



TARGETED SOIL INVESTIGATION

FORMER SHELL EAST FREMANTLE SERVICE STATION 91 CANNING HIGHWAY, EAST FREMANTLE, WESTERN AUSTRALIA 6158

Prepared for

MR ROBERT TURNER 25 Allen Street, East Fremantle, Western Australia 6158

Prepared by

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Revision List

Revision No	Revision Date	Description of Revision	Approved By



ABBREVIATIONS

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ADF	Automotive Diesel Fuel
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
AST	Aboveground Storage Tank
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CoPC	Contaminants of Potential Concern
DEC	Western Australian Department of Environmental Protection
DO	Dissolved Oxygen
DoE	Department of Environment
DOLA	Department of Land Administration
DoW	Department of Water
DPH	Dissolved Phase Hydrocarbons
EC	Electrical Conductivity.
EILs	Ecological Investigation Levels
GC-ECD	Gas chromatography - Electron Capture Detection
GC/FID	Gas chromatography/Flame Ionisation Detection
GCMS-NCI	Gas chromatography Mass Spectrometry - Negative Chemical Ionisation
HILs	Health Investigation Levels
ICP/AES	Inductively Coupled Plasma/Atomic Emission Spectrometry
ICP/MS	Inductively Coupled Plasma/Mass Spectrometry
LOR	Limit of Reporting (Analytical Laboratory)
LP	Leaded Petrol
LRP	Lead Replacement Petrol
m BGS	Metres Below Ground Surface
m BTOC	Metres Below Top of Casing
m ³	Cubic Metres
MW	Groundwater Monitor Well
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environmental Protection Measure
NHMRC	National Health and Medical Research Council
NEHF	National Environmental Health Forum
Non-detect	not detected above the laboratory limit of reporting
NPD	Nitrogen Phosphorus Detection
OCs	Organochlorine Pesticides
OPs	Organophosphate Pesticides
PAHs	Polycyclic Aromatic Hydrocarbons
PID	Photoionisation Detector
PQL	Practical Quantitation Limits
PSH	Phase Separate Hydrocarbons
QA/QC	Quality Assurance/Quality Control
SG	Silica Gel Cleanup Analysis
SP	Super Petrol
SWL	Standing Water Level
TEX	Toluene, Ethylbenzene, Total Xylenes
TDS	Total Dissolved Solids
ТРН	Total Petroleum Hydrocarbons
ULP	Unleaded Petrol
ULT	Ultimate Petrol
UST	Underground Storage Tank
UWPCA	Underground Water Pollution Control Area
VOCs	Volatile Organic Compounds
WRC	Waters and Rivers Commission
IVIE TALS	Arrania
AS	AISEIIIC

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Cd	Cadmium
Cr	Chromium
Cu	Copper
Hg	Mercury
Ni	Nickel
Pb	Lead
Zn	Zinc

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Executive Summary

<u>Client</u> :	Mr Robert Turner, 25 Allen St, East Fremantle, Western Australia 6158
Site Name / Location:	Former Shell East Fremantle Service Station, 91 Canning Hwy, East Fremantle, Western Australia 6158 (the site)
Local Government Area:	Town of East Fremantle
<u>Site Zoning:</u>	"Mixed Use" under Local Planning Scheme No 3
Land Title Details:	Lot 418 on plan 1753, Volume 1938, Folio 760
Registered Title Holder:	Robert Henry Turner of 1 Walter Street, East Fremantle, Western Australia (now residing at 25 Allen Street, East Fremantle)
Department of Environment and Conservation Site Classification:	not listed on Contaminated Sites Database as at reporting date
<u>Historical Site Use:</u>	a Shell service station and attached garage (Harts Garage) operated at the site from the early to mid 1950s until 1973 – former use unknown. Land purchased by Mr Turner in 1992.
Current Site Use:	t-shirt printing and graphic design business
Site Infrastructure:	 brick and iron building covering the majority of the site
	 concrete forecourt containing five decommissioned underground storage tanks (USTs)
<u>Site Setting:</u>	the site is located on the south-western corner of the intersection of Canning Highway and Stirling Highway within a small commercial precinct (fronting Canning Highway). Residential properties are located to the south and across Canning Highway to the north-west and east. The Swan River is located ~150 m to the north-west, with the entrance to the Stirling Traffic Bridge located ~70 m to the north
Works Undertaken:	Targeted Soil Investigation (TGI) of the former forecourt area – August 2008
Scope of Work:	collection of 18 soil samples from 15 soil borings to a maximum depth of 3.5 meters below ground surface (m BGS)
Purpose of Work:	investigation of soil chemical conditions in the vicinity of the former forecourt
<u>Previous Environmental</u> <u>Works:</u>	Water & Environmental Engineering Consultants conducted a Phase 1 Environmental Site Assessment in July 2008
Soil Conditions:	fine to medium grained yellow fill sands to \sim 0.3 m BGS overlying fine to medium grain orange to brown slightly moist sand and limestone to a depth of \sim 3.5 m BGS
Groundwater Information:	~13.5 m BGS (Perth Groundwater Atlas)
No. Primary Soil Samples:	17

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No. QA/QC Soil Samples:	1 trip blank, 1 blind replicate		
<u>No. Primary Groundwater</u> Samples:	nil		
<u>No. QA/QC Groundwater</u> Samples:	nil		
NATA Registered Laboratory:	Australian Laboratory Services Laboratory (Environmental Division) (ALS), located at 10 Hod Way, Malaga – NATA registration No. 825		
Soil Analysis:	petroleum hydrocarbon compounds; benzene, toluene, ethylbenzene, speciated xylenes [BTEX] and C6-C36 fraction total petroleum hydrocarbons [TPH]		
	lead (Pb)		
Groundwater Analysis:	nil		
<u>Assessment Levels – Soil:</u>	Ecological Investigation Levels (EILs) and (based on site zoning and proposed use) the Standard Residential Health Investigation Levels (HIL-As)		
Sensitive Receptors in	- Swan River located ~150 m to the north-west		
Vicinity of the Site:	- four groundwater abstraction bores within 500 m		
Public Drinking Water Source Area(s) in Vicinity of the Site:	nil		

Based on field observations and the results of analytical testing, the following conclusions for the site have been drawn:

- BTEX compounds and TPH fractions were not detected in any of the soil samples collected from the soil borings; and
- concentrations of lead were detected in several of the soil samples a significant concentration (exceeding the site assessment levels) was reported in one sample, with elevated concentrations reported in two other samples. All samples exhibiting elevated concentrations of lead were collected from the former locations of the dispensing pumps.

Recommendations:

Following demolition of the building and canopy, remove the USTs, pipe work and former dispensing pump bases and undertake excavation of identified contaminated soils and the validation of in-situ soils to ensure complete removal of the lead contaminated soils.

Gemec strongly recommends that the conclusions and recommendations stated here be reviewed in context to comments and information contained within the body of the report.



1. Introduction

Gemec Pty Ltd (Gemec) was contracted by Mr Robert Turner to undertake a Targeted Soil Investigation (TSI) of the former Shell East Fremantle Service Station located at 91 Canning Highway, East Fremantle, Western Australia (the site).

The site is located ~100 m east of the East Fremantle Town Centre – within the Town of East Fremantle and is zoned "Mixed Use" under Local planning Scheme No 3.

A t-shirt printing and graphic design business (Red Hot Design) currently occupies the site.

East Fremantle Town Council records indicate the property was last used as a service station in 1973. The site was known as Harts Garage prior to 1973 and operated as a distributer of Shell Pty Ltd (Shell) automotive fuels since at least the 1950s.

Gemec undertook field activities relating to the TSI on 8 August 2008.

The scope of work included the collection of 18 soil samples (including one QA/QC sample) from 15 soil borings. The maximum depth of the investigation was 3.5 meters below ground surface (m BGS).

1.1 Objectives and Purpose

The objective of the TSI was to investigate soil chemical conditions in the vicinity of the former forecourt and underground storage tanks (USTs) so as to identify the extents of contamination (if any).

The work was undertaken as Mr Turner plans to demolish the building and redevelop the site into a mixed commercial / residential development.

This report details the fieldwork undertaken, the results of analytical testing, the conclusions drawn and recommendations for the future environmental management of the site.

1.2 Scope of Work

The Scope of Work (SoW) was developed following discussion with the client with respect to the reason for undertaking the works. The following activities were carried out as part of the SoW:

- o completed a preliminary desktop study of the site;
- o developed and reviewed a sampling and analysis plan (SAP);
- completed project health safety and environment (HSE) documentation with all relevant stakeholders to outline the nature and extent of the works and highlight any safety issues / concerns;
- employed an underground service locating company to identify the locations of sub surface infrastructure using ground penetrating radar;
- o installed 15 soil borings to a maximum depth of 3.5 m BGS;
- logged soil collected at regular intervals from the boreholes in order to characterise the properties of the soil profile;
- field screened samples from the boreholes for volatile organic compounds using a photoionisation detector (PID);

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- transported a total of 17 primary soil samples, one blind replicate and one trip blank sample under chain of custody protocols to the Australian Laboratory Services Laboratory (Environmental Division) (ALS); and
- prepared a comprehensive report detailing the field activities, analytical results, conclusions and any recommendations in a format suitable for submission to the Western Australian Department of Environment and Conservation (DEC).

1.3 Sampling and Analysis Plan

The sampling and analysis plan (SAP) for the site was developed to investigate the soil conditions beneath the forecourt area of the site. This area contains five decommissioned USTs associated pipe work and former dispensing pump bases.

The SAP used judgmental sampling protocols – as per AS 4482.1-2005.

The SAP was designed to establish the type and lateral distribution and to determine the concentrations of the selected contaminants of potential concern (CoPC – refer section 1.3.2), in the subsurface soils at the locations investigated. The locations of the soil borings were selected following the identification of the subsurface infrastructure by ground penetrating radar (refer to Figures 2 and 3 for the site layout and soil boring locations).

The selected soil samples taken from the boreholes were collected from the sample tray and placed in the laboratory supplied sample jars - nitrile gloves were worn during collection of the samples. The gloves were disposed of after each sample was collected.

All samples were placed in appropriate laboratory prepared containers and marked with an identifying number, depth, collection date and site details, kept on ice and transported to the Environmental Division Laboratory of Australian Laboratory Services Laboratory (ALS), located at 10 Hod Way, Malaga, Western Australia for analysis. The samples were delivered within recommended holding times.

ALS is accredited by the National Association of Testing Authorities (NATA) Australia to perform the tests reported herein; ALS's NATA accreditation number is 825. Copies of the analytical data and chain of custody documentation are provided in Appendix A.

Soil sample results were compared to the DEC's Ecological Investigation Levels (EILs) and Standard Residential health investigation levels (HIL-A). The DEC recommends all sites be initially assessed against EILs to determine potential for environmental impact. The HIL-A assessment levels are applied only to residential site use.

The relevant assessment levels are documented in the DEC's draft guideline *Assessment Levels for Soil, Sediment and Water*, Version 3 Contaminated Sites Management Series.

All works were conducted in general compliance with the relevant Standards and Guidelines (refer to s.9) and Gemec's protocols (refer Appendix B).

1.3.1 Quality Assurance / Quality Control

A blind replicate (field duplicate) soil sample and laboratory supplied trip blank were included in the QA/QC programme.

1.3.2 Contaminants of Potential Concern (CoPC)

The age of the site combined with historical site use determined the CoPC that the samples were tested for.

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The CoPC for these works were:

- monocyclic aromatic hydrocarbons (benzene, toluene, ethylbenzene, xylenes (BTEX);
- C₆-C₃₆ fraction total petroleum hydrocarbons (TPH); and
- o lead (Pb).

