual inspection of the site and adjacent areas on 22 April 2013. The following aspects were identified during the visit and are shown in Photographic plates in Appendix C:

- All outdoor areas within the site boundary were accessible with the exception of a small area beside the mechanical workshop which was blocked by vegetation;
- The majority of the site was covered in bitumen and concrete. The bitumen in the northern area of 333 High Street was mostly intact while the bitumen on 11 Montreal Street was partly weathered;
- There were silt drains visible in front of the mechanical workshop and in the north-eastern corner of the block (Plates 9-10);
- The rear section of the Site housed a large boat, two derelict cars and various other deposited rubbish (Plates 11-12);
- Chemical storage was identified behind the mechanical workshop, including a waste oil storage tank, triple interceptor tank (TIT). Several drums and other materials were also identified near the former hire shop office (Plates 13-16);
- A poly-aromatic hydrocarbon sheen was observed in the hardstanding area occupied by the waste oil storage tank;
- Topography was identified to be low relief with the exception of ingress and egress areas which sloped steeply towards the road;
- Limited vegetation was present across the site; and
- Asbestos fragments were identified behind the building in the walkway, these appear to have come from the eaves of the building (Photos 17-18).

3 Site History

3.1 Summary of Site History

Information on the Site history was derived from the following sources and tasks:

- Certificates of title from Landgate
- A review of historical aerial photographs taken between 1953 and 2012, held by Landgate, and;
- Information relating to suspected and known soil and groundwater contamination from the DER Contaminated Sites Database.

Data presented within Table 3.1 provides a summary of the known history of the site.

Table 3.1 – Summary of Known site history

Year	Site Status
Prior to 1966	The area is used as a residential property or small business
1966	A Service Station is developed on the Site, initially leased by Shell
1999	Liberty Oil takes over the lease of the Site
2004	Muzz Buzz takes over the lease of the Site and the Site use changes to coffee shop

3.2 Certificates of Title

All relevant Certificates of Title were sought from Landgate, attached in Appendix B. The tables below summarise changes in ownership over the course of development on the site.

Table 3.2 – Summary of Known site history

Date	Volume	Folio	Site owner	Plan or Diagram	Comment
1961	1249	554	Ludlands Nominees PTY LTD	26574	Leased to Shell 1966, Liberty 1999, Muzz Buzz 2004
1922	795	89	Penelope Thompson	26574	
1947	1098	630	Cordelia Avonia Fladelar	26574	Widow
1902	248	47	Sarah Ann McKenzie		
1900	193	24	Sarah Ann McKenzie	26574	

Date	Volume	Folio	Site owner	Plan or Diagram	Comment
1898	124	149	Mary Ann Kerr and Edard James Wakeman	26574	Crown

In summary, the land appears to have been purchased by Ludlands Nominees Pty Ltd in 1961 and leased to Shell in 1966.

3.3 Review of current and historical aerial photographs

Available historical aerial photographs date from 1948. A selection of the most pertinent historical aerial photographs of the site and surrounding area are presented in Appendix C.

Table 3.3. Development on and around the Site between 1948 and the present.

Date	On-site Development	Development on surrounding land
12th December1947	The Site is occupied by a building, however it is not the current building. The building is different to other residential properties in the area which may indicate an earlier residential property or a business of some kind. The southern portion of the property (11 Montreal) is clear	Land to the north and west are in use as a residential areas. Land to the south and east appear clear.
27th November 1953	Land-use at the area of the site appears unchanged from the 1947 aerial.	Surrounding land use appears unchanged from the 1947 aerial
11th March 1965	The current building is visible on Site. The majority of the Site appears paved in hardstand and the southern portion of the Site appears unsealed	Surrounding land-use appears unchanged, with the exception of development of residential premises to the south of the Site.
6th September 1974	Land-use at the site does not appear to have changed since 1965 with the exception of the sealing (with hardstand) of the southern portion of the Site. 11 Montreal Street appears to be in use as a car yard.	The surrounding area appears unchanged with the exception of the presence of a minigolf course on the eastern corner of Montreal and High Streets.
19th June 1985	Land-use at the site does not appear to have changed since 1974.	Surrounding areas appear unchanged from the 1974 aerial.
6th February 1995	Land-use at the site does not appear to have changed since 1974.	Surrounding areas appear unchanged from the 1974 aerial.
16th March 2006	Due to the change in markings on the hardstand it is apparent the Site use has been changed to the current use as a drive through coffee shop. The rear of the	The surrounding area appears to be unchanged with the exception of the minigolf centre which has changed use to a community garden.

Date	On-site Development	Development on surrounding land
	Site and 11 Montreal Street appear to be in use for storage of unidentifiable materials.	
29th January 2013	The Site appears unchanged from the 2006 aerial with the exception of the rear portion of the Site and 11 Montreal Street which appear to house a boat..	The surrounding area appears generally unchanged.

3.4 Inventory of chemicals, identified potential contaminants, wastes and by-products

A summary of the chemicals and other potential contaminants associated with previous site use i.e. service stations and market gardens are listed in the below tables.

Table 3.4. Potential contaminants of concern associated with service station activities (as per DER guidelines 2004).

Activity	TPH	BTEX	Solvents	Resin	Heavy metals	PAHs	Acids	Alkalis	Cyanides	Phenols	CFCs	Chlorinated hydrocarbons	Oil and grease
Motor Vehicle workshops	x	x	x	x	x	x							
Oil or gas production, refining and storage	x	x			x		x	x	x				
Automotive repair	x	x	x		x (Cu, Cr, Pb, Zn)		x	x		x	x		
Service stations and fuel storage facilities[1]	x	x			x (Pb)	x				x		x	x

1. *Chemical contaminants listed by industry type* (AS3382.1 – 2005)

3.5 Previous Environmental Investigations conducted

A timeline of previous sampling and analysis conducted is as follows.

OTEK, 2004, Environmental Site Assessment Report (Reference: P003 Report revised.doc/V (6), dated 2000).

The OTEK report detailed infrastructure on site as including:

- underground storage tanks (USTs) (formerly used for the storage of petroleum, diesel and waste oil),
- bowsers and associated pipework,
- an above ground storage tank, and
- Triple interceptor tanks (TIT).

Prior to the OTEK investigation the bowsers had been removed however the USTs were not removed and are still present on site. Figure 3 (Appendix A) shows approximate location of the USTs as reported by OTEK.

Six bore holes were drilled, as part of the OTEK investigation, to a maximum of 6m bgl with six of the samples being submitted for laboratory analysis. Six samples were analysed for benzene, toluene, ethylbenzene and xylene (BTEX) and total petroleum hydrocarbons (TPH), two for heavy metals and one for polyaromatic hydrocarbons (PAH).

Concentrations of chromium exceeded the current DER EIL guidelines for hexavalent chromium however no speciation was conducted. All PAH concentrations were below laboratory investigation levels and all other metals and TPH and BTEX concentrations were below relevant EILs and HIL-A.

No groundwater monitoring was conducted as part of the investigation.

Sample locations are shown on Figure 3, Appendix A.

SERS, 2013 Preliminary Site Investigation for High Street Upgrade (HSU) Project

SERS conducted a Preliminary Site Investigation of the HSU project area spanning from East Street in the west to Absolon Street in the East and from George Street in the North to Stevens Street in the south. The report provided a desktop study of the area. Findings included:

- Booyeembara Park has been identified as the nearest ecological receptor to the HSU project area.
- The underlying geology consists of yellow brown medium coarse Sand (derived from Tamala Limestone) underlain by Tamala Limestone.
- The HSU project area is underlain by an unconfined aquifer which generally flows in a westerly direction.
- Due to the high permeability of the superficial sands and Tamala Limestone the HSU project area is susceptible to contamination migration.
- Groundwater is utilised across and within close proximity of the HSU project area for irrigation.
- The HSU project area is not within an acid sulphate soils risk area.
- Vegetation across the HSU project area is considered to be in a good condition.

Findings in relation to 333 High St included:

- The former petrol service station on the corner of Montreal Street has the potential for hydrocarbon contamination to exist associated with the spillage and leakage of fuels and oils. Due to the nature of fuels and oils potential exists for vapour production, and
- Areas formerly supporting development have the potential to contain asbestos material.

Possible pollution linkages related to 333 High St included:

- There is the potential for human inhalation of any volatile vapours associated with spillages/leakages at the petrol service stations; chemical/fuel storage and land fill materials. The vapours may migrate through the underlying permeable geology and into any future excavations which may occur.
- Asbestos materials present in the building footprint have the potential for human inhalation through disturbance.

Recommendations in relation to 333 High St included:

- Intrusive soil and groundwater investigations are undertaken at the former Petrol Service Station located on the corner of High and Montreal Streets in order to characterise the underlying ground conditions and any associated environmental risks which may be present.

3.6 Product spill and loss history, environmental discharges and disposal locations

The Site has been held by the current owner since 1961, prior to the development of the Site as a service station. The Site has been leased to various petroleum companies during this time (Shell, Liberty). The owner has reported no knowledge of spills or environmental discharges during his possession of the Site.

The USTs are still present on Site however are believed to have been emptied and cleaned prior to 2011.

3.7 Potential Fill On Site

There is no historical evidence of onsite fill.

3.8 Mineral Extraction

There is no evidence of mineral extraction on Site, however from examining historical aerial photography and information provided by the City of Fremantle, limestone extraction occurred within the footprint of Booyeembara Park (500m south of the Site) between 1965 and 1985.

3.9 Landfill and Waste Management Activity

Within the surrounding area (a radius of 250m from the site boundary) there are no current or historically active landfill sites.

A report prepared for the City of Fremantle on Knutsford Street East (Masterplan Consultants WA PTY LTD 2006) stated that the area now occupied by Booyeembara Park was formerly used by the City of Fremantle as a sanitary landfill site. Ecoscape (2000) states that the deepest part of the quarry was located at the eastern point near the Royal Fremantle Golf Course and that the quarry accepted bulk wastes such as building rubble and tree loppings. According to Ecoscape (2000) a 300-600mm layer of sand was placed on the site in the early 1990s.

3.10 DER Classified Contaminated Sites

A basic summary of Records for the Site was requested by SERS. The DER reported that the Site has not been classified and holds no information on the Site.

A search of the database revealed that 20 classified sites are present within a 1km radius of the Site. They are all located approximately 400m southwest of the Site.

