

GEMEC Pty Ltd

SITE MANAGEMENT PLAN

for

FORMER BP BLUFF POINT SERVICE STATION

242 CHAPMAN ROAD, BERESFORD
WESTERN AUSTRALIA 6530



March 2012

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Providing Environmental Solutions

SITE MANAGEMENT PLAN

FORMER BP BLUFF POINT SERVICE STATION
242 CHAPMAN ROAD, BERESFORD
WESTERN AUSTRALIA 6530

Prepared for

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Report Distribution Record

Copies Issued	Company	Name/Title
1 hard & 1 CD		Mr RK & Mrs SJ Johnson
1 hard & 2 CDs	DEC Contaminated Sites Branch	Ms Sasha Webb-Ware / Environmental Officer
1 hard & 1 CD	Gemec Pty Ltd	Library

Revision List

Revision No	Revision Date	Description of Revision	Approved By

ABBREVIATIONS

ADF	Automotive Diesel Fuel	MWSLs	Marine Water Screening Levels
ADWGs	Australian Drinking Water Guidelines	NATA	National Association of Testing Authorities
AHD	Australian Height Datum	NEHF	National Environmental Health Forum
ALs	Assessment Levels	NEPC	National Environment Protection Council
ANZECC	Australian and New Zealand Environment and Conservation Council	NEPM	National Environmental Protection Measure
AST	Aboveground Storage Tank	NHMRC	National Health and Medical Research Council
ASLP	Australian Standard Leaching Procedure	OCs	Organochlorine Pesticides
BTEXN	Benzene, Toluene, Ethylbenzene, Xylenes and Naphthalene	OH&S	Occupational Health and Safety
BTOC	Below Top of Casing	OPs	Organophosphate Pesticides
CoPC	Contaminants of Potential Concern	PAHs	Polycyclic Aromatic Hydrocarbons
CoT	Certificate of Title	PASS	Possible Acid Sulphate Soils
CSM	Conceptual Site Model	PDWSA	Public Drinking Water Source Area
DEC	Western Australian Department of Environment and Conservation	PID	Photoionisation Detector
DEP	Western Australian Department of Environmental Protection	ppm_v	parts per million by volume
DO	Dissolved Oxygen	PQL	Practical Quantitation Limits
DoE	Department of Environment	PSH	Phase Separate Hydrocarbons
DoH	Western Australian Department of Health	PULP	Premium Unleaded Petrol
DoHG	Department of Health domestic non-potable groundwater use guidelines	QA	Quality Assurance
DoLA	Department of Land Administration	QC	Quality Control
DoW	Department of Water	SAP	Sampling and Analysis Plan
DPH	Dissolved Phase Hydrocarbons	SB	Soil Boring
EC	Electrical Conductivity	SL	Screening Level
EILs	Ecological Investigation Levels	SoW	Scope of Works
FW	Fresh Water Assessment Levels	SP	Super Petrol
GME	Groundwater Monitoring Event	SVOC	Semi-Volatile Organic Compounds
HILs	Health Investigation Levels	SWL	Standing Water Level
LDPE	Low Density Polyethylene	TEX	Toluene, Ethylbenzene, Total Xylenes
LOR	Limit of Reporting (Analytical Laboratory)	TDI	Tolerable Daily Intake
LPG	Liquefied Petroleum Gas	TDS	Total Dissolved Solids
LTIWALS	Long Term Irrigation Water Assessment Levels	TOC	Total Organic Carbon
mbgs	Metres Below Ground Surface	TPH	Total Petroleum Hydrocarbons
mbtoc	Metres Below Top of Casing	ULP	Unleaded Petrol
m² / m³	Square Metres / Cubic Metres	ULT	Ultimate Petrol
MW	Groundwater Monitor Well	UST	Underground Storage Tank
		UWPCA	Underground Water Pollution Control Area
		VOCs	Volatile Organic Compounds
		WRC	Waters and Rivers Commission

METALS

Al	Aluminium
As	Arsenic
Cd	Cadmium
Cr	Chromium (total)
Cr III	Trivalent chromium
Cr VI	Hexavalent chromium
Cu	Copper
Fe	Iron
Hg	Mercury
Mn	Manganese
Ni	Nickel
Pb	Lead
Zn	Zinc

1. Executive Summary

<u>Client:</u>	Mr RK and Mrs SJ Johnson (ABN 20 037 683 831) of 8 Hemsley Place, Bluff Point WA 6530.
<u>Site Name / Location:</u>	Former BP Bluff Point Service Station, 242 Chapman Road, Beresford, WA 6530 (the site).
<u>Background:</u>	<p>A service station operated at the site for ~50 years, prior to closure and demolition in December 2008.</p> <p>BP Australia Ltd (BP) owned and operated the site from 1959 until 2001. The current owners, Mr & Mrs Johnson, purchased the site from BP in 2001.</p> <p>The site was closed in December 2008 and all buildings and infrastructure removed.</p> <p>Previous land use (prior to the service station) is unknown, but presumed to have been residential.</p> <p>The Indian Ocean is located ~80 m to the west of the site.</p> <p>BP undertook environmental investigations and soil remediation works at the site in 1997 through to 2000. The results of the of the investigations identified contaminated soil and groundwater in the vicinity of the remote fill points located on the southern boundary and in the vicinity of the waste oil sump and triple interceptor trap located at the rear of the workshop building. BP excavated contaminated soil from the vicinity of the fill points in 1998 and waste oil sump in 2000.</p> <p>BP installed a groundwater monitoring well network of seven on-site (MW1 – MW7) and four off-site (MW8 – MW11) wells. Monitoring wells MW1, MW4 and MW11 have been destroyed.</p> <p>The above works (with the exception of the groundwater monitoring data) are documented in the BP's report <i>Environmental Site Assessment and Remediation Report – December 2000</i>.</p> <p>Gemec Pty Ltd (Gemec) has undertaken environmental investigations and soil remediation works beginning in 2007 to the present. The results of the investigations identified that contaminated soil remained in the saturated zone in the vicinity of the remote fill points (in 2007) and in the vicinity of the waste oil sump. Contaminated groundwater is present in the south-central and south-western portion of the site with phase separated hydrocarbons (PSH), identified as waste oil, reported in the vicinity of the former waste oil sump and at a location in the vicinity of the former workshop / wash down pad (identified as diesel). Gemec excavated soils in the vicinity of the waste oil sump and workshop in 2009 and 2010.</p> <p>Gemec has installed an additional 13 wells on-site (MW3, MW3A, MW3B, MW14, MW15, MW15A – MW22) and two off-site (MW13 and MW23). Monitoring wells MW3, MW3A and MW15 have been destroyed.</p> <p>A quantitative health risk assessment (qHRA) has been completed for the site.</p> <p>The site is zoned 'Residential R12.5/40/60.</p>
<u>Objectives of the Site Management Plan (SMP):</u>	To provide a management strategy for the site that will protect human health and the environment from adverse risk of impact from the identified soil and groundwater impacts.

Scope of Work: Review the results of previous environmental investigations.
Review proven and effective management strategies that will realise the objectives.

Summary of Previous Investigations:

BP Australia Ltd (BP):
Environmental Site Assessment (ESA) – November 1996.
Excavation of impacted soils in the vicinity of remote fill points – July 1998.
ESA – July 2000.
ESA – removal of waste oil concrete liner & oily water separator - December 2000.
Bi-annual groundwater sampling of the on & off-site groundwater monitoring well network (eight monitor wells) – October 1997 to present.

Gemec Pty Ltd (Gemec):
Soil investigation – June 2007.
Validation of the tank pit & excavation of contaminated soil – January 2009.
Groundwater investigations, August 2008 – June 2009.
Soil & groundwater investigations, November 2009 – May 2010.
Groundwater monitoring event (GME) – December 2009.
Excavation of contaminated soil from the former waste oil sump area in February / March 2010.
GMEs – April and October 2011.

Leeder Consulting:
Soil vapour flux testing – January 2010.

Environmental Business Solutions Pty Ltd
Risk Assessment – November 2009
Stage 2 Risk Assessment – June 2010

Environmental Risk Sciences Pty Ltd (enRiskS):
Quantitative health risk assessment (qHRA) – December 2012.
Please refer to s. 19 for the reports that relate to the above phases of work.

DEC Site Summary Form: Attached in Appendix B.

1.1 Summary of Conclusions

Soil impacted with hydrocarbons is present in the southern central and south-western corner of the site. The majority of the exceedances are above the ecological investigation levels (EILs). All impacts are located in the saturated zone i.e. below 4 metres below ground surface (mbgs).

Groundwater impacted with elevated levels of hydrocarbons is present in the southern central and south-western corner of the site. No significant off-site impacts have been recorded. Concentrations of benzene and naphthalene exceeding the marine waters screening levels (MWSL) have been reported in two monitoring wells (MW7 and MW19) with concentrations of benzene, ethylbenzene and xylenes exceeding the Department of Health (DoH) guidelines for domestic non-potable use of groundwater (DoHG) in four monitoring wells (MW6, MW7, MW15A and MW19) – October 2011 data.

Phase separated hydrocarbons (PSH), identified as diesel, are present in one monitoring well (MW19) located in the southern central portion of the site. A passive skimmer is installed in the well with 5.2 L of diesel being removed to December 2011.

The intended future use of the site is as mixed commercial (offices) and residential. A three story building is proposed with office space on the ground floor and residential on the top two floors.

The remedial options selected for the site are removal of the PSH via passive skimmer and monitored natural attenuation of the dissolved phase hydrocarbon impacts.

1.2 Quantitative Health Risk Assessment

The enRiskS qHRA report concluded:

- *"No complete or significant pathways of exposure have been identified for all future uses of the site;*
- *On this basis risks to human health for all future users of the site are considered to be negligible. Hence there is no requirement to consider or implement any risk management measures on the site."*

1.3 Summary of Recommendations:

Continued removal of PSH from MW19 until no longer practicable.

On-going monitoring of key wells until such time as concentrations of hydrocarbons fall, and remain, below the adopted screening levels for the site.

Reinstatement of key monitoring wells that are destroyed during the construction of the building.

Reports for the GMEs are to be forwarded to the Contaminated Sites Branch (CSB) of the Western Australian Department of Environment and Conservation (DEC) to enable DEC to update their records for the site.

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

2. Scope of Work

Gemec Pty Ltd (Gemec) was contracted by Mr RK and Mrs SJ Johnson (ABN 20 037 683 831) to prepare this site management plan (SMP) for the former BP Bluff Point service station site located at 242 Chapman Road, Beresford, Western Australia (WA) 6530 (the site).

The scope of work (SoW) developed for the SMP was to:

- review previous environmental reports;
- review risk assessment reports;
- determine if potential data gaps exist;
- assess the requirement for further remediation;
- determine the remedial objectives and assess remedial options;
- identify what additional baseline data may be required to implement the chosen remedial option;
- identify if a community consultation process is required; and
- prepare the SMP in a format suitable for submission to the Western Australian Department of Environment and Conservation (DEC).

3. Site Identification

<u>Site Address:</u>	242 Chapman Road, Beresford, Western Australia 6530.
<u>Common Name of Site:</u>	Former BP Bluff Point Service Station.
<u>Land Title Details:</u>	Lot 563 on Deposited Plan 22471, Volume 1228, Folio 115. Registered title holders listed as Ross Kevin Johnson and Sandra Joy Johnson both of 8 Hemsley Place, Bluff Point, Western Australia. Copy provided in Appendix B.
<u>Site Co-ordinates:</u>	Provided on the attached Figure 3.
<u>Australian Height Datum:</u>	Approximately 4 m Australian Height Datum (AHD).
<u>Site Land Area:</u>	2593 m ² .
<u>Specific Area Under Investigation:</u>	2593 m ² and off-site to the west.
<u>Locality Map / Site Plan:</u>	Provided in the Figures section.
<u>Local Government:</u>	City of Greater Geraldton. Geraldton is located ~374 km north, north-west of Perth in the 'Mid-West Region' of WA.
<u>DEC Contaminated Sites Database Information:</u>	The site was classified on 12 April 2007 as "Contaminated – remediation required" based on information submitted to DEC in March 2007 and information obtained from the 1996 and 2000 site investigations. Refer to Appendix B for a copy of DEC's 'Basic Summary of Records'.
<u>Reason for DEC Site Classification:</u>	The information supplied to DEC related to contamination identified in the south-western corner of the site with concentrations of hydrocarbons present in the soils exceeding the EILs and concentrations of hydrocarbons present in the groundwater at levels exceeding the Australian Drinking Water Guidelines and Aquatic Ecosystems – Fresh / Marine waters.
<u>Dangerous Goods Certification:</u>	N/a.

4. Site History

Former and Current Land Owner(s):

Information gleaned from historical certificates of title (CoT) indicates the following:

1892-1897: Robert David Hutchinson of Geraldton, Masons

1897-1903: Harry Schimmelpennick Ainsworth of Geraldton, Mining Agent

1903-1917: William Bourke of Geraldton

1917-Feb 1923: James Walker Clydesdale of Geraldton, Solicitor

Feb 1923-Oct 1923: Alfred Ernest Builder of Geraldton, Business Manager

Oct 1923-1937: William Bourke of Marine Terrace, Geraldton

1937-1941: unknown

1941-1947: Dennis McMahon Glynn of Durlacher Street, Geraldton

1947-1959: Peter & Kereakos Stavros of Waggrakine

1959-2001: BP Australia Ltd

2001-present: Ross Kevin Johnson and Sandra Joy Johnson (ABN 20 037 683 831), both of 8 Hemsley Place, Bluff Point, Western Australia, as joint tenants.

Zoning:

Previous: unknown.

1972 to September 2011: 'Special Use – Service Station', under City of Geraldton-Greenough Town Planning Scheme No. 3 (District Scheme) - (refer to Appendix B).

Present: Residential R12.5/40/60.