Nineteen soil samples (including one blind replicate and one trip blank) were submitted to the laboratory for analysis for some or all of the CoPC. ALS used the following methods for their analysis:

- TPH volatiles/BTEX:
- TPH semi-volatile fraction:
- o lead:

EP080 (Purge & Trap Capillary GC/MS) EP071 (Capillary GC/FID) EG005T (ICP-AES)



2. Site Details

2.1 Site Description

Site Address:	91 Canning Highway, East Fremantle, W.A. 6158		
Local Government:	Town of East Fremantle		
Zoning:	"Mixed Use" under Local Planning Scheme No. 3		
Land Title Details:	Lot 418 on plan 1753, Volume 1938, Folio 760		
Registered Title Holder:	Robert Henry Turner of 1 Walter Street, East Fremantle (now residing at 25 Allen Street, East Fremantle)		
Site Land Area:	~1 050 m ²		
<u>Australian Height</u> <u>Datum:</u>	~12 m AHD		
Site Co-ordinates:	383053.96 m E / 6454291.84 m S		
<u>Local Topography:</u>	site resides atop a small hill with steep downward slope across Canning Highway and the nature strip to the Swan River to the north, a slight downward slope to the east and west and a moderate upwards slope to the south		
<u>Site Topography:</u>	flat		
<u>Site Setting:</u>	the site is located on the south-western corner of the intersection of Canning Highway and Stirling Highway within a small commercial precinct (fronting Canning Highway). Residential properties are located to the south and across Canning Highway to the north-east and across Stirling Highway to the east. The Swan River is located ~150 m to the north-west, with the entrance to the Stirling Traffic Bridge located ~70 m to the north		
Surrounding Land Use:	north-east – low density residential housing		
	east – low density residential housing across Stirling Highway		
	south - low density residential housing		
	west – commercial (bottle shop, hotel)		
Previous Land Use:	a Shell service station and attached garage (Harts Garage) operated at the site from the early to mid 1950s until 1973. Various businesses occupied the site between 1973 and the current occupier		
Date of Construction:	circa 1950		
<u>Current Occupier /</u> <u>business</u>	Red Hot Design / t-shirt printing and graphic design business		
Site Surfaces:	front forecourt constructed of concrete with bitumen surrounding – the bitumen and concrete surfaces are in reasonable condition		
<u>Site Drainage:</u>	uncontrolled		



<u>Oily Water Treatment</u> <u>System:</u>	not observed
Former occupiers:	Harts Garage (presumed original occupier) to 1973 and various (type unknown) businesses
Fuel Suppliers:	Shell Pty Ltd from 1950s to 1973

2.2 Site Infrastructure

Current infrastructure at the site includes:

- a brick and iron building;
- o five decommissioned and sealed USTs of unknown capacity, suspected to include;
 - two super grade petrol tanks
 - one standard grade petrol tank
 - one diesel fuel tank
 - one kerosene tank all located to the north-east and west of the forecourt
 - sealed direct tank fill points; and
- o a concrete forecourt.

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A drawing indicating the site features is presented as Figure 2, site and historical photographs (circa 1952 to 1955) are presented in Appendix D.

2.3 Previous Investigations

Water & Environmental Engineering Consultants conducted a Phase 1 Environmental Site Assessment in July 2008.

2.4 Tank and Line Testing

Tank and line testing does not form part of this investigation.

2.5 Regional and Site Geology and Hydrogeology

<u>Regional Geology:</u>	Tamala Limestone – eolian calcareous and limestone, variably lithified, kankarized and leached to quartz sand (Geological Survey of Western Australia (1985), Perth, 1:250,000 Environmental Geology Series Perth Map)
<u>Regional Hydrogeology:</u>	the area is underlain by the Superficial Swan aquifer with an approximate groundwater depth of 13.5 m BGS (Perth Groundwater Atlas)
Potable Water Supply:	scheme water
Public Drinking Water Source Area:	there is no public drinking water source in the vicinity of the site
Surface Water Bodies:	Swan River: ~150 m north-west
Regional Groundwater Flow Direction:	assumed to flow north-west and discharge into the Swan River (Perth Groundwater Atlas)
<u>Regional Groundwater</u> <u>Quality:</u>	fresh to marginally fresh (Perth Groundwater Atlas)

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Registered Bore Data:	four groundwater extraction bores located within a 500m radius, three located \sim 300 to 400 m west south-west of the site
<u>Site Geology:</u>	fine to medium grained yellow fill sands to \sim 0.3 m BGS overlying fine to medium grain orange to brown slightly moist sand and limestone to a depth of \sim 3.5 m BGS
Depth of Groundwater:	~13.5 m BGS (Perth Groundwater Atlas)
Site Hydraulic Gradient:	unknown
Site Generic Hydraulic Conductivity:	8.2 m/d for fine to medium grain sand and 100 to 1000 m/d for Tamala Limestone (Davidson, 1995)
Site Groundwater Quality:	assumed to be fresh to marginally fresh (Perth Groundwater Atlas)



3. Field Work

Gemec undertook field activities on 8 August 2008.

The USTs and infrastructure were located and the proposed boring locations cleared by ground penetrating radar prior to being drilled.

Generally boreholes were cleared to 1.5 m with a 75 mm hand auger prior to being drilled using a bobcat mounted pushrod drill rig with 100 mm ø hollow push tubes. Strataprobe Drilling contractors undertook the drilling.

All field work was performed in general accordance with the relevant Australian Standards and applicable Guidelines as indicated in s. 9 and Gemec protocols (refer to Appendix B).

3.1 Site Contaminant Observations

No obvious signs of contamination were observed.

3.2 Soil Investigation

Soil conditions encountered were described as generally consisting of fine to medium grained yellow fill sands to ~ 0.3 m BGS overlying fine to medium grain orange to brown slightly moist sand and limestone to a depth of ~ 3.5 m BGS (refer to Appendix C for a copy of the bore logs).

Sample selection was designed to establish the type, lateral and vertical distribution of the CoPC in the subsurface soils at the site. Soil samples were collected from the boreholes at regular intervals (nominally 1 m) and / or at changes in geology and / or visual and olfactory observations during the drilling of the boreholes.

Following retrieval from the push tubes the samples were placed into snap lock bags which were then sealed and left to rest for 5 minutes to allow for any volatile compounds to equilibrate before being field tested for the presence of volatile organic compounds (VOCs) using a photoionisation detector (PID).

No PID responses were reported in any samples collected; however weak odours and slight staining were detected in the soil at depths between 0m and $\sim 1m$ BGS for soil borings SB6 and SB8.

Eighteen samples from the 15 soil borings were selected (ranging from 0.2 to 3.5 m BGS) for laboratory analysis based on PID response, odours and visual observations in order to quantify the vertical extent of contaminants (if present). A laboratory supplied trip blank was placed in the esky and accompanied the samples to the laboratory. All samples were placed on ice and transported under chain of custody protocols to the laboratory within recommended holding times.

All soil samples were subjected to analysis for BTEX and TPH, eight of which were also analysed for the presence of lead (SB1-3.5m, SB6-0.2m, SB6-0.9m, SB8-1.0m, SB10-1.5m, SB10-3.0m, SB11-0.5m and Dup 1).

Soil boring locations and contaminant concentrations exceeding assessment criteria are presented in Figure 3. Laboratory reported analytical results are provided in the Tables section (Table 1) with copies of the analytical results provided in Appendix A.



4. Assessment Criteria

Under the Contaminated Sites Act 2003 – contaminated is defined as "*in relation to land, water or a site, means having a substance present in or on that 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*".

In November 2003, the DEC released a document entitled Assessment Levels for Soil, Sediment and Water Version 3, which forms part of the Contaminated Sites Management Series. This document outlines the criteria used by the DEC in assessing site contamination and determining the requirements for further investigation, management or remedial action; these criteria have been adopted for this site. With respect to soil contamination the document states "the EILs and HILs as presented are to be used for the identification of contamination. These criteria have not been developed as cleanup or response levels, nor are they desirable soil quality criteria. They are intended to prompt an appropriate site-specific assessment when exceeded and the development of appropriate cleanup / response levels where required".

The EILs are based on threshold levels for phtyotoxicity and uptake of contaminants which may result in impairment of plant growth or reproduction or unacceptable residue levels *(DoE 2003)*.

The HILs are based on the concept of a tolerable daily intake (TDI). A TDI is a dose that humans may be exposed to every day throughout life without appreciable risk, and incorporates assumptions about the general population exposure and the exposure scenario *(DoE 2003)*.

The assessment levels listed in the document were sourced from published guidelines developed within Australia and internationally. The assessment levels are intended to be used for comparative purposes when assessing the presence and severity of contaminants at a site. Application of the assessment levels is based upon the environmental value of the site and the current or potential landuse(s) of the site. The assessment levels represent a list of contaminant concentrations above which an adverse impact to the environment and/or human health may occur under certain exposure scenarios, and have been adopted from numerous sources.

4.1 Soil Assessment Levels

The DEC requires that assessment of soil conditions be compared with the EILs as an initial screening tool. Where sensitive environments are not present selection of appropriate site specific assessment levels based upon the highest beneficial use of the site is required. Although historically the site has been used for commercial / industrial enterprise, Gemec expects the land use in the foreseeable future to include residential and light commercial, therefore the Standard Residential health investigation levels (HIL-A) have been adopted for the site. Both the EILs and HIL-A assessment levels are documented in the DEC guideline Assessment Levels for Soil, Sediment and Water (DoE, 2003). The relevant assessment level for each analyte, where available, is provided within tables documenting the analytical results.

4.2 Groundwater Assessment Levels

The investigation of groundwater conditions beneath the site did not from part of the scope of work for this report.



4.3 Quality Assurance / Quality Control (QA/QC)

The analytical laboratories and methodologies used by Gemec are required to be certified by the National Association of Testing Authorities. As part of their certification the laboratories are required to conduct regular quality control audits on their analyses through the use of reagent blanks, control standards, repeat duplicates and verification of recoveries. Laboratory QA/QC results are summarised below:

4.3.1 Laboratory QA/QC

Soil Samples

The Laboratory reported:

- o for all matrices, no Method Blank value outliers occurred;
- o for all matrices, no Duplicate outliers occurred;
- o for all matrices, no Laboratory Control outliers occurred;
- o for all matrices, no Matrix Spike outliers occurred;
- o for all regular sample matrices, no surrogate recovery outliers occurred;
- no Analysis Holding Time outliers existed; and
- o no Quality Control Sample Frequency outliers exist.

4.3.2 Field QA/QC

Blind replicate (field duplicate) samples are also collected in the field by Gemec personnel and analysed to validate the integrity of field procedures and verify the reliability of laboratory analyses.

One blind replicate sample was collected as part of the QA/QC programme during field activities. Where the laboratory reported concentrations above the laboratory limits of reporting (LOR) for the QA/QC samples, the relative percent difference (RPD) was calculated as shown below. Genec adopt an RPD acceptance criterion up to 50% in accordance with the Australian Standard AS 4482.1.

$$RPD = \frac{(Co - Cs)}{\left(\frac{Co + Cs}{2}\right)} x100$$

Where: Co = concentration of the original sample; and Cs = concentration of the duplicate sample.

It should be noted that variations might be higher for low levels of contaminants and / or heterogeneous soils.

Analytical results from the QA/QC sample collected by Gemec are presented within the respective Tables.

Soil Samples

The RPD for lead (sample SB8 and Dup1) exceeded Gemec's acceptance criterion by 11% - the concentrations were less in the field duplicate sample.



One soil trip blank was transported with all soil samples collected during the TSI to ensure volatiles (if any) did not escape from the primary samples. The soil trip blank reported non-detect for BTEX and TPH compounds.

The RPD exceedance for lead may be attributable to sample heterogeneity.

Summary

Not withstanding the RPD range exceedance, the results of the QA/QC programme are considered acceptable within the context of this investigation as both the primary and the field duplicate concentrations were below the HIL-A assessment level and the fact that the field duplicate result was less than the primary sample.

5. Laboratory Results

The number of soil samples analysed, analytes tested for, minimum / maximum constituent concentrations and samples that exceeded the investigation levels are detailed in the following Tables. Tables of the soil analytical results are included in the Tables Section and copies of laboratory reports of analysis and chain of custody documents are included in Appendix A.