3a, 3b, 3c, 5 and 7 Blinco Street are classified as "*Remediated for Restricted Use*". The site, formerly used as a landfill, contains heavy metals exceeding the HIL's for residential use with minimum soil access. The impacted soil is located from 1m bgl to 5.5m bgl and is covered by a geo-fabric warning barrier and a 1m cap of clean soil. Groundwater use is restricted, however no investigations have occurred due to groundwater depth and conditions.

Lots 1186-1190 Knutsford Street, Lots 1191, 1192, 1197-1200, 1207, 1208, 1213-1215 and 1725 Amherst Street are classified as "*Contaminated-Remediation Required*". The site formerly housed the Bunker Oil Terminal. Soils contain petroleum hydrocarbons and lead exceeding EILs and HILs for residential development. Groundwater contains phase separated hydrocarbons and dissolved phase petroleum hydrocarbons exceeding Drinking Water and Marine water criteria. Groundwater from this site has been found to be migrating under Lots 10-12 Chalmers and 1048 Knustford to the northwest and under Lots 1737 and 1354 Knutsford.

Lots 10-12 Chalmers and 1084 (18) Knutsford Street are classified as "*Contaminated-Remediation Required*" The site is impacted from the nearby former Bunker Oil Storage Site. Soils contain petroleum hydrocarbons and lead exceeding EILs and HILs for residential development. Groundwater contains phase separated hydrocarbons and dissolved phase petroleum hydrocarbons exceeding Drinking Water and Marine water criteria. Groundwater

from this site has been found to be migrating under Lots 10-12 Chalmers and 1048 Knustford to the northwest and under Lots 1737 and 1354 Knutsford.

Lots 1737 Knutsford Street and 30 Swanbourne Street are classified as "*Contaminated-Remediation Required*" The site was formerly a Fuel Oil Storage and Distribution depot. Soil has been found to have concentrations of PAH, petroleum hydrocarbons, chromium, lead and zinc exceeding EILs and HILs. Groundwater containing dissolved phase hydrocarbons is believed to be migrating from the Bunker Oil site to the east.

Lot 1354 (20) Knutsford Street is classified as "*Remediated for Restricted Use*". The site was formerly used as a maintenance depot and soils were impacted with metals, pesticides and hydrocarbons exceeding guidelines. Soil remediation was undertaken prior to 2006. In 2007 groundwater containing dissolved phase hydrocarbons, believed to be migrating from the Bunker Oil Site to the south, was identified. Due to the depth of groundwater the site has been classified as suitable for residential dwellings with restrictions on groundwater use.

Lot 1995 Stevens Street Fremantle (Booyeembara Park) is classified as "*Potentially contaminated-Investigation Required* The site was reported due to unregulated landfilling for 20-30 years and visual indications of asbestos sheeting.

3.11 Details of Relevant Licenses

3.11.1 Department of Mines and Petroleum Freedom of Information Search

A FOI request was submitted to the Department of Mines and Petroleum. A licence to store dangerous goods was held by occupants of the Site between 1970 and 2004 for the fuels listed in table 3.12.1.

Table 3.11.1 .Fuel licence held for 329 (333) High Street

Property	Licenced Goods	Quantity	Dates of Licence/Notes
Liberty Oil 333 High Street Fremantle (Now Muzz Buzz)	LPG Gas	8 kL	1970-2004: Included note saying tanks had been emptied but still insitu.
	Petrol	105 kL	
	Diesel	20 kL	

There was no evidence of any current or historical trade waste agreements for the site.

3.12 Freedom of Information Searches

3.12.1 Department of Water Freedom of Information Search

A Freedom of Information request was sent to the Department of Water. Two reports were supplied regarding bores in North Fremantle and Fremantle Port however information was deemed irrelevant to this study.

3.12.2 City of Fremantle Freedom of Information Search.

A Freedom of Information request was sent to the City of Fremantle. No information was received regarding the Site.

3.12.3 Heritage

A review was conducted of the Aboriginal Heritage Inquiry System. The Site is not registered as having any known links to aboriginal heritage.

3.12.4 Department of Environmental Regulation

A detailed summary of records was requested from the Department of Environmental Regulation. The Department reported no information related to the Site.

3.13 Integrity Assessment of Information

The bulk of historic information presented in this DSI was obtained from the following sources:

- OTEK, *Environmental Site Assessment* (2004).
- Landgate
- Department of Water
- Department of Mines and Petroleum
- Department of Environment Regulation
- City of Fremantle

It is considered that information from the above sources is of a high degree of integrity as they are generally source documents.

3.14 Summary

Areas identified through the historical review that may potentially contain contamination include:

- USTs and TIT are still present beneath the service station however the USTs are believed to have been emptied. Previous investigations have found no evidence of hydrocarbon impacts however no groundwater monitoring was conducted
- A workshop is still present onsite and soil staining is evident in the vicinity.
- The rear of the property has housed a car sales yard and hire business but has generally remained unused.

4 Environmental Setting

The following information has been extracted from the Perth Metropolitan Region 1:50,000 Environmental Geology Series 'Fremantle' Map (sheets 2033 I & IV, dated 1985) and the Perth Groundwater Atlas (DoW 2004).

4.1 Topography

According to the Perth Groundwater Atlas (DoW, 2004), the Site slopes from south to north, ranging from about 24.5m AHD to 22.5m AHD.

4.2 Geology

4.2.1 Soils

Surface geology is described in the Perth Metropolitan Region 1:50,000 Environmental Geology Series 'Fremantle' Map (sheets 2033 I & IV, dated 1985) as a pale yellowish brown, medium coarse grained highly permeable sand derived from Tamala Limestone.

4.2.2 Solid Geology

Information presented within the Perth Metropolitan Region 1:50,000 Environmental Geology Series 'Fremantle' Map (sheets 2033 I & IV, dated 1985) indicates that the underlying solid geology consists of Tamala Limestone. The limestone is principally a lithified eolian calcrenite with shelly lenses interbedded with layers of weathered sand/sandy clay and rare pockets of bright white chalk.

4.2.3 Acid Sulphate Soils

According to the Acid Sulphate Soil (ASS) risk maps provided by the CSIRO mapping system Australian Soil Resource Information System (ASRIS) the Site is classified as having no known risk of ASS occurring within 3m of natural soil surface (or deeper). The acid sulphate soil map for the HSU area is presented as Figure 4 within Appendix A.

4.3 Hydrogeology

The major groundwater resources in the area are in the aquifers of the Perth Basin and are used extensively for irrigation.

The Perth Groundwater Atlas indicates the regional groundwater flow direction in the unconfined aquifer is north-westerly towards the Fremantle Harbour and Indian Ocean Beyond. Based on information presented within the Department of Water website, groundwater is expected to be approximately 23m bgl (1m AHD). The base of the superficial aquifer is expected to be approximately 54m bgl (-30m AHD).

From information provided by the Department of Water, the site is not situated within a Public Drinking Water Source Area (PDWSA).

4.3.1 Groundwater Supply Bores

36no. groundwater bores are registered upon the Department of Water WIN database within a 1km radius of the Site. Bore records supplied by the Department of Water (DoW) are presented as Appendix E. Bore locations are presented as Figure 5 within Appendix A and a summary of data available for registered bores in the High Street Upgrade Study area are presented within Table 4.2.1.

Table 4.2.1 – Summary of Bore Usage

Borehole ID	Owner	Depth (m bgl)	Use	Water Level (m bgl)
61615841	Government Owned	55.80	Irrigation	Information not provided
61601132	Government Owned	56.40	Irrigation	Information not provided
61402397	Royal Perth Golf Club	63.00	Irrigation	Information not provided
61402403	Royal Perth Golf Club	33.60	Irrigation	Information not provided
61615546	Garden Nursery Bore	42.70	Irrigation	Information not provided
61611586	Government Owned	47.80	Monitoring Well	Information not provided
61601133	Government Owned	48.15	Irrigation	Information not provided
61642072	Private owner (Water Resources Licensing Linked)	Information not provided	Irrigation	Information not provided
61402282	Government Owned	44.00	Irrigation	Information not provided
61440091	Private owner (Water Resources Licensing Linked)	Information not provided	Irrigation	Information not provided
61440074	Private owner (Water Resources Licensing Linked)	Information not provided	Irrigation	Information not provided
61440075	Private owner (Water Resources Licensing Linked)	Information not provided	Irrigation	Information not provided
61642111	Private owner (Water Resources Licensing Linked)	Information not provided	Irrigation	Information not provided
61601965	Fremantle Cemetery	72.00	Irrigation	Information not provided
61615545	Government Owned	49.00	Irrigation	Information not provided
61642110	Government Owned	51.50	Irrigation	Information not provided

As per Department of Health and DER guidelines it is recommended that bore water is not consumed in areas of public piped water due to the risk of microbial contamination. Therefore it is unlikely that groundwater within the area is currently being consumed. Registered bores are reported as for irrigation and monitoring purposes.

From information presented within the Groundwater vulnerability to Contamination, Southern part of Perth Basin Map (Appleyard 1993), the Site area is mapped as having "high vulnerability" to contamination. This is owing to

the presence of highly permeable sand and limestone. Groundwater in this area is considered susceptible to contamination from agricultural, industrial and urban activities.

4.4 Hydrology

The Site area is generally covered in hardstanding and slopes from south to north, towards High Street. It is therefore believed that any stormwater runoff would run towards the road and enter the stormwater drainage system.

There are no surface water bodies onsite.

4.5 Potential Flood Risk

Due to its elevation and information provided within flood mapping produced by the DER the Site does not appear to be within an area susceptible to flooding.

5 Preliminary Conceptual Site Model

5.1 Introduction

A Conceptual Site Model (CSM) has been completed using information from desk based information and the previous investigations. The methods used in the CSM follow the DER Contaminated Sites Management Series risk-based approach, with the potential environmental risk assessed qualitatively using the 'source-pathway-target pollutant linkage' concept. For a Site to be designated as Contaminated Land a plausible linkage between the identified Sources, Pathways and Receptors must be demonstrated. The Preliminary CSM is shown graphically in Figure 5, Appendix A.

Overall, the Site setting is considered to be of low environmental sensitivity, due to the following reasons:

- The underlying aquifer is 23m bgl. The aquifer is used for irrigation and therefore considered as a minor water source in the area.
- There are no environmentally sensitive features within 300m of the site
- The intended Site use is as a highway/road.

5.2 Contamination Sources

Onsite sources identified:

- Potentially leaking USTs - fuel, diesel and oil;
- Potentially-leaking bowsers and fuel lines;
- The workshop,-any waste oil traps and/or wash-down sump areas, most likely in the area surrounding the workshop;
- Triple Interceptor Trap;
- Chemical Storage;
- Asbestos associated with buildings and infrastructure, and
- Pesticides beneath the former building footprint.