Land Use:

Previous: a service station operated on-site for ~50 years until demolition in December 2008; land use prior to this is unknown, however based on review of the historical CoTs the site would appear to have been used primarily for residential use up until at least 1947.

Present: vacant – cleared of all infrastructure.

Proposed: three storey mixed commercial / residential property (offices on ground floor with residential on the upper two floors). The proposed building footprint is provided in the Figures section (Figure 8).

Previous
Environmental
Investigations:

BP:

Environmental Site Assessment (ESA) – November 1996.

The ESA identified contaminated soil and groundwater in the vicinity of the remote fill points located on the southern boundary and contaminated soil in the vicinity of the waste oil sump located at the rear of the former workshop. BP installed eleven groundwater monitoring wells on- and off-site in 1997 and 1998 with phase separated hydrocarbons (PSH) reported in MW1 (located in the vicinity of the fill points) and MW4 (located adjacent the south-western corner of the workshop building) and elevated concentrations of benzene, toluene, ethylbenzene, xylenes (BTEX) and C6-C14 fraction total petroleum hydrocarbons (TPH) reported in MW6 and MW7 located on the western boundary.

Remediation of impacted soils – July 1998.

Excavation works were undertaken to remove the contaminated soil from the vicinity of the remote fill points. Due to the location of the contamination (depth and vicinity of the site boundary) and nature of the soils (loose sands above the limestone), complete removal of the contaminated soil was not possible; hence soil containing concentrations of hydrocarbons exceeding the adopted screening levels remained at the southern and western extents of the excavation. Generally the exceedances were above the EIL and at depths ≥ 3.5 metres below ground surface (m BGS).

ESA – July 2000 and removal of waste oil concrete sump and oily water separator – December 2000.

The results of the ESA indicated that contaminated soils remained in the vicinity of the former remote fill points and the waste oil sump. The waste oil sump and triple interceptor trap were removed in December 2000, along with ~ 30 cubic metres (m^3) of contaminated soil. Due to the location of the workshop building not all contaminated soil was removed.

BP has undertaken bi-annual GMEs of the on- and off-site monitoring well network (eight monitoring wells) from 1997 to present. Based on data from those wells that are part of the BP network (MW2, MW5-MW10) contaminated groundwater was generally confined to the south-western corner of the site.

Gemec:

Soil investigation – June 2007.

The soil investigation concentrated on the former (BP) excavation area and waste oil sump area. The outcomes of the excavation area investigation identified that soil with concentrations of hydrocarbons exceeding the EIL remained in the vicinity of the southern and south-western extents of the excavated area. All impacts were located in the saturated zone at ~ 5 mbgs.

Contaminated soil was identified at ~ 3 mbgs (on top of the limestone) at the former location of the waste oil sump with concentrations of hydrocarbons exceeding the EIL and the health investigation levels (HIL) for residential site use (HIL-A).

Previous
Environmental
Investigations Cont...:

Validation of the tank pit and excavation of contaminated soil – January 2009.

Following demolition of the buildings and removal of infrastructure (including the underground storage tanks [USTs]) in December 2008 (undertaken by the site owner) the soils within the former tank pit and beneath the former dispenser locations were validated. Excavation of contaminated soils in the vicinity of the waste oil sump was also undertaken, with the excavation extents validated. The excavation did not extend beyond the hard limestone layer encountered at ~3.3 m BGS. During the excavation monitoring well MW3 was destroyed.

Groundwater investigation, August 2008 – June 2009.

Following the destruction of MW3, four monitoring wells (MW3A, MW14, MW15 and MW16) were installed in the vicinity of the waste oil sump excavation with one installed off-site (MW13 – installed in August 2008) to the north of MW10. Well MW13 was installed to cover a perceived data gap in the network following calculation of groundwater flow being to the north, north-west. Soil impacts exceeding the EIL and HIL-D (HIL for residential use with minimal access to soil) were reported in the MW15 boring at a depth of ~3 m BGS. Of the four newly installed on-site wells, minor concentrations of BTEX and TPH were reported in samples collected from MW3A and MW15, trace concentrations of C15-C36 TPH were reported in the MW16 sample with no BTEX or TPH compounds detected in the MW14 sample above the laboratory limit of reporting (LoR). No BTEX or TPH compounds were detected in the MW13 sample above the laboratory LoR.

The results of the GME indicated that groundwater impacts were present in the vicinity of the former waste oil sump area and south-western site boundary.

Soil, soil vapour, groundwater investigations and excavation of contaminated soil, November 2009 – May 2010.

Sixteen soil borings were installed over those areas of the site not previously subjected to investigation. No impacts exceeding adopted screening levels were reported in any of the samples collected from the borings.

An additional five monitoring wells were installed on-site (MW17 – MW22) with one installed off-site (MW23). Soil impacts exceeding the EIL and HIL-F (HIL for commercial / industrial use) were reported in the MW19 boring at a depth of 5 m BGS (i.e. within the saturated zone).

PSH was reported in MW3A in December 2009 with an apparent thickness of 0.024 m. The PSH was observed to be waste oil.

Following the reporting of PSH in MW3A further excavation was undertaken within the former waste oil sump area in February 2010. The excavation extended through the hard limestone layer to a maximum depth of 7.0 mbgs. The extents were validated. During the excavation MW3A and MW15 were destroyed. The wells were re-instated as MW3B and MW15A in March 2010. A trace of TPH impact marginally exceeding the EIL, HIL-D and HIL-F screening levels was reported in a soil sample collected in the saturated zone in the MW15A borehole.

Leeder Consulting undertook soil vapour flux testing at three locations at the site on 18 and 19 January 2010. Concentrations of benzene and dichlorodifluoromethane were reported at all three locations.

<u>Previous Environmental Investigations Cont...:</u>	<p>Environmental Business Solutions Pty Ltd (EBS) conducted Stage 1 and 2 human health and environmental risk assessments for the site in 2009 and 2010.</p> <p><i>Soil and groundwater investigation – March, April and October 2011.</i></p> <p>Four surface soil samples were collected, one monitoring well (MW24) was installed and an asbestos investigation was undertaken.</p> <p>Trace concentrations of the organochlorine pesticide compounds dieldrin and endrin were reported in one of the surface soil samples – the concentrations of dieldrin and endrin marginally exceeded the EILs. No BTEX or TPH compounds were detected above the laboratory LoR in any of the samples.</p> <p>MW24 was installed on the southern site boundary to assess groundwater concentrations at the boundary adjacent the adjoining lot (Lot 27). No BTEX or TPH compounds were detected above the laboratory LoR in the soil or groundwater samples collected from the well following installation (March and April respectively); however trace concentrations of benzene and xylenes were reported in the sample collected from the well during the October GME.</p> <p>Two GMEs were undertaken, one in April and one in October. PSH was reported in MW19 during the April (0.100 m) and October (0.500 m) GMEs. The PSH was identified as fresh diesel. A passive skimmer was installed in the well with 5.2 L of diesel recovered to December 2011.</p> <p>The site has been subject to routine groundwater monitoring since 1998. Currently there are 15 monitoring wells located on the site with five off-site immediately to the west across Chapman Road. The off-site wells are located ~50 m from the Indian Ocean.</p> <p>Elevated dissolved phase hydrocarbon impacts are confined to the southern central and south-western portion of the site.</p> <p>No significant off-site groundwater impacts have been reported.</p> <p>enRiskS completed a qHRA for the site in December 2012. As part of the qHRA soil gas samples were collected from areas of impacted groundwater in August 2012.</p> <p>Please refer to s. 19 for the reports that detail the phases of work.</p>
<u>Heritage:</u>	<p>A search of the WA Department of Indigenous Affairs Aboriginal Heritage Inquiry System (www.dia.wa.gov.au/AHIS) and Heritage Council of Western Australia's heritage places register (http://register.heritage.wa.gov.au) indicated no Aboriginal or other heritage listing pertaining to the site and / or immediate surrounds.</p>
<u>Surrounding Land Use and Zoning:</u>	<p>Residential.</p>
<u>Review of Aerial Photographs:</u>	<p>Refer to Gemec's <i>Soil & Groundwater Investigation Report November 2009 – May 2010</i>.</p>
<u>Site Photographs:</u>	<p>Refer to Gemec's previous reports.</p>
<u>Chemical Inventory & Waste Disposal:</u>	<p>No chemical storage remains at the site.</p>
<u>Possible Contamination Sources:</u>	<p>Impacted soils in the saturated zone.</p>

Details and Locations
of Current & Former
USTs, ASTs &
Infrastructure:

Provided in the attached Figures.

Details of Tank & Line
(T&L) Testing:

N/a.

Product Spill & Loss
History:

A loose joint in the inlet pipe connecting the former waste oil concrete sump to the work shop was identified as the cause of hydrocarbon impacted soil by BP in 2000.

Leaks from the former remote fill points located adjacent the southern site boundary were identified as the source of contamination delineated during previous investigations by BP in the south-western corner of the site.

Discharges to Land,
Water & Air:

Not applicable within the context of this report as the site is vacant.

Disposal Locations:

Not known.

Relevant Complaint
History:

None recorded.

Groundwater
Information / Local
Usage of Ground &
Surface Waters:

Refer to s. 6.

Integrity Assessment:

Information used in compiling this report was obtained from a variety of sources including a number of State and Local Government agencies, Consultant's reports and discussion with the site owner. Gemec has relied on the integrity of these sources in compiling this report.

5. Site Conditions and Surrounding Environment

<u>Site Setting:</u>	The site is located within a residential area in the City of Geraldton. The Indian Ocean is situated ~80 m west of the site. Refer to the Figures section for a local area map and an aerial photograph of the site.
<u>Local Topography:</u>	A gradual incline from the site continues east approximately 400 metres, rising to approximately 22 m AHD. Across Chapman Road and street verge the topography drops sharply down to the beach and the Indian Ocean.
<u>Site Topography:</u>	The majority of the site is flat (~4 m AHD) with an increase in elevation to ~6 m AHD on the eastern boundary (Henry Street).
<u>Condition at Site Boundary:</u>	Comprised of bitumen crossovers (fair condition), concreted footpaths (good condition) and grass verges (fair condition) adjacent Chapman Road and Dean Street frontages – all other site boundaries are unsealed.
<u>Visible Signs of Contamination:</u>	Phase separated hydrocarbons (PSH) were observed in MW19 during the 2011 GMEs. The PSH was described as fresh diesel.
<u>Visible Signs of Vegetation Stress:</u>	None observed – all trees and shrubs in the near vicinity appeared to be healthy.
<u>Presence of Drums, Wastes and Fill Material:</u>	No drums or waste materials were present at the site. Fill sands have been imported onto the site for previous backfilling activities.
<u>Condition of Buildings and Site Surfaces:</u>	Following the demolition of the buildings and removal of the USTs and associated infrastructure (undertaken by the site owner), site surfaces are comprised of sand overlain by a layer of compacted pea gravel.
<u>Odours:</u>	Hydrocarbon odours were detected within the groundwater samples collected from MW7 and MW19 during the October 2011 GME.
<u>Quality of Surface Water:</u>	The Indian Ocean, located (~80 m west) is a slightly to moderately disturbed marine ecosystem.
<u>Preferential Pathways:</u>	Refer to s. 13.
<u>Site Drainage:</u>	Run-off from site surfaces would discharge onto Chapman Road.
<u>Flood Potential:</u>	Nil.
<u>Residents in Close Proximity:</u>	Low density residential housing is located to the north (~15 m across Dean Street), to the east (~15 m across Henry Street) and the south (directly adjacent the site boundary).
<u>Potential Sensitive Environments in Vicinity of the Site:</u>	Residential housing located on the southern boundary. The Indian Ocean located 80 m west of the site.

6. Geology and Hydrogeology

<u>Site Soil Stratigraphy / Geology:</u>	A thin layer of imported compacted orange pisolitic gravel (pea gravel) covers the majority of the site, overlying sand – fine to medium grain, brown / dark brown tending light brown tending white / light grey with depth, dry tending damp with depth, with a hard limestone layer intercepted at ~4.0 m BGS. The surface of the limestone is hard [cap rock] and variably lithified beneath. The thickness of the limestone layer is unknown (max depth of investigation was 6.3 mbgs) – the aquifer is within the variably lithified limestone layer.
<u>Location and Extent of Imported and Locally Derived Fill:</u>	The BP excavations were backfilled with clean fill sand – the source was not documented in their report. The Gemec January 2009 excavation was backfilled with validated excavated soil with the waste oil sump area excavation (February 2010) backfilled with validated excavated soil and imported fill.
<u>Description of Soil Contamination:</u>	Previous investigations have reported hydrocarbon impacts in the saturated zone, trace OCP impacts in a surface soil sample and sulphate in four surface soil samples.
<u>Site Bore Logs:</u>	Refer to previous reports.
<u>Description of the Construction of On-site Monitoring Well:</u>	Refer to previous reports.
<u>Site Groundwater Quality:</u>	Groundwater field chemical data indicates that groundwater quality is marginal to brackish. Refer to the attached Table 5.
<u>Description and Location of Springs and Wells Within 1 Km of the Site:</u>	Three DoW registered bores were identified within 1 km of the site, located ~650 m to the east (refer to Appendix B) – according to DoW data the wells are inactive having been closed in 1997. No known springs are located within 1 km of the site.
<u>Depth of Groundwater:</u>	On-site groundwater data indicates standing water levels (SWL) of ~4.0 m BGS equating to ~0.2 – 0.5m AHD.
<u>Presence of Multi-Layered Aquifers:</u>	Not known.
<u>Groundwater Flow Direction:</u>	Based on data from the October 2011 GME groundwater was calculated as flowing to the south, south-west.
<u>Site Generic Hydraulic Conductivity:</u>	Hydraulic conductivity of ~3 to 14 m/day. Gradient of 0.0002 m/m (October 2011 data).
<u>Permeability of Strata on the Site:</u>	Sand overlying the limestone – porosity of ~30%, permeability of ~10 ⁻⁴ m/s. Limestone: porosity of ~5%, permeability of ~10 ⁻⁸ m/s. Values are generic.
<u>Direction of Surface Water Runoff:</u>	To the west.