No. of Primary Samples	Analyte	Min Conc. (mg/kg)	Max Conc. (mg/kg)	Assessment Level - EILs / HIL-As	Samples Exceeding Adopted Investigation Levels						
BTEX											
	Benzene	<0.2	<0.2	1/1	None						
17	Toluene	<0.5	<0.5	<u>3 / 520</u>	None						
17	Ethylbenzene	<0.5	<0.5	<u>5 / 230</u>	None						
	Total Xylenes	<0.5	<0.5	<u>5 / 210</u>	None						
			<u>TPH</u>								
	TPH (C ₆ -C ₉)	<10	<10	100 / NE	None						
17	TPH (C ₁₀ -C ₁₄)	<50	<50	500 / NE	None						
17	TPH (C ₁₅ -C ₂₈)	<100	<100	1000 / 90*	None						
	TPH (C ₂₉ -C ₃₆)	<100	<100	NE / 90*	None						
			<u>Metals</u>								
7	Lead	<5	725 (SB6-0.2m)	300 / 300	EILs and HIL-As: SB6-0.2m						

Summary of Soil Analytical Results

Notes:

1) 'NE' denotes assessment level not established by the DEC or is under review

2) '*' indicates the aromatic fraction assessment level



6. Discussion of Results

The site investigation activities (i.e. research, reconnaissance and physical site assessment) provided a basis to evaluate the presence, location and extent of the CoPC within the subsurface soils at the location investigated and to assess the potential for impact to surrounding areas.

The site layout, soil boring locations and contaminant concentration(s) exceeding criteria are presented in the Figures section. A Table of the laboratory analytical results is presented in the Tables section and copies of the laboratory results are provided in Appendix A.

The following sections discuss the findings in respect to soil conditions at the targeted area.

6.1 Soil Conditions

6.1.1 Soil Borings

Eighteen soil samples were taken from 15 soil borings and soil chemical conditions investigated. The analytical results are presented in Table 1.

No BTEX compounds or TPH fractions were detected in any of the 17 primary soil samples or the QA/QC sample collected from the boreholes.

Significant concentrations of lead were detected in the SB6-0.2m sample, with lower concentrations detected in SB6-0.9m, SB8-1.0m, Dup1 and SB11-0.5m and minor concentrations in SB10-1.5m and SB10-3.5m. The concentration of lead found at SB6-0.2m exceeded both the EILs and the HIL-As.

The SB6-2.0m sample was collected from the location of a former dispensing pump (eastern side of the forecourt). Due to historical site use, including the operation of a service station during a time when the distribution and use of lead based petroleum products was widespread, the presence of lead in the surrounding soil is not entirely unexpected.

The concentration of lead can be seen to reduce markedly with depth, indicating that the contaminated soils can be excavated following the removal of the canopy and USTs – this will apply to those other locations (SB8-1.0m and SB11-0.5m) where elevated concentrations of lead were also identified. All samples exhibiting elevated concentrations of lead were collected from the locations of former dispensing pumps.



7. Conclusions and Recommendations

Based on field observations and the results of analytical testing, the following conclusions for the site have been drawn:

- a Shell service station and attached garage (Harts Garage) operated at the site from the early to mid 1950s to 1973. Mr Turner purchased the land in 1992;
- the site is currently occupied by a t-shirt printing and graphic design company (Red Hot Design);
- Water & Environmental Engineering Consultants conducted a Phase 1 Environmental Site Assessment in July 2008;
- objective of the TSI was to investigate soil chemical conditions in the vicinity of the former forecourt and underground storage tanks (USTs) so as to identify the extents of contamination (if any);
- the maximum depth of the investigation was 3.5m BGS;
- soil conditions encountered during the installation of the soil borings were described as fine to medium grained yellow fill sands to ~0.3 m BGS overlying fine to medium grain orange to brown slightly moist sand and limestone to a depth of ~3.5 m BGS;
- 19 soil samples (including one field duplicate and one trip blank sample) were submitted for analysis for the CoPC;
- BTEX compounds and TPH fractions were not detected in any of the soil samples collected from the soil borings;
- concentrations of lead were detected in several of the soil samples a significant concentration (exceeding the site assessment levels) was reported in one sample, with elevated concentrations reported in two samples. All samples exhibiting elevated concentrations of lead were collected from the locations of former dispensing pumps; and
- the Swan River, a possible receiving environment of groundwater exiting the site is located ~150 m north-west of the site.

Recommendations:

Following demolition of the building and canopy, remove the USTs, pipe work and former dispensing pump bases and undertake excavation of identified contaminated soils and the validation of in-situ soils to ensure complete removal of the lead contaminated soils.

Gemec strongly recommends that the conclusions and recommendations stated here be reviewed in context to comments and information contained within the body of the report.



8. References

Department of Environment (DoE), 2003, *Assessment Levels for Soil, Sediment and Groundwater*, Version 3 Contaminated Sites Management Series

Department of Environment (DoE), 2001, *Development of Sampling and Analysis Programs*. Contaminated Sites Management Series, Western Australia

Department of Water Registered Groundwater Bore Data (within 500 m radius of the site)

National Environment Protection Measure (NEPM), Schedule B (1) 1999, *Guideline on the Investigation Levels for Soil and Groundwater*

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National Environment Protection Measure (NEPM), Schedule B (9) 1999, *Guideline on Protection of Health and the Environment During the Assessment of Site Contamination*

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Standards Australia, Australian Standard AS 4482.2:2005, Guide to Sampling and Investigation of Potentially Contaminated Soil, Part 2: Volatile Substances

Standards Australia, Australian/New Zealand Standard AS/NZS 5667.1:1998, Water Quality – Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples

Western Australian Commission for Occupational Safety and Health 2005, Occupational Safety and Health Management and Contaminated Sites Work

Geological Survey of Western Australia 1985, *Perth Metropolitan Region*, *1:50,000 Environmental Geology Series*, Fremantle map

Netherlands Ministry of Housing, Spatial Planning and the Environment

Total Petroleum Hydrocarbon Criteria Working Group – TPHCWG, Volumes 1 to 5

Waters & Rivers Commission (WRC), Perth Groundwater Atlas On-line, <<u>www.wrc.wa.gov.au/infocentre/atlas/atlas_html</u>

W.A Land Information Authority (Landgate)

Google Earth

Water and Environmental Engineering Consultants – Phase 1 – Environmental Site Assessment, July 2008

Personal communication – Mr R Turner

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9. Limitations of Report

The findings and conclusions given in this report are based on the site conditions and those applicable Government regulations that existed at the time the environmental investigation(s) was conducted and this report prepared. This report was prepared in accordance with accepted environmental practices used by environmental professionals undertaking projects of a similar nature. General limitations will exist with regard to the number of sample locations, and the nature and type of subsurface samples collected. Such limitations are due to, the nature of the project, its size and configuration, site restrictions such as the location of structures, site improvements, underground services and scope of service limitations.

Environmental investigation identifies subsurface conditions only at those points where samples are taken at the time they are taken. Preferential pathways for contaminant migration may exist in certain soil types and for certain infrastructures that cannot be reasonably investigated where these infrastructure remain in-situ. Decisions should not be made on the basis of this report if adequacy of the report has been affected by time as the report is based on conditions that existed at the time the site was investigated.

The sampling and analysis plan utilised for this investigation and agreed with the client was designed in accordance with the client's scope of service and budget restrictions. The client agrees that they have received full and complete advice as to the scope and nature of the sampling strategy.

Gemec warrant that the environmental investigation and the assessment(s) presented in this report identifies actual subsurface conditions at those locations where samples have been taken and at the time they were taken. No other warranty as to the accuracy and completeness, express or implied, is made as to any advice included in this report.

This report has only been prepared for use by the client(s) – Mr Robert Turner and St George Bank. This report has not been prepared for use by parties other than the client(s); third parties should not rely on the contents of the report. Gemec accepts no responsibility to third parties to whom this report or any part of this report is made known whether or not such disclosure is authorised. All third parties rely on this report at their own risk.

This report as a whole presents the findings and conclusions drawn from the environmental investigation and must be read in its entirety. Gemec disclaims any responsibility to the client for claims or damages arising out of the client's use of this report for anything other than the purposes given in the report. Gemec shall not be liable for the contents of this report where the client has failed to consider the entirety of this report and the underlying evaluations and where the report recommendations are implemented by consultants other than Gemec. In the above circumstances the client relies on this report at their own risk.

Conclusions and recommendations stated in the Executive Summary of this report must be read in relation to comments and information contained within the body of this report. This report shall only be used by the client for the purpose or purposes that this report was bought into existence.

This report is not intended as a substitute for legal advice which can be given only by a qualified legal practitioner.

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Tables

Table 1: Soil Analytical Results – BTEX, TPH and Lead

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Targeted Soil Investigation Report Former Shell East Fremantle Service Station 91 Canning Highway, East Fremantle, W.A. August 2008

Sample No /	Timo	Dato			BTEX		Tot	n Hydrocarb	Lead		
Depth	Time	Dale	Benzene	Toluene	Ethylbenzene	Total Xylenes	C ₆ -C ₉	C ₁₀ -C ₁₄	C ₁₅ -C ₂₈	C ₂₉ -C ₃₆	Leau
SB1-3.5m	900	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	<5
SB2-1.0m	915	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	NT
SB3-3.3m	940	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	NT
SB4-3.0m	1000	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	NT
SB5-2.8m	1015	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	NT
SB6-0.2m	1030	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	725
SB6-0.9m	1040	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	264
SB7-1.0m	1100	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	NT
SB8-1.0m	1120	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	264
Dup1		08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	140
RPD			NA	NA	NA	NA	NA	NA	NA	NA	61
SB9-1.4m	1130	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	NT
SB10-1.5m	1140	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	10
SB10-3.0m	1150	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	6
SB11-0.5m	1200	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	70
SB12-2.5m	1210	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	NT
SB13-3.5m	1250	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	NT
SB14-3.5m	1300	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	NT
SB15-2.2m	1310	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	NT
Trip Blank	-	08.08.08	<0.2	<0.5	<0.5	<0.5	<10	<50	<100	<100	NT
Ecological Investigation	n Levels		1	3	5	5	100	500	1,000	NE	300
Health Investigation Levels - A			1	520	230	210	NE	NE	90)(1)	300
Laboratory Limit of Re	porting (mg	/kg)	0.2	0.5	0.5	0.5	10	50	100	100	5

Table 1: Soil Analytical Results - BTEX, TPH & Lead

Notes:

all results reported in milligram per kilogram (mg/kg) on a dry weight basis 725 indicates concentrations exceed both EIL & HIL-A assessment levels

'NE' denotes regulatory assessment level not established or under review

'NT' denotes sample not subjected to analysis

RPD = relative percentage difference

(1) - C₁₅ - C₃₆ aromatic fraction

Total Xylenes = sum of meta-, para- & ortho-Xylene

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Figures

- Figure 1: Local Area Map
- Figure 1a: Aerial Photograph
- Figure 2: Site Layout and Infrastructure Locations
- Figure 3: Soil Boring Locations and Contaminant Concentrations Exceeding Criteria



ISSUE	DATE	AMMENDMENTS	CEMEC Duiltd	Local Area Map	Source: StreetSmart					
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			AUSTRALIA							
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Appendix A

Analytical Results

Soil Chain of Custody Form Soil Sample Analytical Results

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ADDRESS	OFFICE: 1/25 Foss St F	almyra	 a				MODI	<u> </u>		0420	0000		Disher		2 454	750						- ALS PH: 08 92097655		
PROJECT		vsek	<u> </u>				MOBIL			0438	1093 5	<u>180 - F</u>	acharo	<u>a 043</u>	3 154	753	<u> </u>							
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ALS LABORATORY GROUP

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Environmental Division



CERTIFICATE OF ANALYSIS

Work Order	EP0804497	Page	: 1 of 7
Client Contact Address	GEMEC PTY LTD MR NICOLO JELOVSEK UNIT 1/25 FOSS STREET PALMYRA WA, AUSTRALIA	Laboratory Contact Address	: Environmental Division Perth : Michael Sharp : 10 Hod Way Malaga WA Australia 6090
E-mail Telephone Facsimile	nicolo@gemec.com.au 9339 8449 :	E-mail Telephone Facsimile	: michael.sharp@alsenviro.com : +61-8-9209 7655 : +61-8-9209 7600
Project Order number	Former Shell East Fremantle	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
C-O-C number Sampler	: : N Jelovsek - Gemec	Date Samples Received Issue Date	: 12-AUG-2008 : 22-AUG-2008
Site Quote number	91 Canning Highway, East Frema	No. of samples received	: 19