Offsite sources identified:

- Nearby light industrial area including the former Bunker Oil storage southwest of the Site, and
- Booyeembara Park (former landfilling south of the Site).

5.3 Pathways

The potential contamination pathways are considered to be as follows:

- Direct contact of the soil by current users, construction workers and future site users;
- Inhalation of asbestos or volatiles by current users, construction workers and future site users;
- Stormwater runoff;
- Infiltration through the building foundation by volatile organic compounds;
- Infiltration through water pipes located on site;
- Leaching of contaminants through the soil profile;

- Further leaching of contaminants to groundwater;
- Formation of contaminant plume in aquifer/s;
- Contaminants travelling off-site via groundwater plume;
- Residents (both on-site and neighbouring) accessing groundwater and suffering negative health impacts;
- Plume impacting down-gradient flora and fauna, and
- Plume impacting down-gradient surface water bodies and causing negative environmental health impacts.

5.4 Receptors

Relevant potential receptors are considered to include:

- Onsite construction and maintenance workers
- Future site users
- Neighbouring residents
- Aquifer
- Local wetlands
- Flora and Fauna.

6 Sampling and Analysis Plan

6.1 Soil Sampling Objectives and Strategy

The objectives of the soil sampling program are to assess the prevalence, composition of any potential soil contamination onsite. If contamination is identified works will be undertaken to delineate the extent of its impact.

6.1.1 Soil Sampling Locations

18no sampling locations, shown in Figure 4, were selected on a grid based system (using a herringbone pattern) with field judgement used to ensure that samples were taken in areas identified within the CSM as a potential source of contamination, and with sufficient distribution of the locations to facilitate the interpretation of site wide contamination issues. Some sample locations differ from the proposed location due to the location of services. The following rationale was used in the selection of the locations:

Table 6.1 – Soil Sampling and Analysis Plan

Sampling Areas	Potential Sources of Contamination	Analysis Suite							
		TPH	BTEX	PAH	Phenols	Metals	OC/OP	Asbestos	Total Cyanide
Service Station	Historic Filling, building construction						X	X	
Service Station	Chemical Storage/ refuelling activities	X	X	X	X	X			X
Garage	Maintenance of Vehicles	X	X	X	X	X			X
Site Wide	Off-site contamination migrating onto the site.	X	X	X	X	X			X

6.1.2 Soil Sampling Methodology

The co-ordinates of each sampling location were recorded using a hand held GPS (with an operating accuracy of +/- 3m). Samples were undertaken using a track mounted push-core drill rig as the site is currently active as a drive through coffee shop. Samples were generally collected to a maximum depth of 4.0 m bgl, which corresponds to the future development, at the following intervals:

- 0.00 to 0.30m.
- 0.30 to 0.60 m.
- 0.60 to 1.00 m.
- 1.00 to 1.50 m.
- 1.50 to 2.00 m.
- 2.00 to 2.50 m.
- 2.50 to 3.00 m.
- 3.00 to 3.50 m.
- 3.50 to 4.00 m.

Some exploratory holes were not able to achieve a depth of 4.00 mbgl due to the underlying strata (limestone) as such samples were collected until limestone was encountered.

Where geological boundaries did not conform to the sampling intervals, one sample was taken per strata with additional samples taken if visual or olfactory evidence of contamination was identified.

Recovered soils were inspected for signs of potential contamination, soil texture, soil appearance, the presence of ACM and were recorded on soil profile logs.

6.2 Groundwater Objectives and Strategy

6.2.1 General

The objectives of the groundwater sampling program were to assess the prevalence and composition of any potential groundwater contamination and to determine both groundwater levels and baseline water quality onsite.

6.2.2 Groundwater Sampling Locations

The sampling locations were selected to monitor potential contaminants migrating onto the site from an off-site source (up gradient of groundwater flow), monitor the impact of the site upon groundwater migrating off-site (down gradient of groundwater flow) and monitor the effect of potential contamination sources (such as chemical storage areas, vehicle refuelling and vehicle maintenance) upon groundwater underlying the site. As the Site is still active, groundwater locations were also selected so as not to interfere with traffic flow or prevent access to the businesses.

6.2.3 Groundwater Borehole Construction

Groundwater bores were installed in accordance with DoW guidance (*'Water Quality Protection Note – Groundwater monitoring bores'*, 2006) and Land and Water Biodiversity Committee, 2003 guidance *('Minimum Construction Requirements for Water Bores in Australia'*).

Due to the depth of limestone mud rotary drilling techniques were used. The drilling fluid used in the installation of groundwater bores was mains water and bentonite clay. The screening intervals were 9.00m in length to ensure that the groundwater interface was encompassed. The bores were screened using slotted 50 mm Class 18 PVC fitted with an end cap. The screen was packed with acid washed 1–3 mm gravel. A 0.5 m bentonite seal was placed 0.5m above the screen. The remainder of the annulus above the seal was backfilled with gravel and drilling cuttings. The bore in the functioning area was flush with ground level and finished with a steel lock cover, while the two bores in the rear portion of the Site were finished with upright lockable covers.

The soil profiles and borehole construction details were logged during construction.

The boreholes were developed by placing a submersible pump into the installation and pumped at a rate of 6.00 litres per second to prevent silt accumulation within the gravel pack and was continued until the water was clear. All groundwater that resulted from development discharge was collected and disposed of to an appropriately licensed facility. The groundwater bores were allowed to settle for at least one week prior to sampling.

To allow effective groundwater modelling the groundwater boreholes were accurately surveyed for position and elevation by a licensed surveyor.

6.2.4 Groundwater Monitoring and Sampling

Prior to groundwater purging and sampling, the groundwater level in each borehole were measured using an electronic multiphase depth meter. The groundwater levels will be used in the hydrogeological assessment of the site.

Groundwater was purged and sampled at less than 1 litre per minute using a low-flow pump. All groundwater collected from the purging process that was not collected for testing purposes was collected and disposed of to an appropriately licensed facility. An YSI multiparameter meter was used to measure pH, electrical conductivity

(EC), dissolved oxygen (DO) and temperature (groundwater indicators). Purging was undertaken until the field parameters were stable (generally within 10%).

The groundwater stabilisation data was recorded on groundwater sampling logs.

6.2.5 Analysis Program

The groundwater samples at each borehole location were taken to NATA accredited laboratories: MPL, Myaree (Primary laboratory) and ALS, Malaga (Secondary laboratory) for the analysis of TPH, BTEX, PAH, Phenols, Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), organochlorine pesticides and organophosphate pesticides (OC/OP) and total cyanide.

7 Fieldwork Results

7.1 Ground Conditions

The following ground conditions have been summarised from the SERS intrusive site investigation; further details are provided on the logs presented in Appendix D:

Table 7.1 – Summary of Soil Lithography

Stratum	Description	Typical Depth Encountered (m bgl)	Typical Thickness (m)	Notes on observed contamination	Locations Found
Surface	Asphalt/Concrete	Surface	0.1	Hydrocarbon staining noted at BH04	BH01, BH02, BH03, BH04, BH05, BH07,. BH09, BH10, BH11, BH12, BH13, BH14, BH15 and BH16.
SAND	Red/Brown/Orange	0.1 to 7.5	2.6	Minor visual evidence of contamination observed. (BH05, BH08, BH14)	BH01, BH02, BH03, BH04, BH05, BH06. BH07, BH08. BH09, BH10, BH11, BH12, BH13, BH14, BH15 and BH16.
Limestone	Beige	0.3 – 7.5	Not applicable	No visual or olfactory evidence of contamination observed.	BH01, BH02, BH03, BH04, BH05, BH06. BH07, BH08. BH09, BH10, BH11, BH12, BH13, BH14, BH15 and BH16.

7.1.1 Soil Field Observations

Minor visual evidence of contamination was noted during the fieldwork investigation.

Two layers of dark organic material were reported in BH05, minor rubbish was noted in BH08 and some minor dark staining was noted in BH14 (may be organic). No suspected ACM was noted within the soil matrix or upon the surface of the soil bores. Some asbestos fragments were identified in the walkway behind the building. These appear to have come from the eaves of the building

7.2 Groundwater Conditions

During monitoring visual and olfactory observations were taken of the water quality. Water was reported to be clear with no odour post purging in all groundwater wells installed (GW1-GW3).

Groundwater strikes noted during construction of groundwater bores were approximately 24-25 m bgl, however due to the well drilling method (mud rotary). Exact depth was difficult to determine.

Groundwater levels recorded during monitoring are shown in Table 7.2.

Table 7.2 - Groundwater levels recorded during monitoring (m bgl)

Monitoring Well ID	Monitored groundwater level during sampling (m bgl)
GW1	24.94
GW2	25.002
GW3	23.812

Taking into consideration the change of gradient across the site (surface level within the vicinity of GW1 and GW2 is 1.0m greater than GW3), the groundwater monitoring data collected shows that groundwater is flowing in a north-westerly direction.

8 Results

8.1.1 Acceptance Criteria

Soil analysis results have been compared to the criteria presented in 'The National Environment Protection *(Assessment of Site Contamination)* Measure (1999 amendment 2013) and Western Australian Department of Environmental Regulation guidance document 'Assessment levels for Soil, Sediment and Water' (2010). Due to the nature of the site as a former petrol service station/garage and the proposed development of the site as a highway; the following criteria were selected:

- WA DER 2010 HIL-D: (human health guideline values associated with a commercial/industrial end use)
- WA DER 2010 EIL: (ecological guideline values)
- NEPM 2013 HIL-D: (Human health guideline values associated with a commercial/industrial end use)
- CRC-CARE HSL-D: (human health guideline values for direct soil contact for a commercial/industrial end use)
- CRC-CARE HSL-D: (vapour intrusion at 0 to 1m bgl; human health guideline values associated with a commercial/industrial end use)

All soils were assessed against all the criteria listed above as a site wide scheme for the site has not yet been finalised.

Guidelines define conservative values to protect the environment and human health respectively. Contaminant levels below the guidelines may be inferred as safe. Levels that exceed the guidelines do not imply that soils are hazardous but signal that further investigation and assessment of contamination risk to human and ecological receptors should be considered.