<u>Groundwater Discharge Location:</u>	Assumed to be the Indian Ocean.
<u>Ambient Groundwater Chemistry (October 2011 data):</u>	<p>Dissolved oxygen (DO):- ranged between 0.19 (MW15) and 2.84 (MW16) mg/L – mean of 0.98 mg/L, inferring that anaerobic conditions are generally present.</p> <p>Redox (ORP):- ranged between -162.8 (MW19) and 153.5 (MW2) mV – mean of 11.8 mV, inferring that both reducing and oxidising conditions are present.</p> <p>Electrical conductivity (EC):- ranged between 876 (MW5) and 6540 (MW7) μS/cm – mean of 2945.4 μS/cm. Equating to TDS values of 587 and 4382 mg/L respectively – mean of 1973 mg/. Inferring that groundwater quality beneath the site is generally brackish.</p> <p>pH:- ranged between 4.04 (MW13) and 10.46 (MW6) – mean of 6.8, inferring that groundwater within the unconfined aquifer is generally neutral.</p>
<u>Groundwater / Surface Water Interaction:</u>	A highly saline 'wedge' of sea water from the Indian Ocean is expected to intrude and impact on the groundwater (and flow direction) in the vicinity of the site – the extent of the salt water intrusion has not been studied.
<u>Groundwater Conditions:</u>	Confined aquifer; however where excavations have been conducted, unconfined.
<u>Beneficial Use of Groundwater in the Vicinity:</u>	<p><u>Potable use</u></p> <p>Not known to occur due to the presence of mains reticulated supply, brackish quality of the groundwater, proximity to the Indian Ocean and lack of registered abstraction bores.</p> <p><u>Registered / down-gradient bore users</u></p> <p>None identified.</p> <p><u>Secondary / incidental use</u></p> <p>The potential for abstraction of groundwater for domestic non-potable beneficial uses (i.e. washing cars / flushing toilets / garden irrigation) however no registered active groundwater bores have been identified within 1 km of the site.</p>
<u>Potable Water Supply:</u>	Scheme water via the reticulated mains network. The Geraldton water supply is sourced from the Allanooka and Mt Hill wellfields, located approximately 50 km south-east of Geraldton in the Shire of Irwin; the wellfields extract groundwater from the Yarragadee Formation.
<u>Public Drinking Water Source Areas in Vicinity of the Site:</u>	None documented.
<u>Surface Water Bodies:</u>	Indian Ocean is located 80 m west of the site. Chapman River mouth located 3 km north of the site.
<u>Preferential Migratory Pathways:</u>	None identified.

7. Basis for Adoption of Screening Criteria

7.1 Selected Screening Criteria and References

<u>Matrix</u>	<u>Adopted Screening Criteria</u>	<u>Reference</u>
<u>Soil:</u>	ecological investigation levels (EIL) residential health investigation levels with minimal opportunities for soil access (HIL-D) commercial / industrial health investigation levels (HIL-F)	DEC, <i>Assessment levels for soils, sediment and water (V4.1, February 2010)</i>
<u>Water:</u>	Marine Waters Assessment Levels (MWSL) Domestic non-potable groundwater use guidelines (DoHG)	ANZECC and ARMCANZ (2000) - <i>DEC Assessment levels for soils, sediment and water (V4.1, February 2010)</i> DoH Contaminated Sites Reporting Guideline for Chemicals in Groundwater (2006)

7.2 Soil – Rational for and Appropriateness of Screening Levels

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 February 2010, DEC released a revised document entitled *Assessment levels for soils, sediment and water*, which forms part of the *Contaminated Sites Management Series (CSM)*. This document outlines the screening levels used by DEC in assessing site contamination and determining the requirements for further investigation, management or remedial action. With respect to soil contamination the document states “*Ecological investigation levels (EIL) and Health Investigation Levels (HIL) are screening assessment levels. If the screening assessment levels are exceeded, further risk assessment is required to determine whether the levels present are likely to pose an actual risk in the site specific setting. EILs and HILs are not default cleanup or remediation levels*”.

The EILs are based on threshold levels for phytotoxicity and uptake of contaminants which may result in impairment of plant growth, plant reproduction or unacceptable residue levels. The EILs are sourced from the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPN) which states that “*it is acknowledged that the EILs for an urban setting have not been derived to protect nominated ecological values and are somewhat arbitrary*”. The DEC requires that assessment of soil conditions be compared with the EILs to determine the potential for environmental impact.

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.

The HILs present a range of screening criteria based on the intensiveness of site usage (see below) – (DEC, 2010):

HIL Determinant / Selection Criteria

- A: standard residential with garden / accessible soil – includes day care centres, kindergartens, pre-schools and primary schools;
- D: residential with minimal opportunity for soil access: includes dwellings with fully or permanently paved yard space such as high rise apartments and flats;**
- E: parks, recreational open space and playing fields, includes secondary schools; and
- F: commercial / industrial, includes premises such as shops and offices as well as factories and industrial sites.**

The proposed future site use is as a three storey mixed commercial / residential property (offices on ground floor with residential on the upper two floors) as such the HIL-F and HIL-D screening criteria have been adopted as appropriate for the protection of human health, based on the intended use.

7.3 Groundwater – Rational for and Appropriateness of Screening Criteria

Where groundwater is being assessed, the most appropriate screening criteria are dependent upon the beneficial uses, management objectives and receiving environment of the groundwater resource. This may include consideration of screening criteria for support and protection of potable water resources, aquatic ecosystems (both fresh and marine), short term / long term irrigation and /or human health via domestic use. The criteria are provided within DEC's *Assessment levels for soils, sediment and water* guideline document (V4.1 DEC, 2010).

In consideration of the nature and quality of the groundwater resource at the site, the potential receiving environment (the Indian Ocean) and the intended future use, the MWSL are considered the appropriate groundwater screening levels for the site.

In instances where groundwater may be utilised for non-potable purpose (i.e. to flush toilets, wash cars and garden irrigation) the WA Department of Health (DoH) has outlined generic assessment criteria (DoHG) for protection of the public which may be using, or who may be exposed to, groundwater containing chemical residues. Given the groundwater quality and that the fact that the proposed site use would not necessitate the use of groundwater; as a conservative measure for the quantitation of risk, the DoHG screening levels were also adopted.

Where groundwater is used (or may potentially be used) as a potable source (i.e. TDS <800 mg/L), criteria as outlined within the Australian drinking water guidelines (ADWG, 2004) must be considered to ensure appropriate protection of drinking water resources. Groundwater was not assessed against the ADWG due to:

- there being no use of groundwater at or in the near vicinity of the site for potable purposes;
- the site is supplied potable water via reticulated mains scheme water; and
- the proposed intended use does not include provision for access to, or use of, groundwater.

The MWSL and DoHG screening levels do not contain published values for C6-C36 fraction TPH compounds.

Groundwater has not been assessed against the short irrigation criteria due to the proposed site use.

8. Results

A summary of the soil samples that have exceeded the adopted screening criteria (and as far as is known remain in situ) and historical and current groundwater analytical results is provided within the Tables section.

8.1 Soil

The locations of the soil samples containing concentrations that exceeded the adopted screening levels are provided in Figure 5.

8.1.1 Petroleum Hydrocarbons

The majority of exceedances were for the EILs with two samples (MW15A-5.0m and MW19-5.0m) marginally exceeding the HIL SLs. The MW19-5.0m sample was not subjected to aromatic / aliphatic speciation; however, based on the MW15A-5.0 m result for aromatic / aliphatic speciation the sample would most likely have speciated below the aromatic screening level for HIL-D and HIL-F site use.

All sample exceedance locations were within the saturated zone.

8.1.2 Organochlorine Pesticides

One surface sample (SS4) collected from the vicinity of the former location of the fuel dispensers reported concentrations of dieldrin and endrin marginally exceeding the EILs.

8.1.3 Nutrients

Four surface samples (SS1-SS4) collected from the vicinity of the former location of the fuel dispensers reported concentrations of sulphate exceeding the EILs.

8.2 Groundwater

Groundwater conditions have been monitored at the site since 1997 / 1998. There are six wells remaining at the site from 1997 / 1998 (MW2, MW5, MW6, MW7, MW8, MW9 and MW10).

No significant hydrocarbon impacts have been reported in any of the off-site wells located across Chapman Road (MW8, MW9, MW10, MW13 and MW23).

No significant hydrocarbon impact (during two GMEs) has been reported in the well (MW24) located on the south-western boundary of the site.

PSH was reported in MW19 in 2011. The PSH was identified as fresh diesel. A passive skimmer has been installed in the well.

A dissolved phase plume with elevated concentrations of benzene is located in the southern central and south-western corner of the site.

8.3 Soil Gas

Two soil gas investigations have been undertaken at the site, one undertaken by Leeder Consulting with a second investigation undertaken by Gemec personnel.

8.3.1 Leeder Consulting – January 2010

The Leeder investigation involved collection of surface gas emissions (vapour flux) at three locations (near MW7 [Flux1], near MW19 [Flux2] and between MW3A and MW15 [Flux3]) using the flux hood technique (the locations are provided in Figure 4). Samples were collected in thermal desorption tubes and analysed at Leeder Consulting's laboratory in Mitcham, Victoria.

The presence of benzene and dichlorodifluoromethane was reported in all samples. Subsequent review of the Leeder investigation and methodology undertaken by enRiskS inferred that the concentrations of benzene in one sample (Flux 3) was of significance however the presence of benzene in the other two samples was anomalous and attributed to equipment contamination. Similarly the presence of dichlorodifluoromethane in all three samples was attributed to sampling equipment contamination given the similar emission rates. The significance of benzene at the Flux 3 location is no longer relevant as the area where the soil gas sample was collected was excavated / remediated in February 2010.

8.3.2 Gemec – August 2011

Gemec installed soil gas probes at four locations (near MW7 [VP1], near MW20 [VP2], between MW19 and MW20 [VP3] and near MW15A [VP4]). The probes were installed to a depth of 1.5 m BGS (construction details are provided in Appendix B). Soil gas was collected in summa canisters and analysed at Air Toxics Ltd in California USA. In summary the data indicated that soil gas was not detected at concentrations that warranted further evaluation in relation to future vapour risk issues. The results are provided in the enRiskS December 2012 Health Risk Assessment Report.

9. Site Characteristics

The following sections detail the identified impacts i.e., at concentrations exceeding adopted SLs, to soil and groundwater at the site.

9.1 Identified Soil Impacts Remaining at the Site

9.1.1 BTEX, TPH and Naphthalene

Seven samples collected in 2007 from five soil borings installed along the southern and western extents of BP's 1998 excavation reported concentrations of toluene, ethylbenzene, xylenes and C6-C14 TPH exceeding the EILs in some or all of the samples. All samples were collected from the saturated zone.

One sample collected from the MW19 borehole in 2009 reported concentrations of ethylbenzene, xylenes, C6-C14 TPH and naphthalene exceeding the EILs and concentrations of C15-C28 TPH exceeding the HIL-D and HIL-F aromatic TPH screening levels. The sample was collected from the saturated zone.

One sample collected from the MW15A borehole in 2010 reported concentrations of C15-C28 TPH exceeding the EILs and concentrations of >C15-C35 aromatic fraction TPH marginally exceeding the HIL-D and HIL-F screening levels. The sample was collected from the saturated zone.

9.1.2 Organochlorine Compounds

The organochlorine compounds dieldrin and endrin were reported in one surface sample collected in 2011 at concentrations marginally exceeding the EILs.

9.1.3 Nutrients

Sulfate was reported in four surface samples collected in 2011 at concentrations exceeding the EILs.

9.2 Extent of Identified Groundwater Impacts

The exceedances reported below have been garnered from the October 2011 GME.

9.2.1 BTEX, TPH and Naphthalene

PSH:

- PSH (diesel) with a thickness of 0.5 m was reported in MW19.

Dissolved phase hydrocarbons:

- benzene concentrations exceeding the MWSL were reported in the MW7 and MW19 samples;
- naphthalene concentrations exceeding the MWSL were reported in the MW7, Dup 1 & Split 1 and MW19 samples;
- benzene concentrations exceeding the DoHG were reported in the MW6, MW7, MW15A and MW19 samples;

- ethylbenzene concentrations exceeding the DoHG were reported in the MW6 MW7, MW15A and MW19 samples; and
- xylene concentrations exceeding the DoHG were reported in the MW6, MW7, Dup 1 & Split 1 and MW19 samples.

9.2.2 Dissolved Metals

- copper concentrations exceeding the MWSL were reported in the MW6, Split 1 (MW7), MW8, MW13, MW14, MW17 and MW20 through MW24 samples
- arsenic concentrations exceeding the DoHG were reported in the MW7, Dup 1 & Split 1 samples

The groundwater impacts are confined to the southern central and south-western portion of the site.

Trace concentrations of benzene and xylenes were reported in MW24, the well is located on the southern boundary adjacent Lot 27.

No significant impacts have been detected in samples collected from the off-site wells.

Monitoring wells MW17 and MW19 are located within the proposed building footprint (refer to Figure 8).

9.3 Chemical Degradation of the Identified Impacts

Biodegradation of hydrocarbon impacts via natural attenuation occurs when naturally occurring bacteria mineralize the hydrocarbons into inorganic compounds.

9.3.1 Soil Impacts

Given the primary source has been removed, it is anticipated that the concentrations reported during the 2007 soil investigation would have further attenuated.

The impacts reported in the MW15A and MW19 boreholes are expected to attenuate over time; again all known primary sources have been removed.