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

		Enu	vironmental Di	vision Perth											
ACCREDITATION	ISO/IEC 17025.	VIEC 17025. Stacey Hawkins			Senior Chemist - Acid Sulphate Soils					Perth Inorganics					
	Accredited for compliance with	Scott James	Production Co	Perth Inorganics											
	accordance with NATA accreditation requirements.	Rassem Ayoubi						Perth Organics							
		Signatories	Accrea	Accreditation Category											
МАТА	This document is issued in	carried out in compliance with procedures specified in 21 CFR Part 11.													
		This document has bee	n electronically	signed by th	he authorized	l signatories	indicated	below.	Electronic	signing	has	been			
	NATA Accredited Laboratory 825	Signatories													

Part of the ALS Laboratory Group

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A Campbell Brothers Limited Company



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been preformed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Key : CAS Number = Chemistry Abstract Services number

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting



Analytical Results

Sub-Matrix: SOIL		Clie	ent sample ID	SB1	SB2	SB3	SB4	SB5
				3.5	1.0	3.3	3.0	2.8
	Cli	ent sampli	ng date / time	08-AUG-2008 09:00	08-AUG-2008 09:15	08-AUG-2008 09:40	08-AUG-2008 10:00	08-AUG-2008 10:15
Compound	CAS Number	LOR	Unit	EP0804497-001	EP0804497-002	EP0804497-003	EP0804497-004	EP0804497-005
EA055: Moisture Content								
^ Moisture Content (dried @ 103°C)		1.0	%	4.6	3.8	1.1	2.1	5.9
EG005T: Total Metals by ICP-AES								
Lead	7439-92-1	5	mg/kg	<5				
EP080/071: Total Petroleum Hydrocar	rbons							
C6 - C9 Fraction		10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction		50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction		100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction		100	mg/kg	<100	<100	<100	<100	<100
EP080: BTEX								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	102	110	116	106	93.7
Toluene-D8	2037-26-5	0.1	%	104	104	122	103	94.2
4-Bromofluorobenzene	460-00-4	0.1	%	99.8	103	111	99.6	88.5


Analytical Results

Sub-Matrix: SOIL		Clie	ent sample ID	SB6	SB6	SB7	SB8	SB9	
				0.2	0.9	1.0	1.0	1.4	
	Cli	ient samplii	ng date / time	08-AUG-2008 10:30	08-AUG-2008 10:40	08-AUG-2008 11:00	08-AUG-2008 11:20	08-AUG-2008 11:30	
Compound	CAS Number	LOR	Unit	EP0804497-006	EP0804497-007	EP0804497-008	EP0804497-009	EP0804497-010	
EA055: Moisture Content									
^ Moisture Content (dried @ 103°C)		1.0	%	8.5	4.5	4.8	9.4	4.8	
EG005T: Total Metals by ICP-AES									
Lead	7439-92-1	5	mg/kg	725	264		264		
EP080/071: Total Petroleum Hydrocar	rbons								
C6 - C9 Fraction		10	mg/kg	<10	<10	<10	<10	<10	
C10 - C14 Fraction		50	mg/kg	<50	<50	<50	<50	<50	
C15 - C28 Fraction		100	mg/kg	<100	<100	<100	<100	<100	
C29 - C36 Fraction		100	mg/kg	<100	<100	<100	<100	<100	
EP080: BTEX									
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%	85.4	97.2	88.0	89.4	95.4	
Toluene-D8	2037-26-5	0.1	%	90.4	108	96.0	101	102	
4-Bromofluorobenzene	460-00-4	0.1	%	90.1	112	98.8	101	107	



Analytical Results

Sub-Matrix: SOIL	b-Matrix: SOIL Cl		ent sample ID	SB10	SB10	SB11	SB12	SB13		
				1.5	3.0	0.5	2.5	3.5		
	Cl	ient sampli	ng date / time	08-AUG-2008 11:40	08-AUG-2008 11:50	08-AUG-2008 12:00	08-AUG-2008 12:10	08-AUG-2008 12:50		
Compound	CAS Number	LOR	Unit	EP0804497-011	EP0804497-012	EP0804497-013	EP0804497-014	EP0804497-015		
EA055: Moisture Content										
^ Moisture Content (dried @ 103°C)		1.0	%	5.7	5.0	6.9	4.9	4.3		
EG005T: Total Metals by ICP-AES										
Lead	7439-92-1	5	mg/kg	10	6	70				
EP080/071: Total Petroleum Hydroca	rbons									
C6 - C9 Fraction		10	mg/kg	<10	<10	<10	<10	<10		
C10 - C14 Fraction		50	mg/kg	<50	<50	<50	<50	<50		
C15 - C28 Fraction		100	mg/kg	<100	<100	<100	<100	<100		
C29 - C36 Fraction		100	mg/kg	<100	<100	<100	<100	<100		
EP080: BTEX										
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2		
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5		
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5		
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5		
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5		
EP080S: TPH(V)/BTEX Surrogates										
1.2-Dichloroethane-D4	17060-07-0	0.1	%	86.7	99.5	93.5	89.7	108		
Toluene-D8	2037-26-5	0.1	%	92.6	104	104	99.2	112		
4-Bromofluorobenzene	460-00-4	0.1	%	95.8	102	104	100	112		



Analytical Results

Sub-Matrix: SOIL		Clie	ent sample ID	SB14 3.5	SB15 2.2	Dup1	Trip Blank			
	Cl	ient sampli	ng date / time	08-AUG-2008 13:00	08-AUG-2008 13:10	08-AUG-2008 15:00	08-AUG-2008 08:00			
Compound	CAS Number	LOR	Unit	EP0804497-016	EP0804497-017	EP0804497-018	EP0804497-019			
EA055: Moisture Content										
^ Moisture Content (dried @ 103°C)		1.0	%	2.6	4.6	9.4	<1.0			
EG005T: Total Metals by ICP-AES										
Lead	7439-92-1	5	mg/kg			140				
EP080/071: Total Petroleum Hydrocar	bons									
C6 - C9 Fraction		10	mg/kg	<10	<10	<10	<10			
C10 - C14 Fraction		50	mg/kg	<50	<50	<50	<50			
C15 - C28 Fraction		100	mg/kg	<100	<100	<100	<100			
C29 - C36 Fraction		100	mg/kg	<100	<100	<100	<100			
EP080: BTEX										
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2			
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5			
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5			
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5			
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5			
EP080S: TPH(V)/BTEX Surrogates										
1.2-Dichloroethane-D4	17060-07-0	0.1	%	92.0	89.5	87.5	94.4			
Toluene-D8	2037-26-5	0.1	%	99.1	96.1	93.4	100			
4-Bromofluorobenzene	460-00-4	0.1	%	102	93.8	93.2	100			

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Client	: GEMEC PTY LTD
Project	: Former Shell East Fremantle



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)		
Compound	CAS Number	Low	High	
EP080S: TPH(V)/BTEX Surrogates				
1.2-Dichloroethane-D4	17060-07-0	70.0	130	
Toluene-D8	2037-26-5	70.0	130	
4-Bromofluorobenzene	460-00-4	70.0	130	

Environmental Division



QUALITY CONTROL REPORT

Work Order	: EP0804497	Page	: 1 of 6
Client	: GEMEC PTY LTD	Laboratory	: Environmental Division Perth
Contact	: MR NICOLO JELOVSEK	Contact	: Michael Sharp
Address	UNIT 1/25 FOSS STREET	Address	: 10 Hod Way Malaga WA Australia 6090
	PALMYRA WA, AUSTRALIA		
E-mail	: nicolo@gemec.com.au	E-mail	: michael.sharp@alsenviro.com
Telephone	: 9339 8449	Telephone	: +61-8-9209 7655
Facsimile	:	Facsimile	: +61-8-9209 7600
Project	: Former Shell East Fremantle	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: 91 Canning Highway, East Frema		
C-O-C number	:	Date Samples Received	: 12-AUG-2008
Sampler	: N Jelovsek - Gemec	Issue Date	: 22-AUG-2008
Order number	:		
		No. of samples received	: 19
Quote number	: EP-074-08 BQ	No. of samples analysed	: 19

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

	NATA Accredited Laboratory 825	<i>Signatories</i> This document has bee	n electronically	signed by the	authorized	signatories	indicated	below.	Electronic	signing	has	been
NATA	This document is issued in accordance with NATA	carried out in compliance wi Signatories	Accreditation Category									
	accreditation requirements.	Rassem Ayoubi Scott James		Production Coord	dinator		Perth Perth	Organic: Inorgani	s cs			
WORLD RECOGNISED	ISO/IEC 17025.	Stacey Hawkins		Senior Chemist - Acid Sulphate Soils		Perth	Inorgani	cs				
		_										

Environmental Division Perth

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General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been preformed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

 Key :
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

 CAS Number = Chemistry Abstract Services number

 LOR = Limit of reporting

 RPD = Relative Percentage Difference

 # = Indicates failed QC

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Work Order	: EP0804497
Client	: GEMEC PTY LTD
Project	: Former Shell East Fremantle



Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:-No Limit; Result between 10 and 20 times LOR:-0% - 50%; Result > 20 times LOR:-0% - 20%.

Sub-Matrix: SOIL						Laboratory I	Duplicate (DUP) Report	•	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Co	ntent (QC Lot: 731657)								
EP0804466-001	Anonymous	EA055-103: Moisture Content (dried @ 103°C)		1.0	%	11.4	12.0	5.4	0% - 50%
EP0804497-001	SB1 3.5	EA055-103: Moisture Content (dried @ 103°C)		1.0	%	4.6	4.8	5.1	No Limit
EA055: Moisture Co	ntent (QC Lot: 731658)								
EP0804497-012	SB10 3.0	EA055-103: Moisture Content (dried @ 103°C)		1.0	%	5.0		0.0	No Limit
EP0804499-011	Anonymous	EA055-103: Moisture Content (dried @ 103°C)		1.0	%	1.1		9.2	No Limit
EG005T: Total Meta	Is by ICP-AES (QC Lot: 7321	83)							
EP0804466-001	Anonymous	EG005T: Lead	7439-92-1	5	mg/kg	<5		0.0	No Limit
EP0804497-001	SB1 3.5	EG005T: Lead	7439-92-1	5	mg/kg	<5		0.0	No Limit
EP080/071: Total Pe	troleum Hydrocarbons (QC I	Lot: 731602)							
EP0804483-023	Anonymous	EP071: C15 - C28 Fraction		100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction		100	mg/kg	<100		0.0	No Limit
		EP071: C10 - C14 Fraction		50	mg/kg	<50		0.0	No Limit
EP0804497-002	SB2 1.0	EP071: C15 - C28 Fraction		100	mg/kg	<100		0.0	No Limit
		EP071: C29 - C36 Fraction		100	mg/kg	<100		0.0	No Limit
		EP071: C10 - C14 Fraction		50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Pe	troleum Hydrocarbons(QC)	Lot: 732378)							
EP0804483-020	Anonymous	EP080: C6 - C9 Fraction		10	mg/kg	<10	<10	0.0	No Limit
EP0804483-031	Anonymous	EP080: C6 - C9 Fraction		10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Pe	troleum Hydrocarbons (QC I	Lot: 732379)							
EP0804497-007	SB6 0.9	EP080: C6 - C9 Fraction		10	mg/kg	<10		0.0	No Limit
EP0804497-017	SB15 2.2	EP080: C6 - C9 Fraction		10	mg/kg	<10		0.0	No Limit
EP080/071: Total Pe	troleum Hydrocarbons (QC I	Lot: 733592)							
EP0804497-012	SB10 3.0	EP071: C15 - C28 Fraction		100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction		100	mg/kg	<100		0.0	No Limit
		EP071: C10 - C14 Fraction		50	mg/kg	<50	<50	0.0	No Limit
EP0804539-013	Anonymous	EP071: C15 - C28 Fraction		100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction		100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction		50	mg/kg	<50	<50	0.0	No Limit
EP080: BTEX (QC L	.ot: 732378)								
EP0804483-020	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			106-42-3						

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Client	: GEMEC PTY LTD
Project	; Former Shell East Fremantle