Groundwater analysis results were compared with criteria presented in the DER *Assessment Levels for Soil, Sediment and Water* (2010). The following criteria were used for the DSI:

- NEPM 2013 Groundwater Investigation Levels (GILs)
- DER 2010 Domestic Non Potable Investigation Levels (DNP)
- CRC HSL-D (Commercial and Industrial) with groundwater encountered greater than 8m bgl.

The assessment of groundwater was based on the beneficial use and management objectives of groundwater. The beneficial use of groundwater within the vicinity of the site has been identified as irrigation.

Determinand levels below the cited assessment levels may be inferred as safe. Levels that exceed do not imply that the groundwater is hazardous but may signal that further investigation and assessment to the risk to human health or the wider environment from the contamination should be considered.

The asbestos assessment criteria are outlined below (Department of Health, May 2009):

Criteria used are presented with the tabulated results in Appendix G. It should be noted that these guidelines have been used as an initial comparison to assess the potential degree of impact and do not reflect clean-up criteria.

- 0.05%w/w asbestos for ACM – Commercial/Industrial.

Criteria used are presented with the tabulated results in Appendix G. It should be noted that these guidelines have been used as an initial comparison to assess the potential degree of impact and do not reflect clean-up criteria.

8.1.2 Statistical Assessment of Data

As the Site investigation has targeted particular features and areas of concern, statistical analysis of the results will not be undertaken and a direct comparison of the analytical results to the guidelines has been undertaken.

Laboratory Results are presented in Appendix E.

8.2 Soil Laboratory Results

A total of 33no. primary samples and 8 QA/QC samples (4 soil and 4 water) were analysed from 16no. exploratory hole locations and analysed for a range of determinands as presented within section 6.1.

With regard to analytes that record a concentration below the laboratory level of detection, a multiplier of 0.5 of the LOR for said determinand was used for calculating the mean and median.

8.2.1 Inorganic Analytes

A total of 33 primary samples were analysed for a range of inorganic analytes (as presented within section 6.5.).

Metals

Metal concentrations in soils detected at the site are summarised in Table 8.2.1.

Table 8.2.1 – Summarised metal concentrations in soil

Analyte	Number of Samples	Number of Samples above Laboratory LOD	Number of samples above guideline values	Min (mg/kg)	Max (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Human Health Guideline Value (mg/kg)	Ecological Guideline Value (mg/kg)
Arsenic	33	26	0	<2	7	2.7	3	400	20
Cadmium	33	1	0	0.4	8.4	0.48	0.2	80	0.3
Chromium (hexavalent)	33	4	4	0.5	1.3	0.56	0.5	400	1
Copper	33	16	1	1	340	19	2	4000	100
Lead	33	29	1	1	4300	168	4	1200	600
Mercury	33	4	0	0.1	0.3	0.08	0.05	60	1
Nickel	31	17	0	1	13	2	1	2400	60
Zinc	31	26	1	1	520	47	9	28000	200

Note: A multiplier of 0.5 against LOR has used for the calculation of the mean and median.

From the samples analysed the following guideline value exceedances were recorded:

- BH04 0.1-0.3m bgl recorded Lead concentrations in excess of the NEPM HIL-D guideline value and concentrations of cadmium, copper, lead and zinc in excess of their respective EIL guideline values.
- Samples BH07 1.5m bgl, BH14 1.3-1.5m bgl and BH15 7-7.5m bgl recorded concentrations of hexavalent chromium at or above EIL guideline value of 1mg/kg.

Asbestos

A total of 6no. soil samples were analysed, the results of which are presented in the below table.

Table 8.2.2 – Summarised asbestos concentrations in soil

Sample location	Sample Depth (mbgl)	Result (NAD = No Asbestos Detected)
BH02	0.1-0.5	NAD
BH03	0.1-0.5	NAD
BH04	0.1-0.3	NAD (SMF detected)
BH10	0.1-0.5	NAD
BH12	0.1-0.6	NAD
BH15	0-0.3	NAD

*SMF – synthetic mineral fibres

No asbestos fibres were reported in soil samples analysed. Synthetic mineral fibres were detected in sample BH04 0.1-0.3.

A fragment of fibre cement broken off the eaves of the building located on site was analysed and shown to contain chrysotile and amosite asbestos

8.2.2 Organic Analytes

TPH

A total of 33no. samples were analysed for speciated TPH, all samples recorded concentrations below LOR with the exception of sample BH04 (0.1-0.3m bgl) and BH08 (0.1-0.3m bgl). All reported concentrations were below the CRC and EIL guidelines.

BTEX

A total of 33no. samples were analysed for BTEX, all samples recorded concentrations below LOR.

PAH's/Phenols

A total of 33no. samples were analysed for PAHs, all samples recorded concentrations below LOR with the exception of BH03 (0.1-0.5m bgl) and BH15 (0.6-1.2m bgl). These samples reported concentrations of benzo (a) pyrene, fluoranthrene, phenanthrene and pyrene below EIL and HIL guidelines.

Pesticides

A total of 13no. samples were analysed for OC/OP, all samples recorded concentrations below LOR with the exception of BH06 (0.1-0.3m bgl) which reported concentrations of dieldrin equal to the EIL guidelines (0.2 mg/kg).

8.3 Groundwater Laboratory Results

A total of 3no. primary samples were analysed for a range of determinands; laboratory results from the single sampling event is discussed below.

8.3.1 Inorganic Analytes

Metals

Metal concentrations in groundwater detected at the site are summarised in Table 8.3.1.

Table 8.3.1 – Summarised metal concentrations in groundwater

Analyte	Number of Samples	Minimum (mg/l)	Maximum (mg/l)	Mean (mg/l)	Median (mg/l)	DER 2010 Dom NP (mg/l)	NEPM 2013 GILs DW (mg/L)
Arsenic	3	0.001	0.004	0.0007	0.0005	0.07"	0.01
Cadmium	3	<0.0001	0.0002	0.0001	0.00005	0.02#	0.002
Chromium	3	<0.001	0.005	0.0028	0.003	0.02#	<0.001
Chromium (hexavalent)	3	<0.005	<0.005	0.0025	0.0025		
Copper	3	0.001	0.009	0.00071	0.0005	0.0014#	<0.001
Lead	3	<0.001	0.001	0.00067	0.0005	0.0034#	<0.001
Mercury	3	<0.00005	<0.00005	0.0000025	0.0000025	0.00006#	<0.00005
Nickel	3	0.002	0.005	0.003	0.002	0.011#	0.003
Zinc	3	0.079	0.082	0.11	0.082	0.008#	0.071

Note: [1]Theshold values in relation of Fresh Waters indicated with #, ADWG Aesthetic indicated with *, ADWG Health indicated with"

8.3.2 Organic Analytes

TPH

A total of 3no. samples were analysed for speciated TPH, all samples recorded concentrations below LOR.

BTEX

A total of 3no. samples were analysed for BTEX, all samples recorded concentrations below LOR.

PAHs

A total of 3no. samples were analysed for PAHs, all samples recorded concentrations below LOR.

Phenols

A total of 3no. samples were analysed for Phenols, all samples recorded concentrations below LOR.

9 Contamination Assessment

9.1 Human Health

The Western Australia Contaminated Sites Act 2003 defines contamination as:

'Contaminated in relation to land, water or a site, means having a substance present in or on the land, water or site at above background concentrations that presents, or has the potential to present, a risk of harm to human health, the environment or any environmental value.'

It is considered that the risk of harm is present when a potential significant pollutant linkage is identified. A significant pollutant linkage is where three contamination migration elements (source-pathway- receptor) have the potential to exist, which could potentially result in harm to the identified receptor. All three elements must be present for the potential for harm and thus contamination to be identified, and subsequently the need for remediation/management (with remediation/management being the application of appropriate techniques to reduce the identified environmental impacts/risks to acceptable levels). This may be by either the removal of the source, the pathway or the receptor, or a combination of all three.

These principles have been adopted in assessing the analytical results as discussed in with this section.

9.1.1 Human Health Assessment

None of the soil samples have recorded determinand concentrations in excess of relevant HIL_D (commercial/industrial) guideline values with the exception of BH04 (0.1-0.3m bgl) which recorded Lead at a concentration of 4300mg/kg which is in excess of the DER HIL-D guideline values of 1200mg/kg.

None of the groundwater samples have recorded elevated concentrations of analytes in excess of the relevant human health guideline values.

9.2 Ecological Receptors

9.2.1 Acceptance Criteria

EIL values (DER 2010) are generic values which were developed for the whole of Australia to assess whether a concentration of an analyte is a phytotoxic risk to flora and fauna. It should be acknowledged that the EILs do not take into consideration the variable background concentrations of certain elements within the soil matrix on a regional level.

9.2.2 Ecological Receptors Assessment

None of the soil samples have recorded any determinands concentrations in excess of relevant EIL values with the exception of BH04 (0.1-0.3m bgl) which recorded cadmium, copper, lead and zinc and samples BH07 (1.5m bgl), BH14 (1.3-1.5m bgl) and BH15 (7-7.5m bgl) which recorded concentrations of hexavalent chromium at or in excess of their respective EIL guideline values.

9.3 Aquifer and Surface Water Receptors

9.3.1 Acceptance Criteria

The main aquifer and surface water receptors associated with the Site are the unconfined aquifer and the Swan River.

9.3.2 Terrestrial and Coastal Waters Receptor Assessment

None of the groundwater samples have recorded any determinand concentrations in excess of the relevant guideline values. Assessment tables are presented in Appendix G.

10 Quality Assurance & Quality Control Assessment

The primary purpose of data validation is to assess and summarize the quality and useability of the laboratory's analytical data for the proposed revised Conceptual Site Model.

SERS evaluates all analytical results and quality control data in accordance with current guidance (USEPA, 1994: National Functional Guidelines for organic data review. and USEPA, 1994: National Functional Guidelines for inorganic data review.). The objective of the Quality Assurance/Quality Control (QA/QC) process is to ensure data utilised is of a suitable quality which can fulfil the projects objectives.

The following QA/QC components have been evaluated for suitability of use within this project:

- Suitability of the sample matrix;
- Frequency of QC audit samples;
- Condition of sample storage and preservatives prior to dispatch to the laboratory;
- Shipping dates;
- Laboratory Sample holding times;
- Laboratory Analyte Level of Reporting;
- Laboratory Blank Sample Results;
- Laboratory field duplicates Results;
- Spike Sample Results;
- Frequency of sample cross contamination, and,
- Review of Laboratory results to identify any possible onerous results which do not appear to correlate to field observations.

10.1 Soil Analytical Data Quality

Where possible soil samples taken in the field were collected in accordance with current Australian standards AS4482.1 and AS4482.2. Table 10.1a summarises the soil analytical results.