9.3.2 Groundwater Impacts

A preliminary evaluation of the ability of the aquifer to support natural attenuation was undertaken by assessing the dissolved oxygen (DO), ferrous iron (Fe^{2+}) and nitrate (NO_3^-) results collected during the 2009, 2010 and 2011 GMEs. A reduction in DO and NO_3^- and an increase in Fe^{2+} are all indicators that degradation is occurring. The indicators of natural attenuation are present in all hydrocarbon impacted wells, with denitrifying bacteria being the predominant driver of natural attenuation.

Evaluation of the BTEX and TPH concentrations measured in MW7 for which there is historical data dating back to 1998 show a significant reduction in the order of one magnitude since 1998 with natural attenuation being determined as the driver of the reduction in concentrations following the removal of the secondary source (hydrocarbon impacted soils) in 1998.

9.4 Potential Exposure Pathways

Determining what exposure pathways may be present at a site involves the identification and confirmation of a source i.e., contaminants in air, soil and / or groundwater that exceed the adopted site SLs, a pathway by which a receptor may be exposed to the contaminants, and identification of the receptor.

Exposure pathways can be natural or man-made. Exposure pathways at the site have been identified based on a review of the intended site use, surrounding land use and geology / hydrogeology. The following potential exposure pathways were identified:

- direct dermal contact and ingestion of impacted soils and groundwater;
- respiration and inhalation of impacted soils and groundwater;
- vertical (and limited horizontal) migration of contaminants through the soil profiles (sands and limestone) of the vadose zone to the water table;
- inhalation of toxic vapours from the impacted groundwater;
- migration of impacted groundwater off-site; and
- service trenches and conduits.

9.5 Potential Receptors

Receptors are defined as populations, individuals and / or ecological receptors (e.g. groundwater, fresh water bodies, marine waters, flora and fauna) that are or may be adversely affected by the identified CoPC. Potential receptors located on or down-hydraulic gradient from the site, which have exposure pathways that may be complete, include the following:

Soil

Workers undertaking excavation activities at the site to depths >5 m BGS.

Plant species growing at the site.

Vapour

Workers, future occupants and residents of the site.

Residents of lots adjacent the southern site boundary.

Groundwater

The Indian Ocean.

Users of groundwater on adjacent sites.

9.6 Assessment of Receiving Environment Sensitivity

The receiving environment is the Indian Ocean located ~80 m to the west of the site. The sensitivity of the ocean is described as 'slightly to moderately disturbed' i.e., a marine environment lying immediately adjacent to metropolitan areas.

10. Tier 1 Health Risk Assessment

The tier one health risk assessment did not identify any potential receptors at adverse risk of impact from those substances identified as containing concentrations exceeding the adopted SLs.

Refer to Gemec's March, April and October 2011, *Soil & Groundwater Investigation Report* for more detailed discussion regarding the human health risks associated with the identified impacts.

A qHRA has been undertaken for the site by enRiskS in December 2011. The qHRA report accompanies this SMP. The qHRA concluded that:

- *"No complete or significant pathways of exposure were identified for all future uses of the site; and*
- *On this basis risks to human health for all future users of the site are considered to be negligible. Hence there is no requirement to consider or implement any risk management measures on the site."*

11. Tier 1 Ecological Risk Assessment

The tier one ecological risk assessment did not identify any potential receptors at adverse risk of impact from those substances identified as containing concentrations exceeding the adopted SLs.

Refer to Gemec's March, April and October 2011, *Soil & Groundwater Investigation Report* for more detailed discussion regarding the ecological risks associated with the identified impacts.

12. Evaluation of Remedial Options

12.1 Remedial Goals

Although no human health or ecological risk has been identified, the site will require monitoring of key wells to ensure that the data and assumptions that the risk assessments have been based on remain valid. Therefore the remedial goal is to remediate the groundwater impacts to a level that complies with the appropriate screening levels for the site (MWSL and DoHG), thereby protecting any long term potential receptors from exposure. This is to be achieved through continued removal of the PSH from MW19 to the extent practicable and use of monitored natural attenuation as a remedial technique.

12.2 Extent of Remediation Required

12.2.1 Soil

No soil impacts have been identified that require active remediation.

12.2.2 Groundwater

Remediation of the groundwater impacts will consist of the removal, to the extent practicable, of PSH from MW19 by passive skimmer.

Remediation of the dissolved phase impacts will consist of the monitoring of trends in the contaminant concentrations until such time that the impacts fall, and remain, below the adopted SLs for the site.

12.3 Remedial Options & Risk Reduction - Soils

Given that no impacts have been identified that require active remediation, as all identified impacts are located in the saturated zone, the requirement to remediate the soil impacts is not anticipated.

12.4 Remedial Options & Risk Reduction – Groundwater

12.4.1 PSH

PSH is to be removed to the extent practicable.

12.4.2 Dissolved Phase

Remediation by monitored natural attenuation relies on natural biological processes to biodegrade the impacts. Analytical results suggest that the aquifer has the potential to support natural attenuation (refer to s.9.3.2).

Given that results and data collected for the site to-date infer that no human or ecological receptors are deemed to be at adverse risk from the identified contaminants in the groundwater, active remediation is not thought warranted.

12.5 Recommended Remedial Option

12.5.1 Soil

No remediation of soil is to be undertaken.

12.5.2 Groundwater

PSH removal and monitored natural attenuation are regarded as appropriate remedial options for the site based on the identification of human and ecological receptors and data collected to-date.

13. Community Consultation

To date formal community consultation has not been undertaken as no impacts have been identified that place members of the immediate community or identified ecological receptors at risk of adverse impact from those substances identified as containing concentrations exceeding the adopted SLs.

The owner(s) of the adjacent Lot 27, to the south-west of the site, are the only potentially affected members of the adjacent community. The owners were verbally made aware of the status of the site prior to the installation of monitoring well MW24. To-date the concentrations reported in MW24 do not require more formal consultation be undertaken.

Should the results of subsequent GMEs indicate that the plume has migrated beneath Lot 27 formal consultations will be undertaken.

14. Long Term Site Management Plan

14.1 Validation of the Site Post Remediation

Remediation activities undertaken at the site to-date have consisted of the excavation of soil impacts. All excavation extents have been validated, with the exception of the southern and western extents of BP's 1998 excavation.

In the future, validation will be confined to groundwater impacts and will take the form of monitoring contaminant concentrations until such time as they remain below the adopted site screening levels for the protection of human health and the environment in the context of the proposed site use.

Future groundwater monitoring events will be confined to those wells in the southern central and south-western corner of the site and two off-site wells. The on-site wells to be subjected to future GMEs will be MW3B, MW6, MW7, MW14, MW15A, MW19, MW20 and MW24 with the off-site wells being MW8 and MW9.

Any of the above wells destroyed during building works will be re-instated. It is anticipated that monitoring well MW19 will be destroyed during construction of the proposed building. If possible the well will be reinstated on the southern boundary between the building and the boundary fence.

14.2 Contingency Plan (if the selected remedial strategy fails)

Should conditions dictate that active remediation of the groundwater impacts is required then in situ chemical reduction (ISCO) remedial methods incorporating biological oxidation of the impacts will be undertaken.

14.3 Interim Site Management

Interim site management will consist of maintaining the integrity of the key monitoring wells during and post construction phase.

14.4 Regulatory Compliance Requirements:

Reports on the GMEs are to be submitted to DEC.

14.5 Site Management Plan – Operational Phase

Not required.

14.6 Remediation Schedule

Recovery of PSH will be on-going until recovery is no longer practicable.

Following each GME the data obtained will be reviewed in order to ensure that the assumptions made with regard to receptor risk remains valid.

An exact completion date cannot be estimated and will be subject to the results of ongoing groundwater monitoring. An estimation of the cessation of monitoring is 5 to 10 years.

14.7 Identification of Regulatory Compliance Requirements

None applicable.

14.8 Receptor Proximity

The primary identified ecological receptor is the Indian Ocean located ~80 m to the west of the site.

The primary identified human health receptors are future visitors, occupants and residents of the intended commercial/ residential development and occupants of the residence located adjacent the south-western boundary on Lot 27.

14.9 Contingency Plan for Receptors (if management plan fails)

The contingency plan will be the same as that identified in s. 14.2.

14.10 Contact Details

Contacts	Name	Position	Phone	Email
Primary contact:	Richard Baldwin	Director	9339 8449	richard@gemec.com.au
Secondary contact:	David Ross	Principal	9339 8449	david@gemec.com.au

14.11 Community Relations Plans

Refer to s. 13.

14.12 Progress Reporting

The GME reports will be forwarded to DEC Contaminated Sites Branch once completed.

A final Validation report will be completed once agreement is reached with DEC that monitoring can cease.

14.13 Equipment To Be Used

Gauging will be undertaken using a Heron[®] interface probe.

Purging and sample collection will be undertaken using a 12 v variable speed stainless steel pump and flow cell.

15. Conclusions and Recommendations

15.1 Summary of Conclusions:

Soil impacted with hydrocarbons is present in the southern central and south-western corner of the site. The majority of the exceedances are above the EILs. All impacts are located in the saturated zone, i.e. below 4 mbgs.

Groundwater impacted with elevated levels of hydrocarbons is present in the southern central and south-western corner of the site. No significant off-site impacts have been recorded. Concentrations of benzene and naphthalene exceeding the MWSL have been reported in two monitoring wells (MW7 and MW19) with concentrations of benzene, ethylbenzene and xylenes exceeding the DoHG in four monitoring wells (MW6, MW7, MW15A and MW19) – October 2011 data.

PSH, identified as diesel, is present in one monitoring well (MW19) located in the southern central portion of the site. A passive skimmer is installed in the well with 5.2 L of diesel being removed to December 2011.

The intended future use of the site is as mixed commercial (offices) and residential. A three story building is proposed with office space on the ground floor and residential on the top two floors.

The remedial options selected for the site are removal of the PSH via passive skimmer and monitored natural attenuation of the dissolved phase hydrocarbon impacts.

15.2 Quantitative Health Risk Assessment

The enRiskS qHRA report concluded:

- *"No complete or significant pathways of exposure have been identified for all future uses of the site;*
- *On this basis risks to human health for all future users of the site are considered to be negligible. Hence there is no requirement to consider or implement any risk management measures on the site."*

15.3 Summary of Recommendations:

Continued removal of PSH from MW19 until no longer practicable.

On-going monitoring of key wells until such time as concentrations of hydrocarbons fall, and remain, below the adopted screening levels for the site.

Reinstatement of key monitoring wells that are destroyed during the construction of the building.

Reports for the GMEs are to be forwarded to the Contaminated Sites Branch (CSB) of DEC to enable DEC to update their records for the site.

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

16. References

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USEPA, January 2010: *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples From Monitoring Wells*

Western Australian Commission for Occupational Safety and Health 2005, Guidance Note: *Occupational Safety and Health Management and Contaminated Sites Work*

WA Atlas – Shared Land Information Platform: <https://www2.landgate.wa.gov.au/bmvf/app/waatlas>

W.A Land Information Authority (Landgate)

17. Limitations of Report

This SMP has been compiled from data collected from the site from 1997 to December 2011.

Gemec have relied on the integrity of the data and the proposed site use in assessing the remedial options for the site.

This report has only been prepared for use by the client – Mr & Mrs Johnson. This report has not been prepared for use by parties other than the client; 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.

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.

Whilst every effort has been made to ensure accuracy, no liability is accepted for errors of fact or opinion herein.

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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Table 1: Historical & Current Groundwater Analytical Results - BTEXN & TPH

Monitoring Well	Date	SWL (m BTOC)	BTEXN					Total Petroleum Hydrocarbons			
			Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	C ₆ -C ₉	C ₁₀ -C ₁₄	C ₁₅ -C ₂₈	C ₂₉ -C ₃₆
MW1	15.10.97	-	0.280 m PSH								
	27.07.98	-	Destroyed during 1998 excavation								
MW2	15.10.97	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	27.07.98	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	12.12.99	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	01.07.00	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	17.01.01	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	28.08.01	3.798	<1	<1	1.3	<2	NT	<25	<25	<100	<100
	24.01.02	3.881	<1	<1	<1	<2	NT	<25	<25	<100	<100
	17.08.02	3.931	<1	<1	<1	<2	NT	<25	<25	<100	<100
	15.01.03	3.975	<1	<1	<1	<2	NT	<25	<25	<100	<100
	07.08.03	3.855	<1	<1	<1	<2	NT	<25	<25	<100	<100
	22.01.04	4.008	<1	<1	<1	<2	NT	<25	<25	<100	<100
	15.07.04	3.808	<1	<1	<1	<2	NT	<25	<25	<100	<100
	27.01.05	4.002	<1	<1	<1	<2	NT	<25	<25	<100	<100
	28.07.05	3.731	<1	<1	<1	<2	NT	<25	<25	<100	<100
	18.01.06	3.804	<1	<1	<1	<2	NT	<25	<25	<100	<100
	23.08.06	3.672	<1	<1	<1	<2	NT	<25	<25	<100	<100
	06.01.07	3.839	<1	<1	<1	<2	NT	<25	<25	<100	<100
	14.06.07	3.856	1.1	<1	<1	<2	NT	<25	<25	<100	<100
	31.01.08	3.869	<1	<1	<1	<2	NT	<25	<25	<100	<100
	23.07.08	3.638	<1	<1	<1	<2	NT	<25	<25	<100	<100
18.02.09	3.795	<1	<1	<1	<2	NT	<25	<25	<100	<100	
03.12.09	3.985	<1	<2	<2	<2	NT	<20	<50	<100	<50	
13.04.11	3.645	<1	<2	<2	<2	<5	<20	<50	250	80	
<i>Silica Gel Cleanup</i>											
05.10.11	3.842	<1	<2	<2	<2	<5	<20	<50	<100	<50	
Marine Waters Assessment Levels			500	NE	NE	NE	50	NE	NE	NE	NE
DoH-Domestic Non-potable Use			10	25 ¹	3 ¹	20 ¹	NE	NE	NE	NE	NE
Laboratory Limit of Reporting - NMI			1	1	1	1	1	25	25	100	100
Laboratory Limit of Reporting - ALS			1	2	2	2	5	20	50	100	50
Notes: all concentrations in micrograms per litre (µg/L) 1. aesthetic value 'NE' denotes screening level not established or under review 'NT' denotes sample not subjected to analysis 'm BTOC' denotes metres below top of casing samples analysed before December 2009 were submitted to NMI, samples analysed post December 2009 were submitted to ALS											