Sub-Matrix: SOIL						Laboratory	Duplicate (DUP) Report		
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP080: BTEX (QC L	ot: 732378) - continued	1							
EP0804483-020	Anonymous	EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP0804483-031	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			106-42-3						
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP080: BTEX (QC L	ot: 732379)								
EP0804497-007	EP0804497-007 SB6 0.9	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5		0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5		0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5		0.0	No Limit
			106-42-3						
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP0804497-017	SB15 2.2	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5		0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5		0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5		0.0	No Limit
			106-42-3						
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	< 0.5	<0.5	0.0	No Limit



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: SOIL				Method Blank (MB)		Laboratory Control Spike (LC	ry Control Spike (LCS) Report e Recovery (%) Recovery Limits (%) LCS Low High 105 88.8 111 85.5 64.7 126 			
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)		
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High		
EG005T: Total Metals by ICP-AES (QCLot: 732183)										
EG005T: Lead	7439-92-1	5	mg/kg	<5	55.5 mg/kg	105	88.8	111		
EP080/071: Total Petroleum Hydrocarbons (QCLot: 73160)	2)									
EP071: C10 - C14 Fraction		25	mg/kg		1351 mg/kg	85.5	64.7	126		
		50	mg/kg	<50						
EP071: C15 - C28 Fraction		100	mg/kg	<100						
		50	mg/kg		3018 mg/kg	71.5	61.7	124		
EP071: C29 - C36 Fraction		100	mg/kg	<100						
		50	mg/kg		583 mg/kg	72.1	64.6	131		
EP080/071: Total Petroleum Hydrocarbons (QCLot: 73237	B)									
EP080: C6 - C9 Fraction		10	mg/kg	<10	32 mg/kg	116	68	140		
EP080/071: Total Petroleum Hydrocarbons (QCLot: 73237	9)									
EP080: C6 - C9 Fraction		10	mg/kg	<10	32 mg/kg	105	68	140		
EP080/071: Total Petroleum Hydrocarbons (QCLot: 73359	2)									
EP071: C10 - C14 Fraction		25	mg/kg		1351 mg/kg	101	64.7	126		
		50	mg/kg	<50						
EP071: C15 - C28 Fraction		100	mg/kg	<100						
		50	mg/kg		3018 mg/kg	76.4	61.7	124		
EP071: C29 - C36 Fraction		100	mg/kg	<100						
		50	mg/kg		583 mg/kg	71.6	64.6	131		
EP080: BTEX (QCLot: 732378)										
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	2 mg/kg	107	73.4	122		
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	2 mg/kg	112	74.3	121		
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	2 mg/kg	121	74.2	122		
EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	4 mg/kg	116	74.8	121		
	106-42-3									
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	2 mg/kg	118	74.2	121		
EP080: BTEX (QCLot: 732379)										
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	2 mg/kg	103	73.4	122		
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	2 mg/kg	108	74.3	121		
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	2 mg/kg	114	74.2	122		
EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	4 mg/kg	109	74.8	121		
	106-42-3					440	74.0	101		
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	2 mg/kg	110	74.2	121		



Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: SOIL					Matrix Spike (MS) Repo	ort	
				Spike	Spike Recovery (%)	Recovery	Limits (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005T: Total Metals	s by ICP-AES (QCLot: 732183)						
EP0804466-002	Anonymous	EG005T: Lead	7439-92-1	50 mg/kg	102	70	130
EP080/071: Total Pet	roleum Hydrocarbons (QCLot: 731602)						
EP0804483-024	Anonymous	EP071: C10 - C14 Fraction		1351 mg/kg	85.0	64.7	126
		EP071: C15 - C28 Fraction		3018 mg/kg	70.6	61.7	124
		EP071: C29 - C36 Fraction		583 mg/kg	71.4	64.6	131
EP080/071: Total Pet	roleum Hydrocarbons (QCLot: 732378)						
EP0804483-021	Anonymous	EP080: C6 - C9 Fraction		28 mg/kg	89.4	69.1	135
EP080/071: Total Pet	roleum Hydrocarbons (QCLot: 732379)						
EP0804497-008	SB7 1.0	EP080: C6 - C9 Fraction		28 mg/kg	90.3	69.1	135
EP080/071: Total Pet	roleum Hydrocarbons (QCLot: 733592)						
EP0804497-013	SB11 0.5	EP071: C10 - C14 Fraction		1351 mg/kg	90.4	64.7	126
		EP071: C15 - C28 Fraction		3018 mg/kg	70.1	61.7	124
		EP071: C29 - C36 Fraction		583 mg/kg	67.8	64.6	131
EP080: BTEX (QCLo	ıt: 732378)						
EP0804483-021	Anonymous	EP080: Benzene	71-43-2	2 mg/kg	78.7	76.4	118
		EP080: Toluene	108-88-3	2 mg/kg	84.3	67.4	127
EP080: BTEX (QCLo	rt: 732379)						
EP0804497-008	SB7 1.0	EP080: Benzene	71-43-2	2 mg/kg	79.3	76.4	118
		EP080: Toluene	108-88-3	2 mg/kg	91.4	67.4	127

Environmental Division



INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: EP0804497	Page	: 1 of 6
Client	: GEMEC PTY LTD	Laboratory	: Environmental Division Perth
Contact	: MR NICOLO JELOVSEK	Contact	: Michael Sharp
Address	UNIT 1/25 FOSS STREET	Address	: 10 Hod Way Malaga WA Australia 6090
	PALMYRA WA, AUSTRALIA		
E-mail	: nicolo@gemec.com.au	E-mail	: michael.sharp@alsenviro.com
Telephone	: 9339 8449	Telephone	: +61-8-9209 7655
Facsimile	:	Facsimile	: +61-8-9209 7600
Project	: Former Shell East Fremantle	QC Level	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: 91 Canning Highway, East Frema		
C-O-C number	:	Date Samples Received	: 12-AUG-2008
Sampler	: N Jelovsek - Gemec	Issue Date	: 22-AUG-2008
Order number	:		
		No. of samples received	: 19
Quote number	: EP-074-08 BQ	No. of samples analysed	: 19

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Environmental Division Perth Part of the ALS Laboratory Group

10 Hod Way Malaga WA Australia 6090 Tel. +61-8-9209 7655 Fax. +61-8-9209 7600 www.alsglobal.com

A Campbell Brothers Limited Company



Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: SOIL		 			Evaluation:	Holding time I	oreach ; 🗸 = Withir	holding time.
Method		Sample Date	Exi	traction / Preparation			Analysis	
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content								
Soil Glass Jar - Unpreserved								
SB1 - 3.5,	SB2 - 1.0,	08-AUG-2008				15-AUG-2008	15-AUG-2008	✓
SB3 - 3.3,	SB4 - 3.0,							
SB5 - 2.8,	SB6 - 0.2,							
SB6 - 0.9,	SB7 - 1.0,							
SB8 - 1.0,	SB9 - 1.4,							
SB10 - 1.5,	SB10 - 3.0,							
SB11 - 0.5,	SB12 - 2.5,							
SB13 - 3.5,	SB14 - 3.5,							
SB15 - 2.2,	Dup1,							
Trip Blank								
EG005T: Total Metals by ICP-AES								
Soil Glass Jar - Unpreserved								
SB1 - 3.5,	SB6 - 0.2,	08-AUG-2008	15-AUG-2008	04-FEB-2009	\checkmark	20-AUG-2008	04-FEB-2009	✓
SB6 - 0.9,	SB8 - 1.0,							
SB10 - 1.5,	SB10 - 3.0,							
SB11 - 0.5,	Dup1							

Page	: 3 of 6
Work Order	: EP0804497
Client	: GEMEC PTY LTD
Project	: Former Shell East Fremantle



Aatrix: SOIL					Evaluation:	× = Holding time	breach ; 🗸 = Withir	holding time.
Method		Sample Date	Ex	traction / Preparation			Analysis	
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080/071: Total Petroleum Hydrocarbon	IS							
Soil Glass Jar - Unpreserved								
SB1 - 3.5,	SB2 - 1.0,	08-AUG-2008	17-AUG-2008	22-AUG-2008	✓	17-AUG-2008	22-AUG-2008	✓
SB3 - 3.3,	SB4 - 3.0,							
SB5 - 2.8,	SB6 - 0.2,							
SB6 - 0.9,	SB7 - 1.0,							
SB8 - 1.0,	SB9 - 1.4,							
SB10 - 1.5,	SB10 - 3.0,							
SB11 - 0.5,	SB12 - 2.5,							
SB13 - 3.5,	SB14 - 3.5,							
SB15 - 2.2,	Dup1,							
Trip Blank								
Soil Glass Jar - Unpreserved								
SB10 - 3.0,	SB11 - 0.5,	08-AUG-2008	18-AUG-2008	22-AUG-2008	\checkmark	19-AUG-2008	28-SEP-2008	✓
SB12 - 2.5,	SB13 - 3.5,							
SB14 - 3.5,	SB15 - 2.2,							
Dup1,	Trip Blank							
Soil Glass Jar - Unpreserved								
SB1 - 3.5,	SB2 - 1.0,	08-AUG-2008	19-AUG-2008	22-AUG-2008	\checkmark	19-AUG-2008	28-SEP-2008	✓
SB3 - 3.3,	SB4 - 3.0,							
SB5 - 2.8,	SB6 - 0.2,							
SB6 - 0.9,	SB7 - 1.0,							
SB8 - 1.0,	SB9 - 1.4,							
SB10 - 1.5								
EP080: BTEX								
Soil Glass Jar - Unpreserved								
SB1 - 3.5,	SB2 - 1.0,	08-AUG-2008	17-AUG-2008	22-AUG-2008	✓	17-AUG-2008	22-AUG-2008	✓
SB3 - 3.3,	SB4 - 3.0,							
SB5 - 2.8,	SB6 - 0.2,							
SB6 - 0.9,	SB7 - 1.0,							
SB8 - 1.0,	SB9 - 1.4,							
SB10 - 1.5,	SB10 - 3.0,							
SB11 - 0.5,	SB12 - 2.5,							
SB13 - 3.5,	SB14 - 3.5,							
SB15 - 2.2,	Dup1,							
Trip Blank								



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: SOIL				Evaluation	i: × = Quality Cor	ntrol frequency n	ot within specification ; \checkmark = Quality Control frequency within specification.
Quality Control Sample Type		Co	ount		Rate (%)		Quality Control Specification
Analytical Methods	Method	QC	Reaular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	4	32	12.5	10.0	\checkmark	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	20	10.0	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	4	38	10.5	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	4	35	11.4	10.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Total Metals by ICP-AES	EG005T	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	2	38	5.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	35	5.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Total Metals by ICP-AES	EG005T	1	20	5.0	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	2	38	5.3	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	35	5.7	5.0	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Total Metals by ICP-AES	EG005T	1	20	5.0	5.0	✓	ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	2	38	5.3	5.0	\checkmark	ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	35	5.7	5.0	✓	ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (1999) Schedule B(3) (Method 102)
Total Metals by ICP-AES	EG005T	SOIL	(APHA 21st ed., 3120; USEPA SW 846 - 6010) (ICPAES) Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (1999) Schedule B(3)
TPH - Semivolatile Fraction	EP071	SOIL	(USEPA SW 846 - 8015A) Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C36. This method is compliant with NEPM (1999) Schedule B(3) (Method 506.1)
TPH Volatiles/BTEX	EP080	SOIL	(USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Method 501)
Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	USEPA 200.2 Mod. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (1999) Schedule B(3) (Method 202)
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	(USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids (Option B - Non-concentrating)	ORG17B	SOIL	In-house, Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 20mL 1:1 DCM/Acetone by end over end tumble. The solvent is transferred directly to a GC vial for analysis.



Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- For all matrices, no Method Blank value outliers occur.
- For all matrices, no Duplicate outliers occur.
- For all matrices, no Laboratory Control outliers occur.
- For all matrices, no Matrix Spike outliers occur.

Regular Sample Surrogates

• For all regular sample matrices, no surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

• No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

• No Quality Control Sample Frequency Outliers exist.

GEMEC Pty Ltd

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Appendix B

Supporting Data

DEC Site Summary Form Land Title Details DoW Registered Bores Figure Gemec Protocols



Site Summary Form

For completion by person(s) submitting report(s) for assessment by the Department of Environment (DoE) as per the information requirements of the *Reporting on Site Assessments (2004)* guideline. Completion of this form assists the DoE in maintaining accurate records for the site.