Table 10.1a – Quality Control Samples Taken

Quality Control Sample Reference	Associated Primary Sample (depth m)	Analysis undertaken	Amount of Primary Samples Analysed (Analyte)
QA01 (Field Duplicate)	BH14 (1.3-1.5)	BTEX, Phenols, Metals, PAHs, TPH	33 (BTEX), 31 (Phenols), 33(Metals), 33 (PAHs), 33 (TPH) 13 (OC/Ops)
QA03 (Field Duplicate)	BH05 (0.3 – 0.6)	BTEX, Phenols, Metals, PAHs, TPH	33 (BTEX), 31 (Phenols), 33(Metals), 33 (PAHs), 33 (TPH) 13 (OC/Ops)
QA02 (Field Triplicate)	BH14 (1.3-1.5)	BTEX, Phenols, Metals, PAHs, TPH	33 (BTEX), 31 (Phenols), 33(Metals), 33 (PAHs), 33 (TPH)

			13 (OC/Ops)
QA04 (Field Triplicate)	BH05 (0.3 – 0.6)	BTEX, Phenols, Metals, PAHs, TPH	33 (BTEX), 31 (Phenols), 33(Metals), 33 (PAHs), 33 (TPH) 13 (OC/Ops)
FB01 (Field Blank)		BTEX, Phenols, Metals, PAHs, TPH	33 (BTEX), 31 (Phenols), 33(Metals), 33 (PAHs), 33 (TPH) 13 (OC/Ops)
FB02 (Field Blank)		BTEX, Phenols, Metals, PAHs, TPH	33 (BTEX), 33 (Phenols), 33(Metals), 33 (PAHs), 33 (TPH) 13 (OC/Ops)
Trip Blank		BTEX, Phenols, Metals, PAHs, TPH	33 (BTEX), 31 (Phenols), 33(Metals), 33 (PAHs), 33 (TPH) 13 (OC/Ops)
Trip Blank		BTEX, Phenols, Metals, PAHs, TPH	33 (BTEX), 31 (Phenols), 33(Metals), 33 (PAHs), 33 (TPH) 13 (OC/Ops)

Table 10.1b - Validation of Soil Analytical Data Quality

Component	Pass/Fail	Comment
Suitability of the sample matrix	Pass	Sampling method used to collect samples was suitable for compounds analysed.
Frequency of QC audit samples	Pass.	2no. duplicate samples (intra-lab) were analysed at a rate of 1 per 14.5 primary samples during soil sampling. 2no. inter-lab triplicate sample were analysed at a rate of 1 per 14.5 primary samples during soil sampling. 2no. field blanks were undertaken during the soil sampling fieldworks. 2no. trip blanks were submitted during the soil sampling fieldworks.
Condition of sample storage and preservatives prior to dispatch to the laboratory	Pass	All samples were either delivered to the laboratory on day of sampling or were stored in a refrigerator prior to dispatch. Whilst samples were onsite, samples were stored in cool boxes loaded with ice bricks. Due to part of the investigation occurring during the evening samples were transported to the laboratory in the morning..
Laboratory Sample holding	Pass	Chain of custody forms were used to ensure the integrity of the samples from collection to receipt by the analytical laboratory

Component	Pass/Fail	Comment
times		within the appropriate holding times. Any missing information from the CoCs was provided to the laboratory post CoC submission.
Requested Analysis completion	Pass	All analysis requested was undertaken.
Field duplicates Results	Pass	Of 216 RPD values calculated, 2 values exceeded 50%, both in cases where one value was below LOR and the other value was <5*LOR, possibly increasing RPD values..
Laboratory Analyte Level of Reporting	Pass	LOR were suitable for assessment values used within the DSI.
Laboratory QA Sample Results	Pass	11 Soil laboratory duplicates, 14 surrogates, 6matrix spikes and 8 control samples were run by the primary laboratory. Results were within the acceptable range for all primary laboratory QA samples (Matrix Spikes and Control Samples: 57% and 67%)
Frequency of laboratory cross contamination	Pass	No rinsate blank samples were undertaken as dedicated sampling equipment was used for each sample location.

RPDs between all field QA samples were calculated for all quality control analytes. All 290 RPD values calculated were within acceptable range. (0% to 33%)

10.2 Groundwater Analytical Data Quality

All groundwater samples taken in the field were collected in accordance with current Australian standards AS4482.1 and AS4482.2.

Table 10.2 - Groundwater analytical result summary.

Component	Pass/Fail	Comment
Suitability of the sample matrix	Pass	Sample taken following correct sampling procedures.
Frequency of QC audit samples	Pass	1no. duplicate samples (intra-lab) were analysed at a rate of 1 per 3 primary samples during groundwater sampling. 1no. inter-lab triplicate sample were analysed at a rate of 1 per 3 primary samples during groundwater sampling. 1no. field blanks were undertaken during the groundwater sampling fieldworks. 1no. trip blanks were submitted during the groundwater sampling fieldworks.
Condition of sample storage and preservatives prior to dispatch to the laboratory	Pass	Appropriate preservation methods were used and ice was used to keep samples chilled during transportation.
Shipping dates	Pass	Samples were shipped on day of sampling. 1no. trip blank was analysed and recorded no signs of cross contamination during

Component	Pass/Fail	Comment
		transport.
Laboratory Sample holding times	Pass	Chain of custody forms were used to ensure the integrity of the samples from collection to receipt by the analytical laboratory within the appropriate holding times.
Laboratory Analyte Level of Reporting (LOR)	Pass	LOR were suitable for assessment values used within the DSI.
Laboratory field duplicates Results	Pass	Results of primary and duplicate sample within acceptable range.
Frequency of sample cross contamination	Pass	One rinsate blank samples was undertaken and all analytes were recorded at concentrations below LOR.
Spike Sample Results	Pass	Matrix Spikes and Control Samples: 30% to 130% recovery for inorganics and metals and general organics.

RPDs between all field QA samples were calculated for all quality control analytes. 158 RPD values calculated were within acceptable range. (0% to 24%).

10.3 Laboratory Data Validation Compliance

The above review concludes that the QA/QC measures employed during sample collection and laboratory analysis is an acceptable quality for the environmental assessment of this project.

11 Revised Conceptual Site Model

The following section provides a revised conceptual model for the Site as a result of onsite activities and the Generic Assessment of the analytical results in the relation to their risk to Human Health, Ecological and Controlled Water receptors.

11.1 Identified Contaminant Sources

A Lead concentration of 4300mg/kg was recorded in sample BH04 (0.1-0.3m bgl) in excess of the DER HIL-D threshold value.

Cadmium (8.4mg/kg), copper (340mg/kg), lead (4300mg/kg) and zinc (520mg/kg) were recorded in sample BH04 (0.1-0.3m bgl) in excess of their respective EIL guideline values.

Hexavalent chromium concentrations of 1mg/kg were recorded in samples BH07 (1.5m bgl), BH14 (1.3-1.5m bgl) and BH15 7-7.5m bgl) reported concentrations at the EIL guideline value of 1mg/kg.

11.2 Receptors

The following receptors have been identified:

- Future end users of the proposed highway/road.
- Site workers during the development phase of any future redevelopment.
- Site users of surrounding properties.
- Unconfined aquifer beneath the Site.
- Surface water bodies with close proximity of the site.
- Surrounding flora and fauna

11.3 Potential Pathways

The following pathways require consideration:

Human Health

- Ingestion of soil.
- Ingestion of groundwater.
- Indoor vapour inhalation.
- Direct contact (i.e. groundwater).

Terrestrial and Coastal Waters

- Migration of impacted groundwater to nearby surface water features

Ecological

- Uptake of contaminants through the plants root network.

11.4 Pollution Linkage Assessment

From the available data associated with the depth of fill materials and geology of the superficial deposits underlying the site, it appears that minor soil disturbance has occurred during the historical development of the site.

The elevated heavy metal concentrations recorded at sample point BH04 (0.1-0.3m bgl) are not considered a risk to human health or the wider environment as the area is currently encapsulated with hardstanding and during the redevelopment of the site SERS have been informed by the client that soils will be excavated to a minimal depth of 1m bgl (with most areas excavated to a depth in excess of 2m bgl), across the majority of the site. Therefore the risk associated with elevated heavy metals at BH04 (0.1-0.3m bgl) will be mitigated and the risk removed.

With regards to the recorded elevated hexavalent chromium recorded at BH07 (1.5m bgl), BH14 (1.3-1.5m bgl) and BH15 (7-7.5m bgl) in excess of the EIL threshold value; further laboratory analysis was undertaken to determine the leachability of the chromium, (results are presented within Appendix E). The results of the analysis indicated that the hexavalent chromium is within a non-mobile state. Taking this into consideration; the risk to the wider environment with regards to hexavalent chromium is negligible as the elevated concentrations were recorded at a depth in excess of flora uptake and is within the soil in a non-mobile form which cannot migrate to sensitive receptors or be absorbed by flora root networks.

11.5 Summary of Significant Pollution Linkages

Based on the revised conceptual site model, no significant pollution linkages have been identified in relation to the redevelopment of the site for the most sensitive end uses.

12 Community Consultation

As no contamination was identified as part of this investigation, the lack of impact that the site poses within the wider community, no community consultation has been undertaken as part of the DSI.

13 Conclusions & Recommendations

13.1 Overview

SERS has completed the Site investigation comprising of 16no. push probe soil bores and the installation of 3no. groundwater bores into the unconfined aquifer, 16no near surface asbestos samples were also taken. The investigation included in-situ and laboratory testing of the soil and groundwater samples for a range of chemical determinands.

The ground conditions encountered in the exploratory holes are generally described as Fill generally consisting of orange brown sand to an approximate depth of 3.00m bgl underlain by natural red/brown/orange sand. Weathered limestone was recorded at various depths across the site (0.3-7.5m bgl). This variation in depth is likely to represent solution features in the form of limestone pinnacles. Groundwater was recorded within the unconfined aquifer approximately between 24.0m to 25.0m bgl to an unproven depth.

13.2 Conclusions

Based upon the investigations performed to date no potential pollutant linkages have been identified within the underlying soils or groundwater which could be a risk to human health or the wider environment.

On the basis that pollution linkages exist in relation to the site and the identified receptors; in accordance with Section 11 of the CS Act 2003 and DEC guidelines *'Reporting of Known Or Suspected Contaminated Sites'* (DEC, 2006), it is recommended that the Site be considered as 'Not Contaminated – Unrestricted Use' by the DEC.