Table 1: Historical & Current Groundwater Analytical Results - BTEXN & TPH

Monitoring Well	Date	SWL (m BTOC)	BTEXN					Total Petroleum Hydrocarbons				
			Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	C ₆ -C ₉	C ₁₀ -C ₁₄	C ₁₅ -C ₂₈	C ₂₉ -C ₃₆	
MW3	15.10.97	-	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	01.07.00	-	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	17.01.01	-	<1	<1	970	380	NT	<25	<25	<100	<100	
	28.08.01	4.164	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	24.01.02	4.248	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	17.08.02	4.285	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	15.01.03	4.348	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	07.08.03	4.199	<1	<1	<1	<2	NT	<25	<25	<100	140	
	22.01.04	4.429	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	15.07.04	4.175	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	27.01.05	4.378	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	28.07.05	4.111	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	18.01.06	4.172	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	23.08.06	4.005	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	06.01.07	4.215	1.1	<1	<1	<2	NT	<25	<25	<100	<100	
	14.06.07	3.988	2.1	<1	<1	<2	NT	<25	<25	<100	<100	
31.01.08	-	No Access										
23.07.08	-	No Access										
28.08.08	4.085	<1	<2	<2	<4		<20	<50	<100	<50		
18.02.09	-	Destroyed during January 2009 excavation										
MW3A	07.04.09	4.581	8	<2	14	62	NT	100	480	1600	1250	
	11.06.09	4.397	6	<2	12	39	NT	90	620	3300	3780	
	04.12.09	4.835	0.24 m PSH (waste oil)									
	04.12.09	4.835 ²	4	<2	3	2	4.1	<20	280	1160	180	
	February 2010		Destroyed during 2009 excavation									
MW3B	12.03.10	4.997	5	<2	<2	2	NT	<20	160	1300	310	
	14.04.11	4.750	2	<2	<2	<2	<5	<20	<50	500	160	
		<i>Silica Gel Cleanup</i>									<50	<100
	06.10.11	4.918	<1	<2	<2	<2	<5	<20	<50	630	720	
<i>Silica Gel Cleanup</i>									<50	<100	60	
MW4	02.02.98	-	42 mm PSH									
	27.07.98	-	Destroyed during 1998 excavation									
Marine Waters Assessment Levels			500	NE	NE	NE	50	NE	NE	NE	NE	
DoH-Domestic Non-potable Use			10	25 ¹	3 ¹	20 ¹	NE	NE	NE	NE	NE	
Laboratory Limit of Reporting - NMI			1	1	1	1	1	25	25	100	100	
Laboratory Limit of Reporting - ALS			1	2	2	2	5	20	50	100	50	
Notes: all concentrations in micrograms per litre (µg/L)							1. aesthetic value					
14 shading indicates concentrations exceed DoHG							2. sample collected after purging PSH					
'NE' denotes screening level not established or under review												
'NT' denotes sample not subjected to analysis												
'm BTOC' denotes metres below top of casing												
samples analysed before June 2009 were submitted to NMI, samples analysed post June 2009 were submitted to ALS												

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Monitoring Well	Date	SWL (m BTOC)	BTEXN					Total Petroleum Hydrocarbons			
			Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	C ₆ -C ₉	C ₁₀ -C ₁₄	C ₁₅ -C ₂₈	C ₂₉ -C ₃₆
MW5	22.03.98	-	5.2	<1	<1	<2	NT	46	350	<100	<100
	27.07.98	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	12.12.99	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	01.07.00	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	17.01.01	-	8.7	9.1	3.5	<2	NT	32	<25	<100	<100
	28.08.01	3.858	<1	<1	<1	<2	NT	<25	<25	<100	<100
	24.01.02	3.939	<1	<1	<1	<2	NT	<25	<25	<100	<100
	17.08.02	3.992	<1	<1	<1	<2	NT	<25	<25	<100	<100
	15.01.03	4.004	<1	<1	<1	<2	NT	<25	<25	<100	<100
	07.08.03	3.914	<1	<1	<1	<2	NT	<25	<25	<100	<100
	22.01.04	4.138	<1	<1	<1	<2	NT	<25	<25	<100	<100
	15.07.04	3.867	<1	<1	<1	<2	NT	<25	<25	<100	<100
	27.01.05	4.007	<1	<1	<1	<2	NT	<25	<25	<100	<100
	28.07.05	3.797	<1	<1	<1	<2	NT	<25	<25	<100	<100
	18.01.06	3.866	<1	<1	<1	<2	NT	<25	<25	<100	<100
	23.08.06	3.739	<1	<1	<1	<2	NT	<25	<25	<100	<100
	06.01.07	3.917	<1	<1	<1	<2	NT	<25	<25	<100	<100
	14.06.07	3.653	<1	<1	<1	<2	NT	<25	<25	<100	<100
	31.01.08	3.946	<1	<1	<1	<2	NT	<25	<25	<100	<100
	23.07.08	3.711	<1	<1	<1	<2	NT	<25	<25	<100	<100
18.02.09	4.026	<1	<1	<1	<2	NT	<25	<25	<100	<100	
03.12.09	4.214	<1	<2	<2	<2	NT	<20	<50	<100	<50	
13.04.11	3.430	<1	<2	<2	<2	<5	<20	<50	230	100	
06.10.11	3.604	<1	<2	<i>Silica Gel Cleanup</i>			<20	<50	<100	<50	
Marine Waters Assessment Levels			500	NE	NE	NE	50	NE	NE	NE	NE
DoH-Domestic Non-potable Use			10	25 ¹	3 ¹	20 ¹	NE	NE	NE	NE	NE
Laboratory Limit of Reporting - NMI			1	1	1	1	1	25	25	100	100
Laboratory Limit of Reporting - ALS			1	2	2	2	5	20	50	100	50
Notes: all concentrations in micrograms per litre (µg/L)							1. aesthetic value				
'NE' denotes screening level not established or under review											
'NT' denotes sample not subjected to analysis											
'm BTOC' denotes metres below top of casing											
samples analysed before June 2009 were submitted to NMI, samples analysed post June 2009 were submitted to ALS											

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Monitoring Well	Date	SWL (m BTOC)	BTEXN					Total Petroleum Hydrocarbons				
			Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	C ₆ -C ₉	C ₁₀ -C ₁₄	C ₁₅ -C ₂₈	C ₂₉ -C ₃₆	
MW6	22.03.98	-	120	540	280	2200	NT	4300	1800	<100	<100	
	27.07.98	-	490	8800	3800	27000	NT	84000	48000	2400	<100	
	12.12.99	-	780	230	470	1800	NT	3800	4300	370	<100	
	01.07.00	-	3.3	1.1	12	310	NT	830	1200	320	<100	
	17.01.01	-	510	31	250	1000	NT	2900	2900	1100	1300	
	28.08.01	3.837	590	34	330	620	NT	2200	2700	500	650	
	24.01.02	3.909	<1	<1	<1	8	NT	110	1100	110	<100	
	17.08.02	3.979	370	1.6	170	220	NT	1100	1300	450	550	
	15.01.03	4.001	470	1.6	400	20	NT	1200	270	<100	<100	
	07.08.03	3.991	290	9.4	140	150	NT	940	3200	1200	1000	
	22.01.04	4.009	680	29	410	240	NT	1500	1000	110	<100	
	15.07.04	3.861	340	250	350	1900	NT	3600	3800	710	<100	
	27.01.05	-	Obstruction in well									
	28.07.05	-										
	18.01.06	-										
	06.01.07	-										
	14.06.07	3.647	54	7.7	200	91	NT	400	1100	100	<100	
	31.01.08	3.912	<1	<1	<1	<1	NT	<25	1700	460	<100	
	23.07.08	-	Not sampled									
	28.08.08	3.751	6	2	43	11	NT	120	570	1100	120	
	18.02.09	-	Not sampled									
	07.04.09	3.978	19	<2	121	<2	NT	200	290	1000	330	
	03.12.09	4.157	29	<2	140	<2	<1	300	150	680	120	
	14.04.11	3.770	<1	<2	<2	2	<5	<20	180	180	<50	
		Silica Gel Cleanup										
	Dup 1		5	18	37	118	13	350	220	310	<50	
	RPD		133	160	179	193	89	178	20	53	NA	
	Split 1 ²		6	19	35	114	9	280	300	220	<50	
RPD		143	162	178	193	57	173	50	20	NA		
06.10.11	3.994	54	6	99	166	46	810	380	170	100		

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Marine Waters Assessment Levels	500	NE	NE	NE	50	NE	NE	NE	NE
DoH-Domestic Non-potable Use	10	25 ¹	3 ¹	20 ¹	NE	NE	NE	NE	NE
Laboratory Limit of Reporting - NMI	1	1	1	1	1	25	25	100	100
Laboratory Limit of Reporting - ALS	1	2	2	2	5	20	50	100	50

Notes: all concentrations in micrograms per litre (µg/L)

120 shading indicates concentrations exceed DoHG

780 shading indicates concentrations exceed DoHG and MWAL

'NA' denotes not applicable - primary and / or QC sample concentration below laboratory LoR

'NE' denotes screening level not established or under review

'NT' denotes sample not subjected to analysis

'm BTOC' denotes metres below top of casing

'RPD' denotes relative percentage difference

samples analysed before June 2009 were submitted to NMI, samples analysed post June 2009 were submitted to ALS

1. aesthetic value
2. sample analysed at ALS Melbourne

Table 1: Historical & Current Groundwater Analytical Results - BTEXN & TPH

Monitoring Well	Date	SWL (m BTOC)	BTEXN					Total Petroleum Hydrocarbons			
			Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	C ₆ -C ₉	C ₁₀ -C ₁₄	C ₁₅ -C ₂₈	C ₂₉ -C ₃₆
MW7	05.02.98	-	5600	7300	720	3300	NT	18000	3500	330	<100
	12.12.99	-	5700	24000	1500	22000	NT	55000	8300	340	<100
	01.07.00	-	3500	13000	1900	19000	NT	49000	7900	<100	<100
	17.01.01	-	6800	9100	2400	20000	NT	47000	9500	700	<100
	28.08.01	3.839	4300	5700	2500	12000	NT	31000	7800	480	<100
	24.01.02	3.928	5000	4200	1400	13000	NT	28000	6400	370	<100
	17.08.02	4.001	4200	10000	2400	18000	NT	42000	10000	1100	<100
	15.01.03	4.004	5500	1200	1400	14000	NT	26000	5700	620	<100
	07.08.03	3.916	3100	1400	1400	11000	NT	21000	8600	1000	<100
	22.01.04	4.118	5600	1200	2800	15000	NT	29000	12000	1500	<100
	15.07.04	3.851	1800	140	1100	6100	NT	11000	7500	390	<100
	27.01.05	4.005	2800	1700	1800	9700	NT	18000	6400	280	<100
	28.07.05	3.797	1200	160	1600	7200	NT	13000	8500	920	<100
	18.01.06	3.859	1900	130	1900	6100	NT	13000	10000	450	<100
	23.08.06	3.744	2700	11	1900	1200	NT	6800	5800	750	<100
	06.01.07	3.922	1600	1600	740	6700	NT	12000	8200	1800	<100
	14.06.07	3.635	260	400	1200	6100	NT	10000	18000	2500	<100
	31.01.08	3.941	1100	5.5	280	540	NT	2400	6500	590	<100
	23.07.08	3.707	1400	<1	1200	780	NT	4800	2700	320	<100
	18.02.09	3.866	860	2.6	720	180	NT	2000	4300	540	<100
04.12.09	4.074	1350	46	1820	365	186	5550	2910	910	<50	
14.04.11	3.735	469	3	482	92	94	1880	1320	480	<50	
06.10.11	4.011	687	3	986	104	164	4960	1220	390	80	
	<i>Dup 1</i>		626	3	876	93	251	4390	1120	320	150
	<i>RPD</i>		9	0	12	11	42	12	9	20	61
	<i>Split 1²</i>		541	4	733	145	122	1960	2090	840	<50
	<i>RPD</i>		24	29	29	33	29	87	53	73	46

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Marine Waters Assessment Levels	500	NE	NE	NE	50	NE	NE	NE	NE
DoH-Domestic Non-potable Use	10	25 ¹	3 ¹	20 ¹	NE	NE	NE	NE	NE
Laboratory Limit of Reporting - NMI	1	1	1	1	1	25	25	100	100
Laboratory Limit of Reporting - ALS	1	2	2	2	5	20	50	100	50

Notes: all concentrations in micrograms per litre (µg/L)

7300 shading indicates concentrations exceed DoHG

186 shading indicates concentrations exceed MWAL

5600 shading indicates concentrations exceed DoHG and MWAL

'NA' denotes not applicable - primary and / or QC sample concentration below laboratory LoR

'NE' denotes screening level not established or under review

'NT' denotes sample not subjected to analysis

'm BTOC' denotes metres below top of casing

'RPD' denotes relative percentage difference

samples analysed before June 2009 were submitted to NMI, samples analysed post June 2009 were submitted to ALS