<u>Please note:</u> A completed Site Summary Form must accompany each report submitted to the DoE for assessment. Copies of all relevant Certificates of Title must accompany this form.

Site Location Details:

Site Nam	e (e.g. where site may be kn	own by a comm	on/ business name)	n/a			
Lot No.	418 H	ouse No. 9	01	Street	Canning Highway		
Suburb	East Fremantle			State	WA	Postcode	6158
Crown Re	eserve (if applicable)						
Certificat	te (s) of Title (or equivalent)	Volume/	Folio: 1938 / 760				

Where the subject site comprises of multiple certificates of title, please list <u>ALL</u> certificates:.....

Where substances have migrated beyond the cadastral boundaries of the subject site, please provide the addresses, relevant Certificates of Title documentation and owners details for <u>ALL</u> offsite properties impacted (includes soil and/or groundwater), as an attachment to this form.

Is a hard copy of Certificate of Title and associated sketch for <u>ALL</u> listed sites attached? (Y/N) Y

Current Owner/Occupier Details:

Site Owner (Name a	and a	ddress) Robert H	enry Turner				
Site Owner Compa	iny A	CN/ABN 12 271	576 317				
Site Occupier (Nam	ne and	address) Red Ho	ot Design				
Site Occupier Corr	npany	ACN/ABN 30 9	09 827 951				
Site Status (at time	e of re	eporting):					
Proposed land us	e (e.g	. high density residenti	al/child care	facility) Commercial / Residential			
Identified substand (e.g. benzene in soil a	ces a ind gro	nd relevant media bundwater, xylene in sc	il only)	Lead in soil			
Asbestos (Y/N)	N	Health Risk Assessment (Y	/N)	Community health concerns identified (Y/N)	N	Other human health issues (Y/N)	N
Air quality issues (Y/N)	Ν	Past/Present Landfill (Y/N)	N	Potential human exposure to identified substances > DoE's Health Investigation Levels or equivalent (Y/N)	N	. ,	·1
Specify other health	issu	⊃ <					

Where <u>YES</u> is recorded for at least one of the above categories, <u>please submit 2 copies of the report(s)</u> (relevant documentation) to the DoE for referral to the Department of Health.

Are site activities lice	ensed under	the Environmental Protection	Act 1986? (Y/N)	Licence No. N A	
Where laboratory an analytical methodolo	alysis has be ogies used?	en undertaken, is the laborator (Y/N) (If No, why not?)	ry NATA accredited	I for ALL analytes an	d Y
Community Consulta	<u>ation</u> (as per t	he DoE's Community Consultation	o <i>n (June 2002)</i> guide	eline)	
Community consulta	ation program	n commenced/proposed (Y/N)	Ν		
Are details of consul	Itation progra	m (e.g. Community Consultation	on Plan) provided i	n attached report (Y/	N) N A
History of Investigati	ion:				
Have previous site in	nvestigations	been undertaken? (Y/N - if yes	, please provide det	ails below) N	
Report title, date and	author:				
Declaration:					
The information press report(s)/document(s).	sented in this	s Site Summary Form is a tr	ue representation	of the information w	ithin the attached
Full name (print)	Richard Balo	dwin			
Position held	Director				
1 USITION HEIG					
Signature				Date	
Signature Please ensure that a The DoE cannot prod	hardcopy of	the current Certificate(s) of T assessment of the report in th	itle and associated	<u>Date</u> I sketch accompanie nformation.	s the Site Summary Form.
Signature Please ensure that a The DoE cannot proc	hardcopy of ceed with the	the current Certificate(s) of T assessment of the report in th	itle and associated e absence of this i	Date <u>Date</u> I sketch accompanie nformation.	s the Site Summary Form.
Signature Please ensure that a The DoE cannot proc	hardcopy of ceed with the	the current Certificate(s) of T assessment of the report in th	itle and associated e absence of this i	Date Sketch accompanie nformation.	s the Site Summary Form.
Signature Please ensure that a The DOE cannot proceed on the proceed of the proce	hardcopy of ceed with the	the current Certificate(s) of T assessment of the report in th	itle and associated the absence of this i Signatu	Date Sketch accompanie nformation.	s the Site Summary Form.
Signature Please ensure that a The DOE cannot proc DoE Registrar Only Registrar Name: CoT verified (Y/N)	hardcopy of ceed with the	T the current Certificate(s) of T assessment of the report in th Owner details verified (Y)	itle and associated e absence of this i Signatu	Date Sketch accompanie nformation. re: Complete Form (s the Site Summary Form.
Signature Please ensure that a The DOE cannot proc DoE Registrar Only Registrar Name: CoT verified (Y/N) Awaiting Classification	hardcopy of ceed with the	T the current Certificate(s) of T assessment of the report in th Owner details verified (Y/	itle and associated e absence of this i Signatu	Date Sketch accompanie nformation. re: Complete Form (s the Site Summary Form.
Signature Please ensure that a The DOE cannot proc DoE Registrar Only Registrar Name: CoT verified (Y/N) Awaiting Classification Awaiting Re-Classification	hardcopy of ceed with the (Y/N) tion (Y/N)	The current Certificate(s) of Tassessment of the report in th	itle and associated e absence of this i Signatu	Date Sketch accompanie nformation. re: Complete Form (s the Site Summary Form.
Signature Please ensure that a The DOE cannot prod DoE Registrar Only Registrar Name: CoT verified (Y/N) Awaiting Classification Awaiting Re-Classification Incomplete Form (Y/N)	hardcopy of ceed with the	The current Certificate(s) of T assessment of the report in th Owner details verified (Y/	itle and associated e absence of this i Signatu	Date Sketch accompanie nformation. re: Complete Form (s the Site Summary Form.
Signature Please ensure that a The DoE cannot proc DoE Registrar Only Registrar Name: CoT verified (Y/N) Awaiting Classification Awaiting Re-Classificat Incomplete Form (Y/N) LWQB Assessment Off	a hardcopy of ceed with the (Y/N) tion (Y/N)	The current Certificate(s) of Trassessment of the report in the repor	itle and associated e absence of this i Signatu	Date I sketch accompanie nformation. re: Complete Form (s the Site Summary Form.
Signature Please ensure that a The DOE cannot prod DOE Registrar Only Registrar Name: CoT verified (Y/N) Awaiting Classification Awaiting Re-Classification Awaiting Re-Classification Complete Form (Y/N) LWQB Assessment Off Comments/Actions:	a hardcopy of ceed with the (Y/N) tion (Y/N) ficer:	The current Certificate(s) of T assessment of the report in th Owner details verified (Y/	itle and associated e absence of this i Signatu	Date I sketch accompanie nformation. re: Complete Form (s the Site Summary Form.

مى ^{ىنىد} مە ^{سلىلى} ك		rec 41	BISTER NUMBER 8/P1753	
WESTERN	AUSTRALIA	duplicate edition N/A	DATE DUPLIC.	ATE ISSUED
RECORD OF CERTIFIC	ΓΔΤΕ ΟΕ ΤΙ		VOLUME	FOLIO
UNDER THE TRANSFER OF	FIAND ACT 1893		1938	/00

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

KaRoberts **REGISTRAR OF TITLES**

LAND DESCRIPTION:

LOT 418 ON PLAN 1753

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

ROBERT HENRY TURNER OF 1 WALTER STREET, EAST FREMANTLE (T E930159) REGISTERED 8 JULY 1992

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS: (SECOND SCHEDULE)

1. E930160 MORTGAGE TO ADVANCE BANK AUSTRALIA LTD REGISTERED 8.7.1992.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
 * Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
 Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: PREVIOUS TITLE: PROPERTY STREET ADDRESS: LOCAL GOVERNMENT AREA:

1938-760 (418/P1753).1300-970.91 CANNING HWY, EAST FREMANTLE.TOWN OF EAST FREMANTLE.

LANDGATE COPY OF ORIGINAL NOT TO SCALE Tue Sep 2 15:33:43 2008 JOB 30927311

Transfer E930159

Dated 8th July, 1992

WESTERN Volume 1300 Folio 970

CERTIFICATE



OF TITLE

REGISTER BOOK VOL. FOL. 938



LT. 37

UNDER THE "TRANSFER OF LAND ACT, 1893" AS AMENDED

ORIGINAL-NOT TO BE REMOVED FROM OFFICE OF TITLES

I certify that the person described in the First Schedule hereto is the registered proprietor of the undermentioned estate in the undermentioned land subject to the easements and encumbrances shown in the Second Schedule hereto.

REGISTRAR OF TITLES



PERSONS ARE

CAUTIONED AGAINST

ALTERING

QR

ADDING

б

THIS

CERTIFICATE

OR

ΑΝΥ

NOTIFICATION HEREON

ESTATE AND LAND REFERRED TO

Estate in fee simple in portion of Swan Location 71 and being Lot 418 on Plan 1753, delineated on the map in the Third Schedule hereto.

FIRST SCHEDULE (continued overleaf)

Robert Henry Turner of 1 Walter Street, East Fremantle.

SECOND SCHEDULE (continued overleaf)

MORTGAGE E930160 to Advance Bank Australia Ltd. Registered 8.07.92 at 12.13 hrs. 1.

THIRD SCHEDULE





NOTE: ENTRIES MAY BE AFFECTED BY SUBSEQUENT ENDORSEMENTS.

SEAL OFFICER		SEAL CERT.	
TIME		REGISTERED OR LODGED	
REGISTE		NUMBER	
		CANCELLATION	
	IENTS	CERT. OFFICER	
DORGEN	DORSEN	SEAL	60
	JENT EN	TIME	FOL
	3Y SUBSEQI	REGISTERED	0L.1938
STERED PROPRIETOR	NOTE: ENTRIES MAY BE AFFECTED I	PARTICULARS	
REGIS	HEDULE (continued)		
	OND SC	ENT NUMBER	
	SEC	INSTRUM	



Location of bores within a 1km radius of 91 Canning Hwy, E.Fremantle

GEMEC Pty Ltd

GEMEC PROTOCOLS

GEMEC Pty Ltd

1.0 Hazard & Risk Assessment

Prior to the commencement of any work, an assessment of the potential HAZARDS and RISKS (HRA) is carried out.

The HRA includes (but is not limited to) the following:

- 'dial before you dig' (DBYD) information is accessed from the on-line source to identify the locations of services (communications [including optic fibre], gas electricity, water and sewer). Be aware that DBYD information is <u>not necessarily accurate</u> and is only valid for <u>1</u> <u>month</u>
- o contact with the local government authority if investigations are going to extend off-site
- conduct a walk over of the site to identify the locations of services and relevant infrastructure (look for disturbed ground, concrete, bitumen), location and number of vent lines, location of potentially contaminating infrastructure
- contracting of an underground services locating company utilising ground penetrating radar (GPR) to locate underground services and structures (all services, underground storage tanks [USTs], lines etc). Note that GPR will identify HDPE and fibreglass pipes whereas 'wand' type devices will only identify steel pipes and lines
- completion of a job safety analysis / health and safety plan (JSA / HASP) form. The JSA / HASP includes all stakeholders, including but not limited to: all contractors involved in the works e.g. electricians, plumbers, drilling contractors, excavation contractors, truck drivers, the site operator / owner etc. The objective of a JSA / HASP is:
 - to identify the types of permits required to undertake the work
 - to inform stakeholders of the reasons for the works about to be undertaken
 - to impress upon those involved the Health, Safety and Environmental (HSE) aspects of the project
 - to involve all stakeholders in a discussion of the works to be undertaken and to obtain feed back from the different trades etc as to their concerns regarding the HSE implications; identify hazards and ways of addressing concerns and mitigating identified hazards
 - identify any hazardous substances that may be encountered
 - to inform all stakeholders of their obligations and what Gemec expects of them
 - to inform contractors of the personal protective equipment (PPE) requirements for the site
 - identify emergency service locations, routes, phone numbers (e.g., ambulance service, nearest hospital, fire and emergency services, police)
 - identify emergency escape routes and muster points
 - document the proceedings as a record of commitments and undertakings given
 - identify management of change issues i.e. whenever there is a significant change in field conditions to those present at the time the JSA / HASP was conducted



Community Consultation is undertaken if and as required.