13.3 Recommendations

Due to the identification of ACM within the eves of the existing building it is recommended that prior to the demolition of the site a full hazardous material survey is undertaken. This survey will identify asbestos containing materials and allow for the safe removal of asbestos to be undertaken. It will also prevent the soil beneath the site from becoming contaminated with ACM during the demolition process.

It should be noted that as part of this investigation that no work was undertaken beneath the footprint of the existing buildings. If during the development of the site contamination is noted within these areas, it is recommended that an environmental consultant is engaged to manage the delineation and mitigation of said contamination.

To minimise the potential risks to third parties from dust inhalation it is recommended that dust suppression measures are undertaken during the construction phase. Personnel and / or perimeter monitoring may be required to demonstrate the absence of any dust exposure.

References

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000). *Australian Water Quality Guidelines for Fresh and Marine Waters, National Water Quality Management Strategy,* Australian and New Zealand Environment and Conservation Council, Canberra.

Australian Standard AS 1726-1993 *Geotechnical Investigations.* Australian Standards, Canberra, Australia.

Australian Standard AS 4482.1-2005. *Guide To The Sampling And Investigation Of Sites With Potentially Contaminated Soil, Part 1: Non-Volatile And Semi-Volatile Compounds.* Australian Standards, Canberra,.

Australian Standard AS 4482.2-1999. *Guide To The Sampling And Investigation Of Potentially Contaminated Soil, Part 2: Volatile Substances*. Australian Standards, Canberra.

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) (2011), *Technical Report series, no. 10, Health screening levels for petroleum hydrocarbons in soil and groundwater,* CRC Salisbury South, South Australia

Department of Environment & Conservation (2010). *Assessment Levels for Soil, Sediment & Water,* Contaminated Sites Management Series, Perth.

Department of Environment & Conservation (2006) *Community Consultation Guideline*, DEC, Perth.

Department of Environmental Protection (2001). *Reporting of Site Assessments*, Contaminated Sites Management Series, Perth.

Department of Environmental Protection (2001a). *Development of Sampling & Analysis Programs,* Contaminated Sites Management Series, Perth.

Department of Environmental Protection (2001b). *Potentially Contaminating Activities, Industries & Landuses,* Contaminated Sites Management Series, Perth.

Department of Health (2006). *Contaminated Sites Reporting Guidelines for Chemicals in Groundwater.* DoH, Perth.

Department of Water (2004) *Perth Groundwater Atlas*, DoW, Perth

NEPM (2011). *Guideline on Investigation Levels For Soil and Groundwater-Schedule B1.*

World Health Organisation (2011). *Guidelines for Drinking Water Quality – 4th Edition.* Online: http://www.who.int/water_sanitation_health/dwq/guidelines/en/

SERS
Site Environmental and Remediation Services

End of Report

DISCLAIMER

This report is prepared for a particular client objective and is formulated on this basis only. All limitations and conditions in the writing of this report are clearly agreed to by the client and SERS prior to it's formulation and may not be suitable or applicable for any other use other than that of the original intended objective. No other parties other than the client and SERS should use this information without firstly conferring with SERS.

Whilst all due care is taken any information within this report that has relied on information from previous assessments made by others including visual inspections, laboratory testing and overall methodologies cannot be guaranteed for its accuracy or competency by SERS.

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Statement of Limitations

Scope of Services

The environmental Site assessment report has been prepared in accordance with the agreed scope of services.

Reliance on Data

In preparing this report SERS relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations. In some instances SERS have not been able to verify the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. SERS will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or not fully disclosed to SERS.

Environmental Conclusions

In accordance with the scope of services, SERS has relied upon data and conducted field work as described in this report. The conclusions and findings of this report have been based on the analytical results of this field work.

As with all Sites, varying degrees of non-uniformity of the vertical and horizontal soil conditions are encountered. Hence no monitoring, common testing or sampling technique can eliminate the possibility that monitoring or testing results / samples are not totally representative of the soil conditions encountered. The conclusions are based upon the data and the environmental fieldwork and testing and are therefore merely indicative of the environmental condition of the Site at the time of preparing the report, including the presence or otherwise of contaminants or emissions. Site conditions including extent and concentration of contaminants can change with time.

All work in the preparation of this report has been carried out in a professional manner by a suitably qualified SERS environmental scientist. Works have been undertaken in accordance with generally accepted practices with a high degree of skill and care.

Whilst all due care is taken any information within this report that has relied on information from previous assessments made by others including visual inspections, laboratory testing and overall methodologies cannot be guaranteed for its accuracy or competency by SERS.

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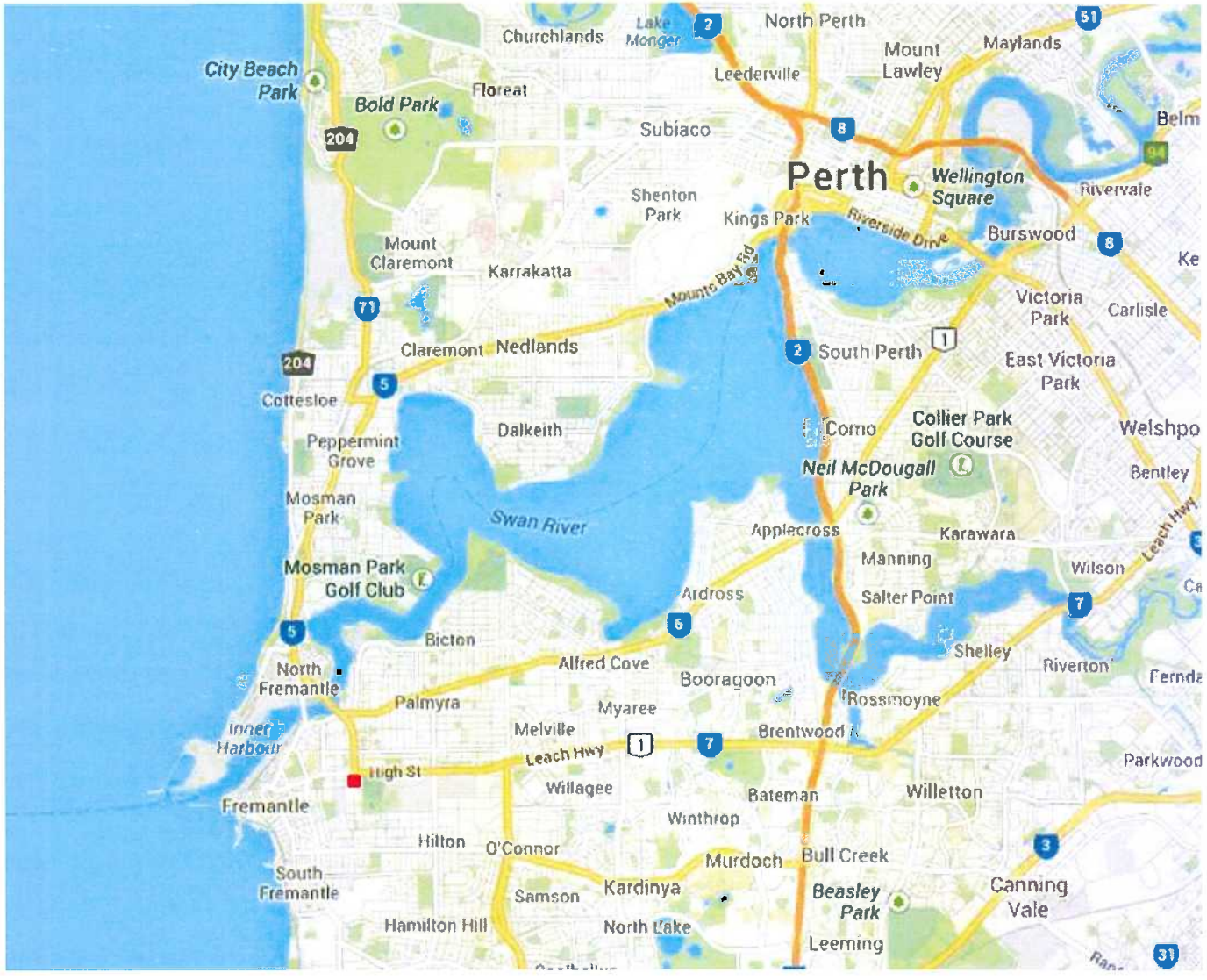
Appendix A – Drawings



DO NOT SCALE

NOTES:

Site Location

SERS

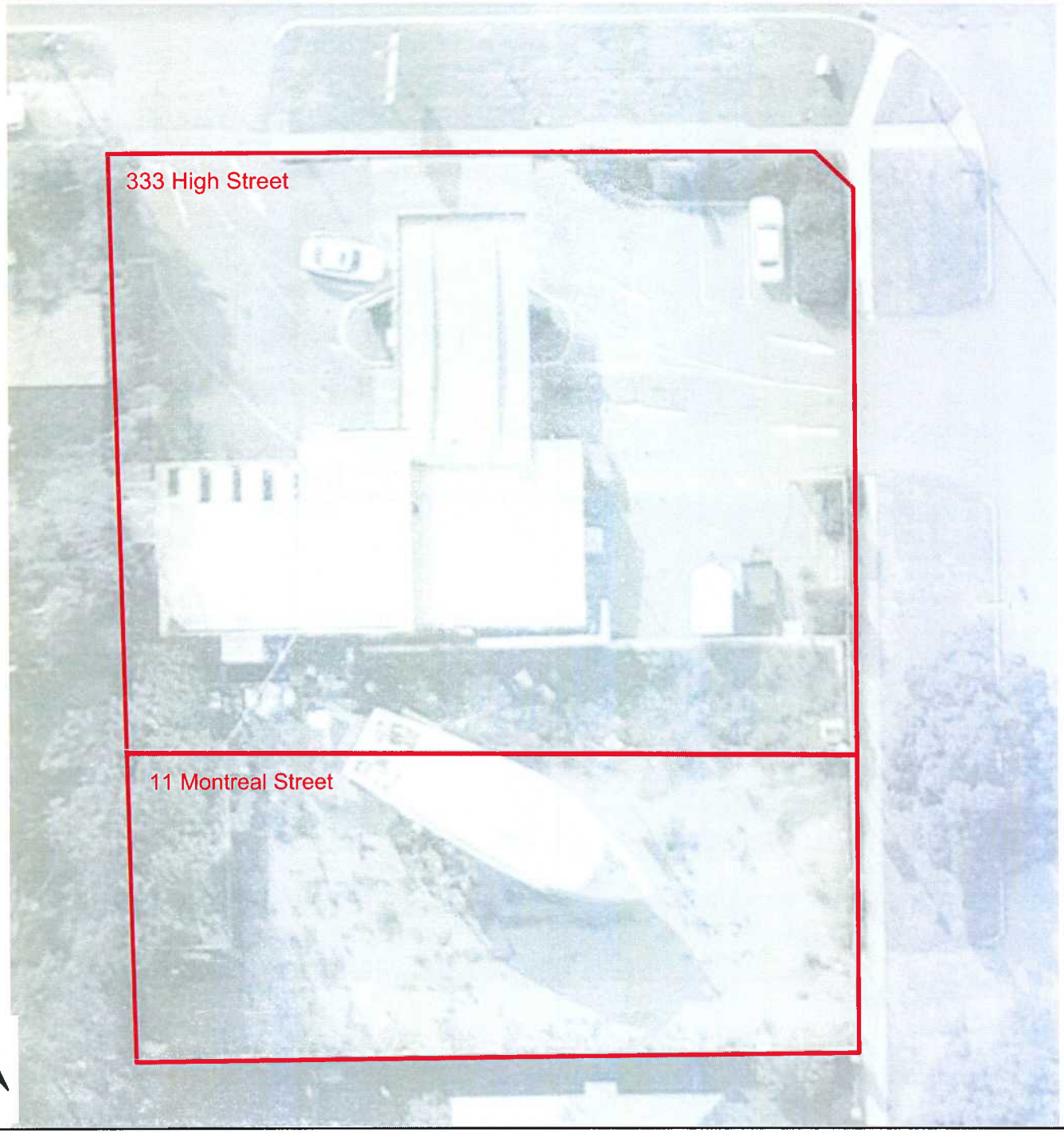
Site Environmental & Remediation Services (SERS)
Tel: +61(0) 89220 2000 Fax: +61(0) 89220 2010
http:// www.sers.net.au