1. aesthetic value
2. sample analysed at ALS Melbourne

Table 1: Historical & Current Groundwater Analytical Results - BTEXN & TPH

Monitoring Well	Date	SWL (m BTOC)	BTEXN					Total Petroleum Hydrocarbons			
			Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	C ₆ -C ₉	C ₁₀ -C ₁₄	C ₁₅ -C ₂₈	C ₂₉ -C ₃₆
MW8	22.03.98	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	27.07.98	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	01.07.00	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	17.01.01	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	28.08.01	3.731	<1	<1	<1	3.1	NT	<25	<25	<100	<100
	24.01.02	3.811	<1	<1	<1	<2	NT	<25	<25	<100	<100
	17.08.02	3.862	<1	<1	<1	<2	NT	<25	<25	<100	<100
	15.01.03	3.888	<1	<1	<1	<2	NT	<25	<25	<100	<100
	07.08.03	3.781	<1	<1	<1	<2	NT	<25	<25	<100	<100
	22.01.04	3.997	<1	<1	<1	<2	NT	<25	<25	<100	<100
	15.07.04	3.737	<1	<1	<1	<2	NT	<25	<25	<100	<100
	27.01.05	3.931	<1	<1	<1	<2	NT	<25	<25	<100	<100
	28.07.05	3.662	<1	<1	<1	<2	NT	<25	<25	<100	<100
	18.01.06	3.724	<1	<1	<1	<2	NT	<25	<25	<100	<100
	23.08.06	3.601	<1	<1	<1	<2	NT	<25	<25	<100	<100
	06.01.07	3.779	<1	<1	<1	<2	NT	<25	<25	<100	<100
	14.06.07	3.531	<1	<1	<1	<2	NT	<25	<25	<100	<100
	31.01.08	3.802	<1	<1	<1	<2	NT	<25	<25	<100	<100
23.07.08	3.591	<1	<1	<1	<2	NT	<25	<25	<100	<100	
18.02.09	3.737	<1	<1	<1	<2	NT	<25	<25	<100	<100	
03.12.09	3.933	<1	<2	<2	<2	NT	<20	<50	<100	<50	
13.04.11	3.582	<1	<2	<2	<2	<5	<20	<50	<100	<50	
06.10.11	3.847	<1	<2	<2	<2	<5	<20	<50	<100	<50	
Marine Waters Assessment Levels			500	NE	NE	NE	50	NE	NE	NE	NE
DoH-Domestic Non-potable Use			10	25 ¹	3 ¹	20 ¹	NE	NE	NE	NE	NE
Laboratory Limit of Reporting - NMI			1	1	1	1	1	25	25	100	100
Laboratory Limit of Reporting - ALS			1	2	2	2	5	20	50	100	50
Notes: all concentrations in micrograms per litre (µg/L)							1. aesthetic value				
'NE' denotes screening level not established or under review											
'NT' denotes sample not subjected to analysis											
'm BTOC' denotes metres below top of casing											
samples analysed before June 2009 were submitted to NMI, samples analysed post June 2009 were submitted to ALS											

Table 1: Historical & Current Groundwater Analytical Results - BTEXN & TPH

Monitoring Well	Date	SWL (m BTOC)	BTEXN					Total Petroleum Hydrocarbons				
			Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	C ₆ -C ₉	C ₁₀ -C ₁₄	C ₁₅ -C ₂₈	C ₂₉ -C ₃₆	
MW9	22.03.98	-	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	27.07.98	-	1.7	<1	<1	<2	NT	<25	<25	<100	<100	
	01.07.00	-	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	17.01.01	-	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	28.08.01	3.787	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	24.01.02	3.868	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	17.08.02	3.916	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	15.01.03	3.944	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	07.08.03	3.842	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	22.01.04	4.006	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	15.07.04	3.798	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	27.01.05	3.995	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	28.07.05	3.725	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	18.01.06	3.787	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	23.08.06	3.666	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	06.01.07	3.841	<1	<1	<1	3.7	NT	<25	<25	<100	<100	
	14.06.07	3.584	<1	<1	1	3.8	NT	<25	<25	<100	<100	
	31.01.08	3.865	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	23.07.08	3.641	<1	<1	<1	<2	NT	<25	<25	<100	<100	
	18.02.09	3.491	<1	<1	<1	<2	NT	<25	<25	<100	<100	
03.12.09	3.985	<1	<2	<2	<2	NT	<20	<50	<100	<50		
13.04.11	3.645	<1	<2	<2	<2	<5	<20	<50	180	<50		
<i>Silica Gel Cleanup</i>										<50	<100	<50
06.10.11	3.856	<1	<2	<2	<2	<5	<20	<50	<100	<50		
Marine Waters Assessment Levels			500	NE	NE	NE	50	NE	NE	NE	NE	
DoH-Domestic Non-potable Use			10	25 ¹	3 ¹	20 ¹	NE	NE	NE	NE	NE	
Laboratory Limit of Reporting - NMI			1	1	1	1	1	25	25	100	100	
Laboratory Limit of Reporting - ALS			1	2	2	2	5	20	50	100	50	
Notes: all concentrations in micrograms per litre (µg/L)							1. aesthetic value					
'NE' denotes screening level not established or under review												
'NT' denotes sample not subjected to analysis												
'm BTOC' denotes metres below top of casing												
samples analysed before June 2009 were submitted to NMI, samples analysed post June 2009 were submitted to ALS												

Table 1: Historical & Current Groundwater Analytical Results - BTEXN & TPH

Monitoring Well	Date	SWL (m BTOC)	BTEXN					Total Petroleum Hydrocarbons			
			Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	C ₆ -C ₉	C ₁₀ -C ₁₄	C ₁₅ -C ₂₈	C ₂₉ -C ₃₆
MW10	22.03.98	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	28.07.98	-	1.8	<1	<1	<2	NT	<25	<25	<100	<100
	12.12.99	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	01.07.00	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	17.01.01	-	<1	<1	<1	<2	NT	<25	<25	<100	<100
	28.08.01	3.795	<1	<1	<1	<2	NT	<25	110	<100	<100
	24.01.02	3.868	<1	<1	<1	<2	NT	<25	<25	<100	<100
	17.08.02	3.923	<1	<1	<1	<2	NT	<25	<25	<100	<100
	15.01.03	3.965	<1	<1	<1	<2	NT	<25	36	<100	<100
	07.08.03	3.841	<1	<1	<1	<2	NT	<25	<25	<100	<100
	22.01.04	4.005	<1	<1	<1	<2	NT	<25	<25	<100	<100
	15.07.04	3.806	<1	<1	<1	<2	NT	<25	<25	<100	<100
	27.01.05	3.994	<1	<1	<1	<2	NT	<25	<25	<100	<100
	28.07.05	3.725	<1	<1	<1	<2	NT	<25	<25	<100	<100
	18.01.06	3.783	<1	<1	<1	<2	NT	<25	<25	<100	<100
	23.08.06	3.683	<1	<1	<1	<2	NT	<25	<25	<100	<100
	06.01.07	3.838	<1	<1	<1	<2	NT	<25	<25	<100	<100
	14.06.07	3.628	<1	<1	<1	<2	NT	<25	<25	<100	<100
	31.01.08	3.866	<1	<1	<1	<2	NT	<25	<25	<100	<100
	23.07.08	3.671	<1	<1	<1	<2	NT	<25	<25	<100	<100
18.02.09	3.805	<1	<1	<1	<2	NT	<25	<25	<100	<100	
03.12.09	3.974	<1	<2	<2	<2	NT	<20	<50	<100	<50	
13.04.11	3.647	<1	<2	<2	<2	<5	<20	<50	<100	<50	
06.10.11	3.868	<1	<2	<2	<2	<5	<20	<50	<100	<50	
Marine Waters Assessment Levels			500	NE	NE	NE	50	NE	NE	NE	NE
DoH-Domestic Non-potable Use			10	25 ¹	3 ¹	20 ¹	NE	NE	NE	NE	NE
Laboratory Limit of Reporting - NMI			1	1	1	1	1	25	25	100	100
Laboratory Limit of Reporting - ALS			1	2	2	2	5	20	50	100	50
Notes: all concentrations in micrograms per litre (µg/L)							1. aesthetic value				
'NE' denotes screening level not established or under review											
'NT' denotes sample not subjected to analysis											
'm BTOC' denotes metres below top of casing											
samples analysed before June 2009 were submitted to NMI, samples analysed post June 2009 were submitted to ALS											

Table 1: Historical & Current Groundwater Analytical Results - BTEXN & TPH

Monitoring Well	Date	SWL (m BTOC)	BTEXN					Total Petroleum Hydrocarbons					
			Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	C ₆ -C ₉	C ₁₀ -C ₁₄	C ₁₅ -C ₂₈	C ₂₉ -C ₃₆		
MW11	22.03.98	-	<1	<1	<1	<2	NT	<25	<25	<100	<100		
	28.07.98	-	<1	<1	<1	<2	NT	<25	<25	<100	<100		
	12.12.99	-	<1	<1	<1	<2	NT	<25	<25	<100	<100		
	01.07.00	-	<1	<1	<1	<2	NT	<25	<25	<100	<100		
	17.01.01	-	<1	<1	<1	<2	NT	<25	<25	<100	<100		
	28.08.01	3.673	<1	<1	<1	<2	NT	<25	<25	<100	<100		
	24.01.02	3.678	<1	<1	<1	<2	NT	<25	<25	<100	<100		
	17.08.02	3.815	<1	<1	<1	<2	NT	<25	<25	<100	<100		
	15.01.03	3.823	<1	<1	<1	<2	NT	<25	<25	<100	<100		
07.08.03	-	Well Destroyed in 2004											
MW13	28.08.08	3.548	<1	<2	<2	<2	NT	<20	<50	<100	<50		
	07.04.09	3.613	<1	<2	<2	<2	NT	<20	<50	<100	<50		
	03.12.09	3.837	<1	<2	<2	<2	NT	<20	<50	<100	<50		
	14.04.11	3.495	<1	<2	<2	<2	<5	<20	<50	<100	<50		
	06.10.11	3.717	<1	<2	<2	<2	<5	<20	<50	<100	<50		
MW14	11.06.09	4.236	<1	<2	<2	<2	NT	<20	<50	<100	<50		
	03.12.09	4.627	<1	<2	<2	<2	NT	<20	<50	<100	<50		
	14.04.11	4.290	<1	<2	<2	<2	<5	<20	<50	470	110		
	<i>Silica Gel Cleanup</i>										<50	<100	<50
MW15	05.10.11	4.490	<1	<2	<2	<2	<5	<20	<50	<100	<50		
	11.06.09	4.421	10	8	9	33	3.6	100	310	2800	1390		
	03.12.09	4.807	9	<2	4	<2	NT	40	300	1830	440		
Destroyed during the 2009 excavation													
MW15A	12.03.10	4.798	12	3	3	23	NT	40	300	2110	430		
	14.04.11	4.798	15	<2	7	8	6	50	<50	870	270		
	06.10.11	4.311	24	<2	10	7	6	100	60	1770	5370		
MW16	11.06.09	4.086	<1	<2	<2	<2	NT	<20	<50	300	160		
	03.12.09	4.460	<1	<2	<2	<2	NT	<20	<50	170	160		
	<i>Silica Gel Cleanup</i>										<50	<100	<50
	13.04.11	4.132	<1	<2	<2	<2	<5	<20	<50	330	290		
06.10.11	4.333	<1	<2	<2	<2	<5	<20	<50	<100	<50			

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Marine Waters Assessment Levels	500	NE	NE	NE	50	NE	NE	NE	NE
DoH-Domestic Non-potable Use	10	25 ¹	3 ¹	20 ¹	NE	NE	NE	NE	NE
Laboratory Limit of Reporting - NMI	1	1	1	1	1	25	25	100	100
Laboratory Limit of Reporting - ALS	1	2	2	2	5	20	50	100	50

Notes: all concentrations in micrograms per litre (µg/L) 1. aesthetic value
12 shading indicates concentrations exceed DoHG
 'NE' denotes screening level not established or under review
 'NT' denotes sample not subjected to analysis
 'm BTOC' denotes metres below top of casing
 samples analysed before June 2009 were submitted to NMI, samples analysed post June 2009 were submitted to ALS

Table 1: Historical & Current Groundwater Analytical Results - BTEXN & TPH

Monitoring Well	Date	SWL (m BTOC)	BTEXN					Total Petroleum Hydrocarbons			
			Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	C ₆ -C ₉	C ₁₀ -C ₁₄	C ₁₅ -C ₂₈	C ₂₉ -C ₃₆
MW17	04.12.09	4.647	<1	<2	<2	<2	NT	<20	<50	140	60
	<i>Silica Gel Cleanup</i>										
	13.04.11	4.311	<1	<2	<2	<2	<5	<20	<50	<100	80
<i>Silica Gel Cleanup</i>											
MW18	04.12.09	4.492	<1	<2	<2	<2	NT	<20	<50	<100	<50
	13.04.11	4.071	<1	<2	<2	<2	<5	<20	<50	170	120
	<i>Silica Gel Cleanup</i>										
MW19	04.12.09	4.401	363	2	163	243	32.6	870	2080	430	50
	0.100 m PSH										
	14.04.11 ²	4.040	308	8	140	117	38	830	5540	570	<50
	0.500 m PSH										
MW20	04.12.09	4.481	23	<2	<2	5	NT	120	70	240	<50
	14.04.11	4.177	<1	<2	<2	<2	<5	40	460	3720	820
	06.10.11	4.357	<1	<2	<2	<2	<5	<20	<50	<100	<50
MW21	04.12.09	4.817	<1	<2	<2	<2	NT	<20	<50	<100	50
	<i>Silica Gel Cleanup</i> ³										
	13.04.11	3.785	<1	<2	<2	<2	<5	<20	90	550	220
<i>Silica Gel Cleanup</i>											
MW22	04.12.09	5.671	<1	<2	<2	<2	NT	<20	<50	<100	<50
	13.04.11	5.340	<1	<2	<2	<2	NT	<20	<50	<100	140
	<i>Silica Gel Cleanup</i>										
MW23	04.12.09	3.923	<1	<2	<2	<2	NT	<20	<50	<100	<50
	13.04.11	3.572	<1	<2	<2	<2	<5	<20	<50	<100	<50
	05.10.11	3.771	<1	<2	<2	<2	<5	<20	<50	<100	<50
MW24	14.04.11	4.056	<1	<2	<2	<2	<5	<20	<50	<100	<50
	05.10.11	4.259	2	<2	<2	5	<5	<20	<50	<100	<50