A photographic record of the various stages of the works is maintained.

The following Standards and Guidelines are used as reference tools when conducting site works:

- Department of Environment (DoE), 2001, *Development of Sampling and Analysis Programs*. Contaminated Sites Management Series, Western Australia
- National Environment Protection Measure (NEPM), Schedule B (2) 1999, *Guideline on Data Collection, Sample Design and Reporting*
- National Environment Protection Measure (NEPM), Schedule B (9) 1999, *Guideline on Protection of Health and the Environment During the Assessment of Site Contamination*
- National Environment Protection Measure (NEPM), 1999, Assessment of Site Contamination
- Standards Australia, Australian Standard AS 4482.1:1997, Guide to Sampling and Investigation of Potentially Contaminated Soil, Part 1: Non-volatile and Partly-Volatile Compounds
- Standards Australia, Australian Standard AS 4482.2:1997, Guide to Sampling and Investigation of Potentially Contaminated Soil, Part 2: Volatile Substances
- Western Australian Commission for Occupational Safety and Health 2005, Occupational Safety and Health Management and Contaminated Sites Work
- Standards Australia, Australian/New Zealand Standard AS/NZS 5667.1:1998, Water Quality Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples
- Standards Australia, Australian/New Zealand Standard AS/NZS 5667.11:1998, Water Quality – Sampling, Part 11: Guidance on sampling of groundwaters
- Department of Water 1999 *Monitoring Bores (Slotted Casing)*
- Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) *Minimum Bore Construction Requirements.*

2.1 Accidents / Near Misses

All near misses and accidents are recorded on the JSA / HASP form and reported to the Safety Officer. Root cause analysis is conducted on all near misses and accidents so as to inform all team members of the circumstances in an effort to eliminate the hazard (if possible) or to put in place mitigating factors to reduce the occurrence.

The following injuries <u>must</u> be reported to the WorkSafe Commissioner:

- a fracture of the skull, spine or pelvis
- a fracture of any bone in the arm (other than hand or wrist) and leg (other than in the ankle or foot)
- o amputation of an arm, hand, finger, finger joint, leg, foot, toe or toe joint
- any other injury that is likely to prevent an employee from returning to work within 10 days

Photographs are taken of any incident.

<u>2.2 Drilling</u>

The drilling rig is to be 'fit for purpose' and be in a safe working condition. The drilling contractor's maintenance records and safety check list must be provided and reviewed prior to the start of work. An inspection of the rig is undertaken to identify any potential hazards e.g. do all energised lines have safety chains attached, are there any items not secured properly that could vibrate free, etc.

Drilling personnel are to be suitably qualified.



The set up location must be barricaded off from traffic and the public by witches hats, barriers, danger tape, etc. The barricaded area must be sufficient for the drilling and Gemec personnel to be able to move freely around the drilling rig. Only drilling and Gemec personnel are allowed within the barricaded area.

Prior to raising the mast of the drilling rig the overhead area must be assessed for hazards and the mast must be clear of energy sources e.g. powerlines. Note the minimum stand-off distance from powerlines is 6.0 m (22 KvA & 415 v).

When moving the drilling rig between locations the mast must be lowered.

All personnel in the vicinity of the drilling rig must keep alert as to the operations and stay clear of all rotating equipment.

2.3 Soil Boring / Monitor Well Boring

Soil borings are completed utilising a suitable drilling method and/or hand drilling (hand auger) equipment.

Soil samples are collected as soon as practicable from the borehole, augers, core barrel, split spoon, core tray or hand auger using a clean decontaminated stainless steel trowel or by hand using single use disposable nitrile gloves.

Following collection the soil samples are immediately placed into 500 mL (18 cm x 17cm) snap lock plastic bags – half fill the bag. The soil borehole number, depth and time is written on the bag in permanent ink. A duplicate of each soil sample is taken and placed into a separate snap lock plastic bag for field headspace screening tests with a photo-ionisation detector (PID). If sufficient soil cannot be collected to fill two snap lock bags, one snap lock bag is used for PID screening and sample collection – if this is the case minimal disturbance of the sample is undertaken. The PID is calibrated prior to use with iso-butylene (97.3 ppm) with reference to benzene. A minimum period of at least 5 minutes is allowed from when the sample was placed in the snap lock bag to the time it is screened with the PID to allow equilibrium of the headspace vapour to occur. The headspace vapours are sampled by piercing the snap lock bag, inserting the PID probe into the headspace and measuring the maximum reading. Soil samples taken as PID duplicates are subsequently discarded (appropriately if contaminated).

The PID measures the level of a range of volatile compounds in relation to iso-butylene and indicates potential volatile organic compounds. The PID results can then be used as a semi-quantitative assessment of soil contamination – *PID readings are not to be substituted for analytical sampling*, they are to be used as a field guide only!

The maximum PID reading is recorded in the field with the time of sampling and background PID reading.

The PID values are used to field rank the soil samples; those samples that reported the highest PID readings are submitted for laboratory analysis. Sample selection is also made on a judgmental basis, i.e. odour, change of geology, etc. Generally, two to three samples are collected from each borehole (with one from the maximum extent of the boring) to delineate the vertical extent of soil impact or (or as agreed with the client).

Once a sample has been selected for analysis the soil is transferred from the snap lock bag into clean laboratory supplied sample jars. Jars are filled completely so that there is zero headspace. Prior to placing the lid on the sample jar the thread and lip of the jar are carefully wiped (with a clean paper towel) to remove any soil so that the lid seals properly and volatiles cannot escape – ensuring that the Teflon seal is in place beneath the lid. The sample number, depth, date and time of sampling, initials of sampler and site location are written on the sample jar in permanent ink.

The locations of the borings / samples are accurately noted on the site plan.



The following quality assurance and quality control (QA/QC) samples are collected:

- o blind replicate (field duplicate) samples at the rate of 1 in 20
- split samples at the rate of 1 in 20

The QA/QC samples are as homogeneous as possible.

2.3.2 Equipment Decontamination

Drilling equipment and soil core boxes used for laying out of cores and collection of samples are washed thoroughly prior to use by the drillers, using a high pressure water spray and phosphate free detergent – e.g. Quantumclean, so that clean drilling equipment is used for each borehole location and cores are laid in cleaned boxes ready for logging and sampling.

The sampling trowel is decontaminated between each sample collection by soaking in Quantumclean solution and then an intermediate rinse in clean tap water and final rinse in demineralised water in accordance with AS4482.1-1997.

Disposable gloves are discarded after each sample collection.

2.3.3 Sample Preservation & Transport

Immediately following jarring of the sample, the sample jar is placed into an esky. Crushed ice or ice bricks are placed around the sample jars. A laboratory supplied trip blank is placed in the esky at the beginning of the work. Bubble wrap or other means of protecting the glass jars / bottles is used to prevent breakages.

A Chain of Custody (CoC) form is completed and accompanies the samples to the laboratory. If samples cannot be transported to the laboratory on the same day as collection they are placed in a refrigerator for storage – taking notice of the recommended holding times for different analyses.

2.3.4 Forms

All onsite work is recorded on the Daily Field Report (DFR) worksheet. Other details recorded on the DFR are the personnel onsite and weather conditions.

A borelog is completed for each borehole. The borelog form contains observations relating to soil type, plasticity / particle size, colour, secondary / minor components (& ~percentage), moisture content, consistency / density and any additional observations. Also recorded are the depth log, times, PID values and contaminant observations.

All samples collected for analysis are logged on a Soil Sample Register form.

2.4 Monitor Well Installation

Groundwater monitoring wells provide a static geographic point source for information on the physical and chemical conditions of the groundwater at a site over time.

2.4.1 Installation

Monitor wells are generally constructed of new, clean 50mm diameter Class 18 PVC casing and screen (0.4mm slot) with flush threaded joints. Typically the well is constructed so that a minimum of two metres of the screened interval is below the stabilised water concentrations (taking into account seasonal variations). After placing the screen and blank sections in the borehole, graded filtered gravel is placed around the well screen to a depth approximately one-half metre above the top of the screen. A granular bentonite seal is then placed above the gravel pack. The bentonite pellets are then 'activated' by pouring water down the borehole. The remainder of the borehole is backfilled with clean



sand (or grouted with cement-bentonite slurry in sensitive locations), with a further bentonite seal placed beneath the surface (aquifer conditions determine what method is employed). A metal flush-mount cast iron cover is then cemented over the top of the well to protect it from damage from traffic. A tamper proof cap is installed to prevent unauthorised persons from accessing the well.

2.4.2 Monitor Well Development

Monitor wells are developed as soon as possible following installation. Well development is undertaken to remove drill cuttings and fines from the well casings.

For relatively shallow monitor wells, development is achieved by vigorously bailing and surging the well with groundwater with a new, disposable, polyethylene bailer. Generally a minimum of five well volumes is removed via this procedure or until the purge water is observed to be clean. For deeper wells, an electric pump such as a variable flow Grundfos MP1 pump may be used. All development water is disposed of in accordance with the appropriate regulations.

2.4.3 Gauging and Sample Collection

Sampling of monitor wells is undertaken 7 days post installation.

Prior to the collection of groundwater samples, the depth to water is measured from the top of the well casing using a depth to water probe or oil/water interface probe. If previous data is available gauging and sampling starts at the least contaminated monitor well.

If the interface probe signals phase separated hydrocarbons (PSH) a disposable polyethylene bailer (or similar) is to be lowered into the well (slowly) to measure the apparent thickness. If no PSH was detected, a minimum of three to six well volumes is removed (or purged until dry) from the well to purge the stagnant water and allow a representative sample to be collected. During purging field chemical data (pH, electrical conductivity (EC), redox, dissolved oxygen (DO) and temperature) is collected to establish stabilised conditions (generally accepted as when parameters stabilise within 10%). The field chemical meter (YSI 556 MPS) probes are calibrated on a regular basis.

A dedicated disposable clear PVC bailer is used to purge and sample each well; the bailer is discarded after sampling. Sampling is undertaken by staff wearing clean disposable nitrile gloves, which are changed prior to the sampling of each subsequent monitor well. The bailer is lowered slowly into the well so as to cause the least amount of surging. As and when required low flow sampling is undertaken.

A groundwater sample from each monitor well is collected and placed in laboratory prepared bottles (1L / 500 mL bottle and two 400 ml vials for TPH and BTEX analysis). The sample bottles are filled so that no headspace remains. The samples are labelled with the monitor well identification number, site name and date in permanent ink.

Groundwater samples for contaminants other than BTEX and TPH are collected in appropriate laboratory sample containers preserved as per laboratory requirements and transported to the laboratory within recommended holding times.

2.4.4 Equipment Decontamination

The probe and tape of the interface meter is decontaminated between wells by soaking in Quantumclean solution followed by an intermediate rinse in clean tap water and final rinse in demineralised water in accordance with AS4482.1-1997.

2.4.5 Quality Assurance

The following quality assurance and quality control (QA/QC) samples are collected:

- o blind replicate (field duplicate) samples at the rate of 1 in 20
- split samples at the rate of 1 in 20
- one rinsate sample per piece of equipment per day



Immediately following collection, samples are placed into an esky. Ice or ice bricks are placed around the sample bottles to keep chilled. A laboratory supplied trip blank is placed in the esky at the beginning of the work. Bubble wrap or other means of protecting the glass jars / bottles is used to prevent breakages.

A Chain of Custody (CoC) form is completed and accompanies the samples to the laboratory. If samples cannot be transported to the laboratory on the same day as collection they are placed in a refrigerator for storage – taking note of the recommended holding times for different analyses.

2.4.7 Flow Direction Survey

Following installation of the monitor wells the tops of the bore casings are surveyed to a relevant datum e.g. Australian Height datum (AHD) by a licensed surveyor or other suitably qualified personnel. Surveyed data for the tops of the casings will also include the bearing relative to north, co-ordinates and distance from the temporary benchmark.

2.4.8 Forms

All onsite work is recorded on the Daily Field Report (DFR) worksheet. Other details recorded on the DFR are the personnel onsite and weather conditions.