CLIENT: Main Roads

PROJECT: High Street Service Station, Fremantle

TITLE: Site Location

SCALE@SIZE:	ISSUE:
NTS	FINAL
DESIGN/DRAWN:	DATE:
AH	August 2013
PROJECT No:	DRAWING No:
489	Figure 1



DO NOT SCALE

NOTES:

Site Boundary

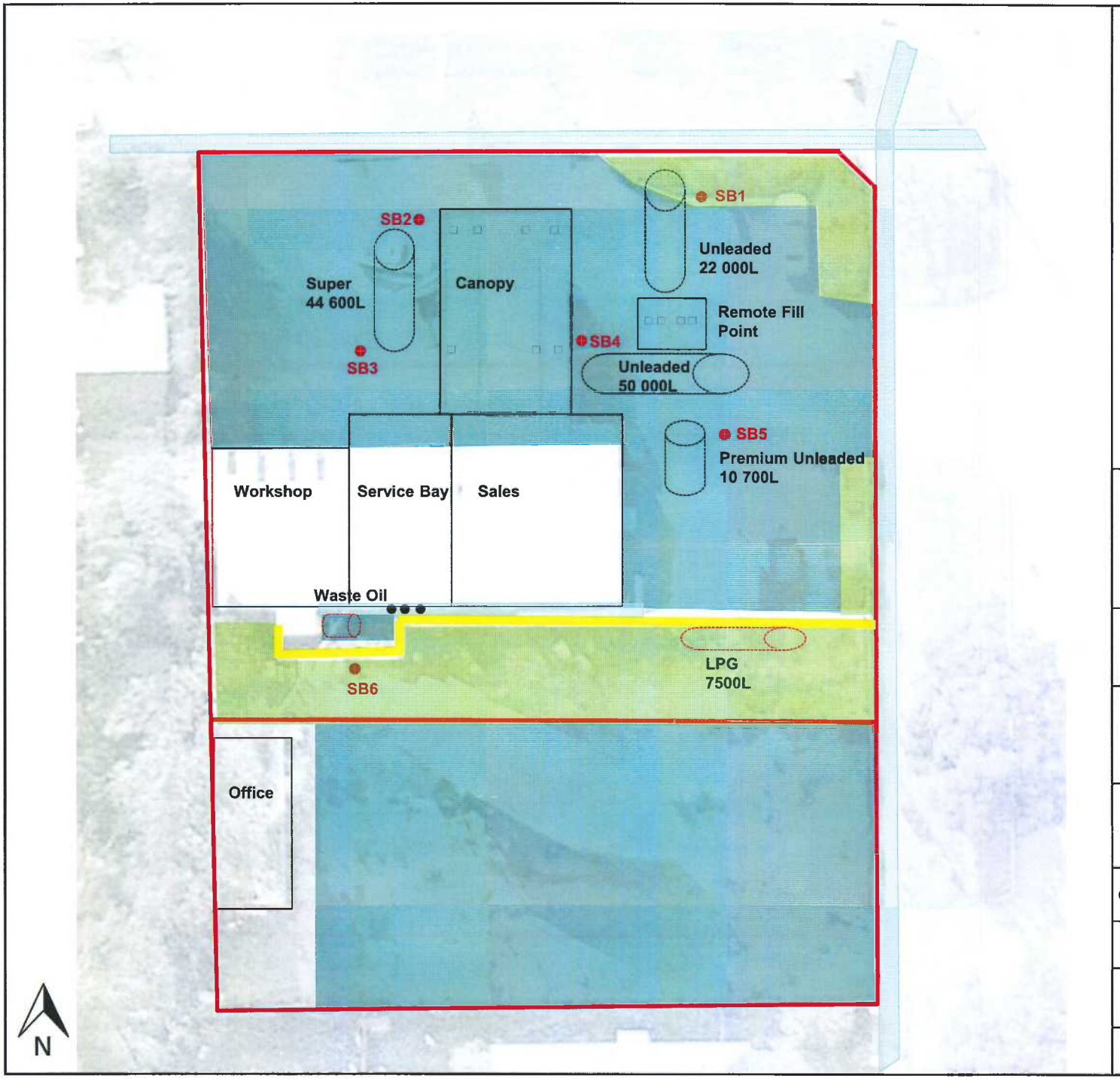
SERS
Site Environmental & Remediation Services (SERS)
Tel: +61(0) 89220 2000 Fax: +61(0) 89220 2010
http:// www.sers.net.au

CLIENT: Main Roads

PROJECT: High Street Service Station, Fremantle

TITLE: Site Boundary

SCALE@SIZE: 0m 5m 10m	ISSUE: FINAL
DESIGN/DRAWN: AH	DATE: August 2013
PROJECT No: 489	DRAWING No: Figure 2



DO NOT SCALE

NOTES:

- Building Locations
- UST Locations
- Former AST Locations
- SB5 OTEK Sample Locations
- Footpath Locations
- Hardstand
- Vegetated Area
- Bowser Locations
- Site Boundary
- Limestone Wall
- Triple Interceptor Trap

SERS
Site Environmental & Remediation Services

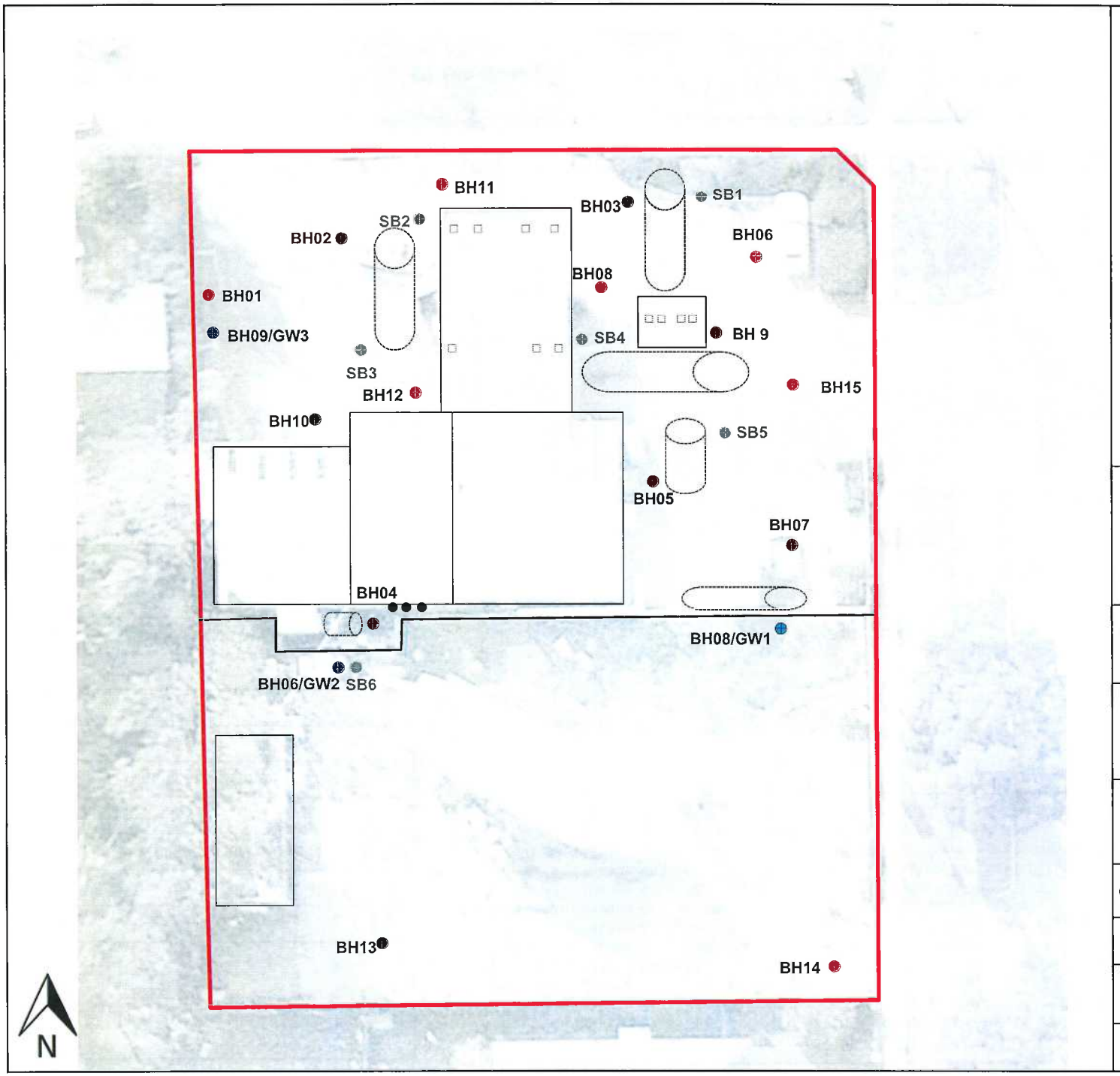
Site Environmental & Remediation Services (SERS)
Tel: +61(0) 89220 2000 Fax: +61(0) 89220 2010
http:// www.sers.net.au