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Marine Waters Assessment Levels	500	NE	NE	NE	50	NE	NE	NE	NE
DoH-Domestic Non-potable Use	10	25 ¹	3 ¹	20 ¹	NE	NE	NE	NE	NE
Laboratory Limit of Reporting - NMI	1	1	1	1	1	25	25	100	100
Laboratory Limit of Reporting - ALS	1	2	2	2	5	20	50	100	50

Notes: all concentrations in micrograms per litre (µg/L)

363 shading indicates concentrations exceed DoHG

74 shading indicates concentrations exceed MWAL

1300 shading indicates concentrations exceed DoHG and MWAL

'NE' denotes screening level not established or under review

'NT' denotes sample not subjected to analysis

'm BTOC' denotes metres below top of casing

samples analysed before June 2009 were submitted to NMI, samples analysed post June 2009 were submitted to ALS

1. aesthetic value
2. sample collected after purging PSH
3. LoR raised

Table 1: Historical & Current Groundwater Analytical Results - BTEXN & TPH

Monitoring Well	Date	SWL (m BTOC)	BTEXN					Total Petroleum Hydrocarbons			
			Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	C ₆ -C ₉	C ₁₀ -C ₁₄	C ₁₅ -C ₂₈	C ₂₉ -C ₃₆
Recovery Well	01.07.00	-	1300	78	750	300	NT	3200	770	<100	<100
	17.01.01	-	960	8.4	610	20	NT	2000	960	150	<100
	28.08.01	3.908	700	5.5	790	440	NT	2600	1800	240	<100
	24.01.02	3.967	490	<1	410	2.1	NT	1000	720	150	<100
	17.08.02	4.001	350	3.3	510	20	NT	1200	440	<100	<100
	15.01.03	4.007	210	3.2	370	7.7	NT	760	210	<100	<100
	07.08.03	3.932	15	<1	4.5	<2	NT	46	270	220	<100
	22.01.04	4.105	240	49	340	180	NT	930	1000	410	<100
	15.07.04	3.909	170	<1	570	8.1	NT	960	1400	160	<100
	27.01.05	4.005	38	12	<1	170	NT	410	890	200	<100
	28.07.05	3.821	8.2	<1	7.1	<2	NT	49	84	<100	<100
	18.01.06	3.884	14	1	12	<2	NT	55	71	<100	<100
	23.08.06	3.815	4.7	<1	5	<2	NT	<25	43	<100	<100
	06.01.07	3.931	180	68	680	610	NT	2500	2100	230	<100
	14.06.07	3.705	21	1.5	64	24	NT	220	600	<100	<100
	31.01.08	3.949	<1	<1	<1	<2	NT	<25	<25	<100	<100
	23.07.08	3.801	<1	<1	<1	<2	NT	<25	<25	<100	<100
18.02.09	3.841	<1	<1	<1	<2	NT	<25	<25	<100	<100	
04.12.09	3.920	<1	<2	<2	<2	NT	<20	<50	<100	<50	
14.04.11	3.675	<1	<2	<2	<2	<5	<20	<50	<100	<50	
05.10.11	-		Dry								
Trip Blank	13.04.11	-	<1	<2	<2	<2	<5	<20	<50	<100	<50
	14.04.11	-	<1	<2	<2	<2	<5	<20	<50	<100	<50
	05.10.11	-	<1	<2	<2	<2	<5	<20	<50	<100	<50
Rinsate	13.04.11	-	<1	<2	<2	<2	<5	<20	<50	<100	<50
	14.04.11	-	<1	<2	<2	<2	<5	<20	<50	<100	<50
	05.10.11	-	<1	<2	<2	<2	<5	<20	<50	<100	<50
	06.10.11	-	<1	<2	<2	<2	<5	<20	<50	<100	<50

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Marine Waters Assessment Levels	500	NE	NE	NE	50	NE	NE	NE	NE
DoH-Domestic Non-potable Use	10	25 ¹	3 ¹	20 ¹	NE	NE	NE	NE	NE
Laboratory Limit of Reporting - NMI	1	1	1	1	1	25	25	100	100
Laboratory Limit of Reporting - ALS	1	2	2	2	5	20	50	100	50

Notes: all concentrations in micrograms per litre (µg/L) 1. aesthetic value

700 shading indicates concentrations exceed DoHG

1300 shading indicates concentrations exceed DoHG and MWAL

'NE' denotes screening level not established or under review

'NT' denotes sample not subjected to analysis

'm BTOC' denotes metres below top of casing

samples analysed before June 2009 were submitted to NMI, samples analysed post June 2009 were submitted to ALS

Table 2: Historical and Current Groundwater Analytical Results - Polynuclear Aromatic Hydrocarbons

Monitoring Well	Date	SWL (m BTOC)	Polynuclear Aromatic Hydrocarbons																
			Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(123-cd)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	
MW3A	04.12.09	4.835	4.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
MW6	03.12.09	4.157	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
	06.10.11	3.994	46 ¹	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
MW7	04.12.09	4.074	186	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
	06.10.11	4.011	164 ¹	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	<i>Dup 1</i>		251 ¹	<1.0	1.7	1.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
	<i>RPD</i>		42	NA	158	158	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	<i>Split 1²</i>		122 ¹	<0.2	0.3	0.3	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	<i>RPD</i>		29	NA	40	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW15	11.06.09	4.421	3.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
MW15A	06.10.11	4.311	6 ¹	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
MW19	04.12.09	4.401	26	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
	06.10.11	4.269	74 ¹	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
MW20	04.12.09	4.481	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Marine Waters Assessment Levels			50	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
DoH-Domestic Non-potable Use			NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0.1	NE	NE	NE
Laboratory Limit of Reporting			1/0.2	1/0.2	1/0.2	1/0.2	1/0.2	1/0.2	1/0.2	1/0.2	1/0.2	1/0.2	1/0.2	1/0.2	1/0.2	0.5/0.2	1/0.2	1/0.2	1/0.2

Notes: all concentrations in micrograms per litre (µg/L)

186 shading indicates concentrations exceed MWAL

'NA' denotes not applicable - primary and / or QC sample concentration below laboratory LoR

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

'RPD' denotes relative percentage difference

1. naphthalene value from volatile analysis presented as instructed by laboratory

2. sample analysed at ALS Melbourne

Table 3: Historical & Current Groundwater Analytical Results - Dissolved Metals

Monitoring Well	Date	SWL (m BTOC)	Metals												
			Arsenic (As)	Barium (Ba)	Beryllium (Be)	Cadmium (Cd)	Chromium (total) (Cr)	Hexavalent Chromium (CrVI)	Cobalt (Co)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Nickel (Ni)	Vanadium (V)	Zinc (Zn)
MW2	03.12.09	3.985	12	NT	NT	<0.1	<1	NT	NT	<1	<1	<0.1	<1	NT	<5
	13.04.11	3.645	10	NT	NT	<0.1	<1	<10	NT	<1	<1	<0.1	<1	NT	<5
	05.10.11	3.842	11	NT	NT	<0.1	<1	<10	NT	1	<1	<0.1	<1	NT	<5
MW3	28.08.08	4.085	3	4	<1	<0.1	<1	NT	<1	1	<1	<0.1	<1	<10	<5
MW3A	07.04.09	4.581	8	NT	NT	<0.1	<1	NT	NT	1	1	<0.1	8	NT	137
	11.06.09	4.397	18	NT	NT	<0.1	<1	NT	NT	<1	<1	<0.1	8	NT	5
	04.12.09	4.835	19	NT	NT	0.1	1	<10	NT	<1	<1	<0.1	11	NT	13
MW3B	12.03.10	4.997	46	NT	NT	<0.1	2	NT	NT	3	<1	<0.1	3	NT	21
	14.04.11	4.750	40	NT	NT	<0.1	<1	NT	NT	<1	<1	<0.1	2	NT	<5
	06.10.11	4.918	30	NT	NT	<0.1	<1	<10	NT	<1	<1	<0.1	3	NT	<5
MW6	28.08.08	3.751	81	12	<1	<0.1	<1	NT	<1	<1	3	<0.1	<1	<10	22
	07.04.09	3.978	57	NT	NT	<0.1	<1	NT	NT	1	1	<0.1	1	NT	8
	14.04.11	3.770	36	NT	NT	<0.1	<1	<10	NT	<1	<1	<0.1	<1	NT	<5
	<i>Dup 1</i>		36	<i>NT</i>	<i>NT</i>	<i><0.1</i>	<i><1</i>	<i><10</i>	<i>NT</i>	<i>1</i>	<i><1</i>	<i><1</i>	<i><1</i>	<i>NT</i>	<i><5</i>
	<i>RPD</i>		<i>0</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>0</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>
	<i>Split 1¹</i>		29	<i>NT</i>	<i>NT</i>	<i><0.1</i>	<i><1</i>	<i><10</i>	<i>NT</i>	3	<i><1</i>	<i><1</i>	<i><1</i>	<i>NT</i>	<i><5</i>
	<i>RPD</i>		22	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	100	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>
	06.10.11	3.994	17	NT	NT	<0.1	<1	<10	NT	3	<1	<0.1	3	NT	<5
MW7	06.10.11	4.011	142	NT	NT	<0.1	<1	<10	NT	<1	<1	<0.1	1	NT	<5
	<i>Dup 1</i>		139	<i>NT</i>	<i>NT</i>	<i><0.1</i>	<i><1</i>	<i><10</i>	<i>NT</i>	<i><1</i>	<i><1</i>	<i><0.1</i>	2	<i>NT</i>	<i><5</i>
	<i>RPD</i>		2	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>67</i>	<i>NA</i>	<i>NA</i>
	<i>Split 1¹</i>		133	<i>NT</i>	<i>NT</i>	<i><0.1</i>	<i><1</i>	<i><10</i>	<i>NT</i>	2	<i><1</i>	<i><0.1</i>	<i><1</i>	<i>NT</i>	6
	<i>RPD</i>		7	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	67	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	18
MW8	03.12.09	3.933	25	NT	NT	0.2	<1	NT	NT	<1	<1	<0.1	2	NT	<5
	13.04.11	3.582	19	NT	NT	<0.1	<1	<10	NT	3	<1	<0.1	1	NT	<
	06.10.11	3.847	21	NT	NT	<0.1	<1	<10	NT	2	<1	<0.1	1	NT	<5

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Marine Waters Assessment Levels	NE	NE	NE	0.7	10	4.4	1	1.3	4.4	0.1	7	100	15
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DoH-Domestic Non-potable Use	70	7000	NE	20	NE	500	NE	20000	100	10	200	NE	30000 ²
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Laboratory Limit of Reporting	1	1	1	0.1	1	10	1	1	1	0.1	1	10	5
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Notes: all concentrations in micrograms per litre (µg/L)
8 shading indicates concentrations exceed MWAL
 'NA' denotes not applicable - primary and / or QC sample concentrations below laboratory LoR
 'NE' denotes screening level not established or under review
 'NT' denotes sample not subjected to analysis
 'RPD' denotes relative percentage difference
 1. sample analysed at ALS Melbourne
 2. aesthetic value

Table 3: Historical & Current Groundwater Analytical Results - Dissolved Metals

Monitoring Well	Date	SWL (m BTOC)	Metals												
			Arsenic (As)	Barium (Ba)	Beryllium (Be)	Cadmium (Cd)	Chromium (total) (Cr)	Hexavalent Chromium (CrVI)	Cobalt (Co)	Copper (Cu)	Lead (Pb)	Mercury (Hg)	Nickel (Ni)	Vanadium (V)	Zinc (Zn)
MW13	28.08.08	3.548	6	130	<1	<0.1	<1	NT	2	1	<1	<0.1	2	<10	11
	07.04.09	3.613	7	NT	NT	<0.1	<1	NT	NT	2	<1	<0.1	1	NT	<5
	13.04.11	3.495	7	NT	NT	<0.1	<1	NT	NT	2	<1	<0.1	2	NT	<5
	06.10.11	3.717	6	NT	NT	<0.1	<1	<10	NT	2	<1	<0.1	6	NT	5
MW14	11.06.09	4.236	12	NT	NT	<0.1	<1	<10	NT	2	<1	<0.1	5	NT	<5
	14.04.11	4.290	17	NT	NT	<0.1	<1	NT	NT	2	<1	<0.1	3	NT	<5
	05.10.11	4.490	17	NT	NT	<0.1	<1	<10	NT	2	<1	<0.1	6	NT	8
MW15	11.06.09	4.421	14	NT	NT	<0.1	<1	NT	NT	<1	<1	<0.1	7	NT	6
MW15A	12.03.10	4.798	25	NT	NT	<0.1	1	NT	NT	<1	<1	<0.1	1	NT	<5
	14.04.11	3.882	19	NT	NT	<0.1	<1	<10	NT	<1	<1	<0.1	2	NT	<5
	06.10.11	4.311	38	NT	NT	<0.1	<1	<10	NT	<1	<1	<0.1	3	NT	<5
MW17	04.12.09	4.647	4	NT	NT	0.3	<1	NT	NT	1	<1	<0.1	3	NT	6
	13.04.11	4.311	3	NT	NT	<0.1	<1	NT	NT	2	<1	<0.1	2	NT	5
	05.10.11	4.494	4	NT	NT	<0.1	<1	<10	NT	2	<1	<0.1	2	NT	11
MW20	04.12.09	4.481	26	NT	NT	0.1	3	NT	NT	<1	<1	<0.1	5	NT	<5
	06.10.11	4.357	8	NT	NT	<0.1	<1	<10	NT	2	<1	<0.1	2	NT	11
MW21	04.12.09	4.817	8	NT	NT	0.2	1	NT	NT	<1	<1	<0.1	4	NT	8
	13.04.11	3.785	6	NT	NT	<0.1	<1	<10	NT	2	<1	<0.1	2	NT	<5
	05.10.11	3.981	4	NT	NT	<0.1	<1	<10	NT	3	<1	<0.1	4	NT	8
MW22	04.12.09	5.671	5	NT	NT	0.2	<1	NT	NT	1	<1	<0.1	2	NT	6
	13.04.11	5.340	5	NT	NT	<0.1	<1	<10	NT	2	<1	<0.1	1	NT	<5
	05.10.11	5.526	4	NT	NT	<0.1	<1	<10	NT	2	<1	<0.1	1	NT	9
MW23	04.12.09	3.923	4	NT	NT	<0.1	<1	NT	NT	1	<1	<0.1	5	NT	5
	13.04.11	3.572	4	NT	NT	<0.1	<1	<10	NT	2	<1	<0.1	2	NT	<5
	05.10.11	3.771	4	NT	NT	<0.1	<1	<10	NT	2	<1	<0.1	2	NT	9
MW24	14.04.11	4.056	13	NT	NT	<0.1	<1	<10	NT	2	<1	<0.1	2	NT	6
	05.10.11	4.259	10	NT	NT	<0.1	1	<1 ¹	NT	2	<1	<0.1	3	NT	7
Marine Waters Assessment Levels			NE	NE	NE	0.7	10	4.4	1	1.3	4.4	0.1	7	100	15
DoH-Domestic Non-potable Use			70	7000	NE	20	NE	500	NE	20000	100	10	200	NE	30000 ²
Laboratory Limit of Reporting			1	1	1	0.1	1	10 / 1	1	1	1	0.1	1	10	5