The field chemical data collected from the purge water is recorded on a groundwater field chemical data form.

2.5 Excavations

Excavation works contain inherent safety issues. An excavation is considered to be any ground disturbance that is equal to or more than 1.5 metres deep. All excavations are classed as 'confined space' and therefore must not be entered into without a confined space permit.

If deemed necessary a dilapidation survey is undertaken by a competent person prior to the start of any excavation works.

2.5.1 Fencing and Signage

If the excavation is of sufficient size and likely to remain open for more than one day, then temporary fencing is erected around the site. Appropriate signage is erected on the fencing; the signage must be clearly visible. Signage includes: No Smoking, Hard Hats To Be Worn, Safety Glasses To Be Worn, Danger Deep Excavation, Keep Out, etc. In Western Australia any barrier must be at least 900 mm high.

Traffic Management Plans (TMPs) (if required) are submitted to the relevant authorities for approval prior to the start of works. If TMPs are to be implemented all signage must be in place prior to the start of works. Consideration of local residents concerns with regard to their ease of ingress and egress to their properties is undertaken. If necessary a community meeting or a letter drop is undertaken to inform the community of the activities and expected length of the works.

2.5.2 Services

The mains water, power, gas, telephone lines, sewer etc, services are located with GPR. If the services are likely to interfere with the excavation the supplies are terminated by a competent person prior to the start of works.

Please note that Gemec will not be held responsible for any damage to subsurface utilities, cables and/or piping unless precise (as built) drawings are made available. Wherever possible Gemec will



employ the services an underground services locating company, however they are not foolproof and the above applies.

2.5.3 Excavation Integrity

The design of the excavation takes into account any remaining infrastructure. At no time is the integrity of the infrastructure compromised (undermined).

Excavations are constructed to retain suitable batters to maintain the integrity of the excavation. Competent excavator contractors are employed, if they or Gemec personnel are unsure as to the required batter, works must cease and an engineer brought to site to advise on suitable batter for the in-situ soils.

Digging boxes are employed if site conditions / contaminant levels require their use.

2.5.4 Entering Excavations

Employees / contractors are not to enter excavations that are greater than 1.5 meters deep. If it is absolutely necessary to enter an excavation, then "Confined Space Entry" conditions are adhered to; an observer posted in a safe place, outside the excavation, the observer must have an unobstructed view of the person entering the excavation at all times. The person entering the excavation must have a full safety harness on with a rope tethered to a fixed point well outside the top of the excavation. Gemec directors are informed if a person is planning to enter a confined space.

2.5.5 Soil Sampling

Soil samples are obtained from the tines of the excavator bucket when brought to surface. The sample is collected from the middle of the material to produce a more representative sample.

Soil sampling and decontamination procedures are conducted as per s. 2.3

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Appendix C

Soil Bore Logs

CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB1 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : Hand auger (H/A) DRILL METHOD : NA

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID - ppmv	SAMPLE (X)	OBSERVATIONS
			Ground Surface				
0.0-			FILL SAND fill sand, fine to medium grain, yellow to brown, moist.	-			
-			LIMESTONE ROADBASE limestone roadbase, cream to brown, minor and major blue metal fragments, moist, poorly sorted.				
1.0-			SAND sand, fine grain, beige to light brown, moist.	NO	0.0		
2.0-			SAND sand, fine grain, orange, damp.	NO	0.0		
3.0-				NO	0.0	Х	EOH @ 3.5 mBGS
_							

CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB2 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : Hand auger (H/A) DRILL METHOD : NA

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID - ppmv	SAMPLE (X)	OBSERVATIONS
0.0			Ground Surface				
0.0-	SOIL	LITHOLOGY	DESCRIPTION Ground Surface SAND Sand, fine to medium grain, cream to brown, variably sized blue metal and imestone fragments, dry, poorly orted.	NO	- Old	SAM (X)	OBSERVATIONS
						х	EOH @ 1.0 mBGS
_							

CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB3 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : H/A & Bobcat mounted pushrod DRILL METHOD : Hammer

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID - ppmv	SAMPLE (X)	OBSERVATIONS
			Ground Surface				
0.0			FILL SAND fill sand, fine to medium grain, yellow to brown, dry.	-			
-			LIMESTONE ROADBASE limestone roadbase, cream to brown, minor and major blue metal fragments, dry, poorly sorted.				
1.0			SAND sand, fine grain, beige to light brown, dry.	NO	0.0		
2.0-			SAND sand, fine grain, orange, dry.	NO	0.0		
3.0-				NO	0.0	Х	EOH @ 3.3 mBGS

CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB4 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : H/A & Bobcat mounted pushrod DRILL METHOD : Hammer

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID - ppmv	SAMPLE (X)	OBSERVATIONS
0.0			Ground Surface				
			LIMESTONE ROADBASE limestone roadbase, cream to brown, minor and major blue metal fragments, dry, poorly sorted.				
			SAND sand, fine grain, orange to brown, dry.	NO	0.0		
2.0-			SAND sand, fine grain, orange, damp.	NO	0.0	Х	EOH @ 3.0 mBGS
CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB5 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : H/A & Bobcat mounted pushrod DRILL METHOD : Hammer

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID - ppmv	SAMPLE (X)	OBSERVATIONS
0.0			Ground Surface				
0.0			SAND AND LIMESTONE ROADBASE sand and limestone roadbase, fine to medium grain, brown, black and beige (mixed), with various fragments, damp.				
1.0-				NO	0.0		
2.0-			SAND sand, fine grain, orange to brown, damp.	NO	0.0		
-			SAND sand, fine grain, orange, damp.	-			
3.0				NO	0.0	х	EOH @ 3.5 mBGS
_							

CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB6 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : H/A & Bobcat mounted pushrod DRILL METHOD : Hammer

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID - ppmv	(X) (X)	OBSERVATIONS
0.0			Ground Surface				
- 0.0			LIMESTONE ROADBASE limestone roadbase, brown, minor and major blue metal fragments, dry, poorly sorted.	wo			
			LIMESTONE ROADBASE limestone roadbase, cream to brown, minor and major blue metal fragments, dry, poorly sorted.	-	0.0	Х	
-							detected throughout soil column
_				NO	0.0	х	
1.0-				-			EOH @ 1.0 mBGS

CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB7 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : H/A & Bobcat mounted pushrod DRILL METHOD : Hammer

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID - ppmv	SAMPLE (X)	OBSERVATIONS
0.0			Ground Surface				
- 0.0			LIMESTONE ROADBASE limestone roadbase, brown, minor and major blue metal fragments, dry, poorly sorted.				
-			LIMESTONE ROADBASE limestone roadbase, cream to brown, minor and major blue metal fragments, dry, poorly sorted.	WO			
_							
_			SAND sand, fine to medium grain, orange, damp	-			
-				NO			
1.0-				-	0.0	Х	EOH @ 1.0 mBGS
_							

CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB8 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : H/A & Bobcat mounted pushrod DRILL METHOD : Hammer

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID - ppmv	SAMPLE (X)	OBSERVATIONS
			Ground Surface				
- 0.0			LIMESTONE ROADBASE limestone roadbase, brown, minor and major blue metal fragments, dry, poorly sorted.				
				60			
_			LIMESTONE ROADBASE limestone roadbase, cream to brown, minor and major blue metal fragments, dry, poorly sorted.	50			
_							
_							Very slight old hydrocarbon odour and slight staining observed in soil profile to 1.2 mBGS
_			SAND sand, fine to medium grain, orange, damp				
_				NO			
-							
1.0-					0.0	Х	EOH @ 1.0 mBGS

CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB9 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : H/A & Bobcat mounted pushrod DRILL METHOD : Hammer

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID - ppmv	SAMPLE (X)	OBSERVATIONS
0.0			Ground Surface				
0.0			SAND sand, fine grain, brown, small and soft limestone fragments (<5%), moist.				
1.0-				NO	0.0		
			SAND sand, fine grain, slightly darker brown, small and soft limestone fragments (<5%), moist. SAND sand, fine grain, orange, moist.			х	
2.0-				NO	0.0		
3.0-				NO	0.0		
							EOH @ 3.5 mBGS

CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB10 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : H/A & Bobcat mounted pushrod DRILL METHOD : Hammer

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID - ppmv	SAMPLE (X)	OBSERVATIONS
0.0-			Ground Surface				
0.0			SAND sand, fine grain, mottled white and grey with some brown, small to large (1-5 cm) limestone, bitumen and blue metal fragments (60 -70%), moist.				
1.0			SAND sand, fine grain, dark brown (stained), moist.	NO	0.0	х	
2.0-			SAND sand, fine grain, brown orange, moist.	NO	0.0		
3.0-				NO	0.0	Х	EOH @ 3.0 mBGS

CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB11 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : Bobcat mounted pushrod DRILL METHOD : Hammer

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	- Old ppmv	SAMPLE (X)	OBSERVATIONS	
0.0-			Ground Surface					
0.0-			LIMESTONE ROADBASE					
			limestone roadbase with mottled					
			sand, cream and brown, moist					
_								
_								
-								
-								
-				NO	0.0	X	EOH @ 0.5 mBGS	
			aak Odouri NO-Madarata Odouri SO, Steare O			on: 64		
	REMARKS :NO=No Odour; WO=Weak Odour; MO=Moderate Odour; SO=Strong Odour; VSO=Very Strong Odour PID : NR = No Response							

CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB12 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : Bobcat mounted pushrod DRILL METHOD : Hammer

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID - ppmv	SAMPLE (X)	OBSERVATIONS
0.0			Ground Surface				
0.0-			SAND sand, fine grain, brown to dark brown, moist.				
1.0-				NO	0.0		
2.0-			SAND sand, fine grain, orange, moist.	NO	0.0	¥	Drilling stopped as limestone intercepted at 2.5 mBGS
						X	

CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB13 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : Bobcat mounted pushrod DRILL METHOD : Hammer

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID - ppmv	SAMPLE (X)	OBSERVATIONS
0.0			Ground Surface				
0.0			LIMESTONE ROADBASE limestone roadbase, brown, dry.				
			SAND sand, fine grain, mottled orange and brown, limestone and blue metal fragments (<20%), moist.	-			
1.0-				NO	0.0		
			SAND sand, fine grain, orange and brown tending lighter with depth, moist.	-			
2.0-				NO	0.0		
3.0-				NO	0.0		
-				-		x	EOH @ 3.5 mBGS

CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB14 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : Bobcat mounted pushrod DRILL METHOD : Hammer

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID - ppmv	SAMPLE (X)	OBSERVATIONS
0.0			Ground Surface				
0.0			SAND sand, fine grain, layered cream, white and brown, approximately 50% limestone fragments, slightly moist.				
1.0-				NO	0.0		
2.0-			SAND sand, fine grain, orange, slightly moist.	NO	0.0		
3.0-				NO	0.0	Х	EOH @ 3.5 mBGS
_							

CLIENT : Mr R Turner CONSULTANT : GEMEC Pty Ltd PROJECT : Former Shell East Fremantle Service Station LOCATION : 91 Canning Hwy, East Fremantle DRILLING CO : Strataprobe SOIL BORING : SB15 DRILL DATE : 08.08.08 EASTING : NA NORTHING : NA DRILL RIG : Bobcat mounted pushrod DRILL METHOD : Hammer

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID - ppmv	SAMPLE (X)	OBSERVATIONS
0.0			Ground Surface				
0.0			SAND sand, fine grain, layered cream, white and brown, approximately 50% limestone fragments, slightly moist.				
1.0-				NO	0.0		
2.0-			SAND sand, fine grain, orange, slightly moist.	NO	0.0		
3.0-				NO	0.0	X	EOH @ 3.5 mBGS
_							

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Appendix D

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Site Photographs

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Targeted Soil Investigation Report Former Shell East Fremantle Service Station 91 Canning Highway, East Fremantle, W.A. August 2008



Former Shell East Fremantle Service Station

view to the south-east - 08 August 2008



view to the west - 08 August 2008

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view to the north - across the former forecourt - 08 August 2008

GEMEC Pty Ltd

Targeted Soil Investigation Report Former Shell East Fremantle Service Station 91 Canning Highway, East Fremantle, W.A. August 2008

Historical Photographs