CLIENT: Main Roads

PROJECT: High Street Service Station, Fremantle

TITLE: Site Layout

SCALE@SIZE: 0m 5m 10m	ISSUE: FINAL
DESIGN/DRAWN: AH	DATE: August 2013
PROJECT No: 489	DRAWING No: Figure 3



DO NOT SCALE

NOTES:

- Building Locations
- UST/AST Locations
- GW1 — SERS Groundwater Locations
- BH01 — SERS Soil Bore Locations
- SB5 — OTEK Sample Locations
- Site Boundary
- Triple Interceptor Trap

SERS
Site Environmental and Remediation Services

Site Environmental & Remediation Services (SERS)
Tel: +61(0) 89220 2000 Fax: +61(0) 89220 2010
http:// www.sers.net.au

CLIENT: Main Roads

PROJECT: High Street Service Station, Fremantle

TITLE: Sample Locations

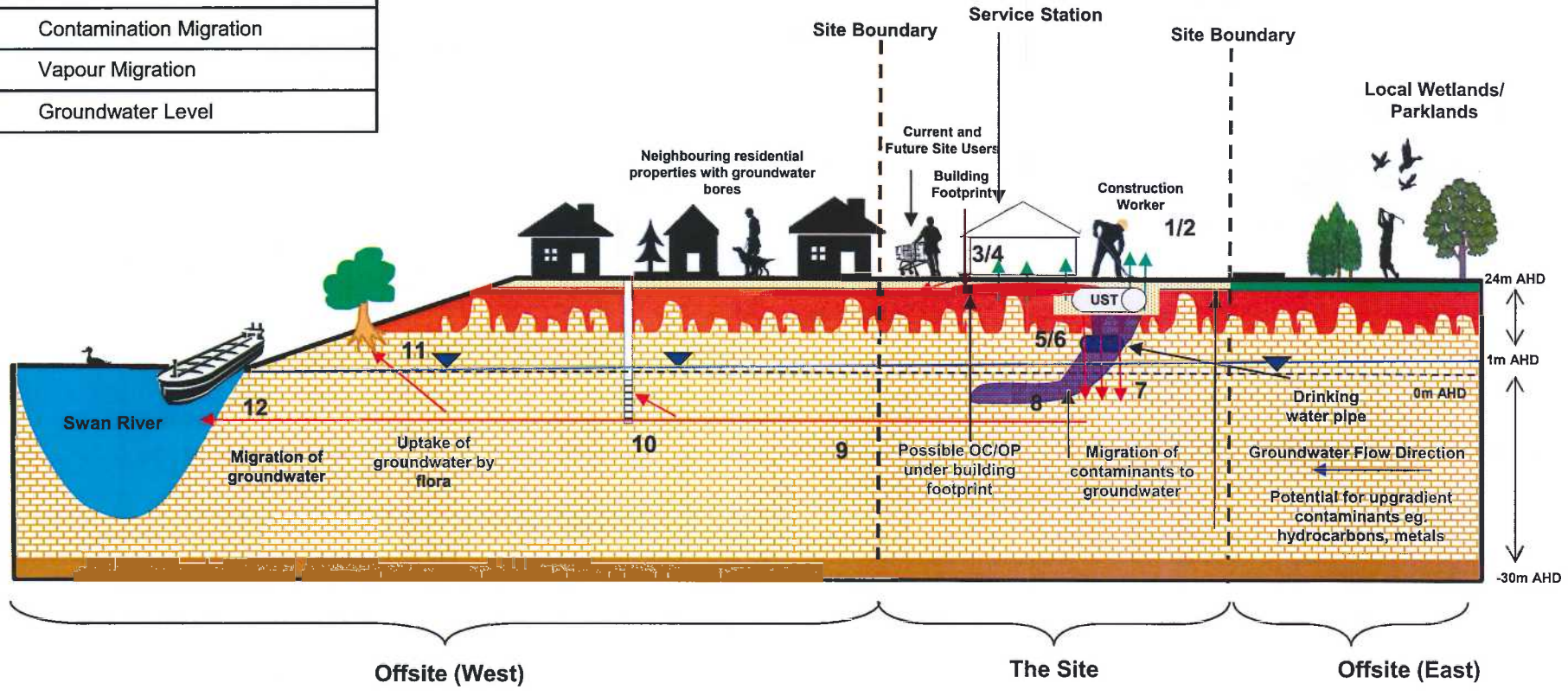
SCALE@SIZE: 0m 5m 10m	ISSUE: FINAL
DESIGN/DRAWN: AH	DATE: August 2013
PROJECT No: 489	DRAWING No: Figure 4

SERS
Site Environmental and Remediation Services

Site:	333 High Street, Fremantle
Job No.:	489
Title:	Figure 5 - Conceptual Site Model
Scale:	NTS
	Tamala Limestone
	Tamala Soils
	Made Ground
	Base of Aquifer
	Contamination Migration
	Vapour Migration
	Groundwater Level

POLLUTION LINKAGES

Pollution Linkage 1	Direct contact of the soil by current site users, construction workers and future site users;
Pollution Linkage 2	Inhalation of asbestos/volatiles by current site users, construction workers and future site users;
Pollutant Linkage 3	Stormwater Runoff
Pollution Linkage 4	Infiltration through the building foundation by volatile organic compounds;
Pollution Linkage 5	Infiltration of contaminants through water pipes located on Site;
Pollution Linkage 6	Leaching of contaminants through the soil profile;
Pollution Linkage 7	Further leaching of contaminants to groundwater;
Pollution Linkage 8	Formation of contaminant plume in aquifer;
Pollution Linkage 9	Contaminants travelling off-site via groundwater plume;
Pollution Linkage 10	Residents (both on-site and neighbouring) accessing groundwater;
Pollution Linkage 11	Down gradient flora accessing groundwater; and
Pollution Linkage 12	Plume impacting down-gradient surface water bodies.



Fiona's Current Work

Occupier	Premises Instrument File number	Application	Site contact
Echo Resources Limited	Bronzewing Gold Project – L8358/2009/2 DER2015/001858-1 (FA236566)	Amendment to recommence operation after being in care and maintenance and increase production from 50,000 to 2.5m tpa. Application received 17 April 2018 This amendment triggered a full licence review. Licence and Decision Report drafted (A1707780 and A1684053). 21 day package is in signing folder. Needs to be signed and sent to proponent.	Lauren Pick – lauren@botanicaconsulting.com.au
Echo Resources Limited	Bronzewing Gold Project – L8358/2009/2 DER2015/001858-1	Transfer application. Received 1 May 2018. Merging with the above amendment but administratively being dealt with as a separate application.	Lauren Pick – lauren@botanicaconsulting.com.au
Kalium Lakes Potash Pty Ltd	Beyondie Sulphate of Potash Project W5939/2015/1 DER2015/002764-1	Amendment to works approval W5939/2015/1 received on 26 July 2018. Works approval was issued for a series of trial ponds in 2016 The WA Holder now wishes to expand to full production and has applied via an amendment to the WA. Assessment is currently underway with EPA and is at PER stage. Validation needs to be put on stop-clock because we require further information. Letter has been drafted by Fiona and Tim ensuring we are not duplicating the EPA requests. Letter has **not** been sent out yet.	Gavin Edwards gedwards@prestonconsulting.com.au
Kalium Lakes Potash Pty Ltd	Beyondie Sulphate of Potash Project WTBA	New works approval for category 89 landfill received on 18/09/2018. Validation checklist complete. Waiting to be assigned in ILS. Compass validation can't be completed until ILS catches up.	Gavin Edwards gedwards@prestonconsulting.com.au
Regis Resources Limited	Garden Well Gold Project – L8578/2011/1 2010/008096-1	Licence amendment to construct new TSF received on 27/08/2018. Validation not completed. FRI letter sent on 25/09/2018 and clock stopped. Response received on 10 October 2018 – clock re-started.	Tim Clarke – Tclarke@regisresources.com

GSM Mining Company Pty Ltd	Granny Smith Gold Mine – L8435/2010/3 2011/000299-3	Licence amendment for a number of changes to power station, landfill, WWTP and some waste containment. Received on 31/07/2018. Validation letter and invoice need to be sent out (in Trim and signing folder plus Compass task). Amendment Notice 2 partially drafted. Some further information may be required during 21-day draft. Highlighted in the document.	Jeff Yates – Jeffrey.Yates@goldfields.com
Evolution Mining (Mungari) Pty Limited	Mungari Gold Project – L7750/2001/9 2011/009482-1~2	Licence amendment application submitted on 20/09/2018 for change in location to landfill. Further information required prior to validation. Letter sent on 3 October 2018. Application remains on stop-clock.	Kara Postle – kara.postle@evolutionmining.com.au
Evolution Mining (Mungari) Pty Limited	Mungari Gold Project – L7750/2001/9 2011/009482-1~2	Licence amendment application submitted on 27/09/2018 for TSF lift. This will be processed together with the amendment for the landfill (however they will be administratively separate applications). Further information request sent on 3 October 2018 (combined letter for both applications). Put on stop clock prior to validation. Information received on 10 October 2018. Clock re-started. Information not yet assessed.	
Thunderbird Operations Pty Ltd	Thunderbird Mineral Sands Mine – Stage 1A – W6088/2017/1 DER2017/001386-1	Works approval amendment submitted on 21/09/2018 for construction of TSF. Validation checklist complete. Awaiting validation letter and invoice to be signed and sent out as per Compass task.	Jonathon Barker – jbarker@mbsenvironmental.com.au
Saracen Gold Mines Pty Limited	Carosue Dam Operations L7465/1999/8 WTBA 2011/011727-1	New works approval for a series of TSF lifts. Submitted 3/10/2018. Requires allocating to LO.	Robert Mills – rmill@saracen.com.au
Eastern Goldfields Milling Services Pty Ltd	Burbanks Treatment Plant L8382/2009/2 2011/011726-1	Application for annual fee refund A1707782 – not yet processed.	Kerrie Kelly – kkelly@maximusresources.com