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Notes: all concentrations in micrograms per litre (µg/L)
2 shading indicates concentrations exceed MWAL
 'NE' denotes screening level not established or under review
 'NT' denotes sample not subjected to analysis

1. lower LoR requested
 2. aesthetic value

Table 4: Historical & Current Groundwater Analytical Results - Major Cations, Major Anions & Selected Dissolved Metals

Monitor Well	Date	Cations				Anions					Metals		
		Calcium (Ca ²⁺)	Magnesium (Mg ²⁺)	Sodium (Na ⁺)	Potassium (K ⁺)	Chloride (Cl ⁻)	Sulphate (SO ₄ ²⁻)	Nitrate (NO ₃ ⁻)	Carbonate (CO ₃ ²⁻)	Bicarbonate (HCO ₃ ⁻)	Aluminium (Al)	Ferrous Iron (Fe ²⁺)	Manganese (Mn)
MW2	03.12.09	73	32	121	10	148	55	18.3	<1	294	<0.01	<0.05	<0.001
	13.04.11	81	29	134	10	185	58	16.2	<1	266	<0.01	<0.05	<0.001
MW3	28.08.08	81	8	46	4	54	17	1.32	<1	232	<0.01	<0.05	<0.001
MW3A	07.04.09	138	35	353	21	553	113	0.23	<1	390	<0.01	0.07	0.444
MW3B	12.03.10	169	33	143	16	277	46	0.03	<1	424	<0.01	1.85	0.268
	14.04.11	170	34	182	14	368	34	<0.01	<1	421	<0.01	6.24	0.278
MW5	13.04.11	91	42	72	18	126	107	0.38	<1	328	<0.01	<0.05	0.002
MW6	28.08.08	78	97	417	44	516	10	0.02	<1	852	<0.01	0.36	0.012
	07.04.09	84	100	394	57	545	5	0.02	<1	723	0.02	0.14	0.017
	14.04.11	76	96	351	62	499	74	<0.01	<1	664	<0.01	0.16	0.010
	Dup 1	94	91	345	59	496	76	0.01	73	524	<0.01	0.15	0.010
	RPD	21	5	2	5	1	3	0	195	24	NA	6	0
	Split 1	70	97	387	59	514	152	<0.01	<1	631	<0.01	0.27	<0.01
RPD	8	1	10	5	3	69	NA	NA	5	NA	51	0	
MW7	14.04.11	89	97	551	46	881	11	<0.01	<1	750	<0.01	4.02	0.035
MW8	03.12.09	117	98	660	37	1090	255	10.9	<1	371	<0.01	<0.05	<0.001
	13.04.11	133	107	776	45	1310	222	11.1	<1	373	<0.01	<0.05	<0.001
MW9	13.04.11	130	90	583	40	1010	197	8.83	<1	383	<0.01	<0.05	<0.001
MW10	13.04.11	116	81	478	38	826	180	4.46	<1	356	<0.01	<0.05	<0.001
MW13	28.08.08	99	85	568	30	794	180	1.18	<1	412	<0.01	<0.05	0.125
	07.04.09	101	88	533	36	1010	186	2.82	<1	360	<0.01	<0.05	0.106
	14.04.11	124	110	698	43	1200	241	7.91	12	267	<0.01	<0.05	0.015
MW14	14.04.11	179	64	482	35	922	208	10.9	<1	196	<0.01	<0.05	0.007
MW15A	12.03.10	125	35	84	12	127	26	0.02	<1	401	<0.01	0.57	0.043
	14.04.11	132	40	100	12	254	14	<0.01	<1	291	<0.01	2.99	0.080
MW16	13.04.11	208	37	187	18	322	150	60.2	<1	148	<0.01	<0.05	0.001
MW17	04.12.09	109	33	100	16	150	51	38.6	<1	306	<0.01	<0.05	0.001
	13.04.11	123	52	163	23	434	81	15.5	2	210	<0.01	<0.05	<0.001
Marine Waters Assessment Levels		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	1/0.3 ^{2,3}	NE
DoH Domestic Non-potable Use		NE	NE	NE	NE	2500	5000	500	NE	NE	2 ¹	3 ²	5
Laboratory Limit of Reporting		1	1	1	1	1	1	0.01	1	1	0.01	0.05	0.001

Notes: all concentrations in milligrams per litre (mg/L)

'NA' denotes not applicable - primary and / or QC sample concentration below laboratory LoR

'NE' denotes screening level not established or under review

'RPD' denotes relative percentage difference

1. aesthetic value

2. assessment levels for total iron

3. assessment levels for pH > 6 / pH < 6

Table 4: Historical & Current Groundwater Analytical Results - Major Cations, Major Anions & Selected Dissolved Metals

Monitor Well	Date	Cations				Anions					Metals		
		Calcium (Ca ²⁺)	Magnesium (Mg ²⁺)	Sodium (Na ⁺)	Potassium (K ⁺)	Chloride (Cl ⁻)	Sulphate (SO ₄ ²⁻)	Nitrate (NO ₃ ⁻)	Carbonate (CO ₃ ²⁻)	Bicarbonate (HCO ₃ ⁻)	Aluminium (Al)	Ferrous Iron (Fe ²⁺)	Manganese (Mn)
MW18	13.04.11	116	82	276	39	634	153	20.7	14	296	<0.01	<0.05	0.007
MW19	14.04.11	88	113	359	65	737	48	<0.01	90	539	<0.01	0.13	0.002
MW20	04.12.09	109	75	483	40	739	55	0.27	<1	659	<0.01	0.36	0.026
	14.04.11	93	86	459	48	675	78	<0.01	57	449	<0.01	3.02	0.021
MW21	04.12.09	98	52	91	16	128	149	12.9	<1	318	<0.01	<0.05	0.021
	13.04.11	88	48	129	21	231	193	2.78	9	206	<0.01	0.15	0.014
MW22	04.12.09	80	79	413	40	702	146	13.9	<1	381	<0.01	<0.05	0.003
	13.04.11	98	89	477	52	797	240	26.3	14	270	<0.01	<0.05	<0.001
MW23	04.12.09	86	83	494	33	854	181	6.92	<1	356	<0.01	<0.05	0.008
	13.04.11	124	117	763	46	1250	238	9.84	<1	258	<0.01	<0.05	<0.001
MW24	14.04.11	95	44	301	27	527	101	7.72	6	208	<0.01	<0.05	0.003
Recovery Well	14.04.11	173	50	321	20	469	221	4.87	<1	303	<0.01	<0.05	0.048
Marine Waters Assessment Levels		NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	1/0.3 ^{2,3}	NE
DoH Domestic Non-potable Use		NE	NE	NE	NE	2500	5000	500	NE	NE	2 ¹	3 ²	5
Laboratory Limit of Reporting		1	1	1	1	1	1	0.01	1	1	0.01	0.05	0.001
Notes: all concentrations in milligrams per litre (mg/L) 'NE' denotes screening level not established or under review										1. aesthetic value 2. assessment levels for total iron 3. assessment levels for pH > 6 / pH < 6			

Table 5: Historical & Current Groundwater Field Chemical Data

Monitoring Well	Date	Depth of Well (m BTOC)	Depth to Water (m BTOC)	Reduced Levels (m AHD)	Top of Screen (m BTOC)	Purged volume (L)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	EC (µS/cm)	TDS (mg/L) (Calculated)	Temp (°C)
MW2	03.12.09	6.309	3.985	0.250	-	30	0.1	22.8	7.25	1169	783	24.73
	13.04.11	6.317	3.645	0.590		17	1.69	-30.2	6.7	1303	873	25.96
	05.10.11	6.344	3.842	0.393		9	1.94	153.5	6.94	1239	830	23.92
MW3	28.08.08	6.059	4.058	0.572	3.01	20	4.59	336.7	7.43	618	414	22.38
MW3A	07.04.09	6.067	4.581	0.465	3.07	15	3.25	41.7	7.14	2904	1946	25.91
	11.06.09	6.067	4.397	0.649		20	1.24	46.0	7.14	1388	930	27.00
	04.12.09	6.050	4.835	0.211		field chemistry parameters not obtained due to presence of PSH						
MW3B	05.03.10	6.792	4.997	UC	3.79	28	0.15	-118.8	7.03	1523	1020	28.05
	14.04.11	6.940	4.75	UC		11.5	0.21	-161	6.87	1962	1315	27.07
	06.10.11	6.935	4.918	UC		8	0.98	-102.7	6.66	2070	1387	24.21
MW5	03.12.09	6.010	4.214	0.251	-	21.5	0.13	25.0	7.16	1006	674	25.22
	13.04.11	5.535 ¹	3.430	UC		14.5	0.55	-89.3	6.66	1208	809	26.69
	05.10.11	5.456 ¹	3.604	UC		14	0.91	90.6	6.86	876	587	24.41
MW6 ¹	07.04.09	4.533	3.978	0.442	1.53	5 ²	1.89	31.8	7.19	3142	2105	28.40
	03.12.09	4.550	4.157	0.263		3 ²	1.58	-158.0	7.25	2766	1853	25.91
	14.04.11	4.535	3.77	UC		6.25	0.22	-210	6.65	2917	1954	27.71
	06.10.11	4.508	6.994	UC		5	0.51	-136.2	10.46	1214	813	25.26
MW7	04.12.09	5.678	4.074	0.161	-	14	0.06	-174.0	6.87	4202	2815	26.21
	14.04.11	5.695	3.735	0.500		8.75	1.17	-158.0	6.65	4606	3086	27.49
	06.10.11	5.661	4.011	0.224		8	0.37	-155.3	6.89	6540	4382	24.31
MW8	03.12.09	4.946	3.933	0.229	-	36	1.24	45.3	7.19	4186	2805	24.57
	13.04.11	4.975	3.582	0.580		21.5	0.88	-75.5	6.19	5454	3654	25.49
	06.10.11	4.941	3.847	0.315		12	1.41	26.2	6.68	4894	3279	23.78
MW9	03.12.09	4.834	3.985	0.241	-	26	0.63	59.0	7.09	3111	2084	24.82
	13.04.11	4.845	3.645	0.581		22	0.78	83.7	6.23	4355	2918	25.80
	06.10.11	4.830	3.856	0.370		8	0.58	15.8	6.51	3951	2647	24.12
MW10	03.12.09	5.116	3.974	0.264	-	38	0.82	41.8	7.23	2585	1732	24.54
	13.04.11	5.095	3.647	0.591		19.5	0.91	74.3	6.25	3630	2432	25.72
	06.10.11	5.101	3.868	0.370		10	0.58	29.8	7.02	3691	2473	23.86
MW13	07.04.09	5.241	3.613	0.504	2.24	16	4.48	32.3	8.20	3990	2673	25.97
	03.12.09	5.100	3.837	0.280		21	0.28	41.6	7.19	3727	2497	24.39
	13.04.11	5.099	3.495	0.622		18	1.09	77.0	5.91	5022	3365	25.41
	06.10.11	5.093	3.717	0.400		3 ²	1.46	59.3	4.04	5133	3439	24.20

Notes: all results are field measured parameters - YSI 556 multi probe meter
TDS is calculated by multiplying EC by 0.67 (ANZECC 2000)
'UC' denotes unable to be calculated as bore casing damaged / not surveyed

1. monitor well casing has been damaged and repaired
2. monitor well purged dry

Table 5: Historical & Current Groundwater Field Chemical Data

Monitoring Well	Date	Depth of Well (m BTOC)	Depth to Water (m BTOC)	Reduced Levels (m AHD)	Top of Screen (m BTOC)	Purged volume (L)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	EC (µS/cm)	TDS (mg/L) (Calculated)	Temp (°C)
MW14	11.06.09	6.070	4.236	0.644	3.00	15	2.58	171.0	7.24	3090	2070	24.70
	03.12.09	6.070	4.627	0.253		18.5	0.25	38.6	7.08	2544	1704	24.47
	14.04.11	6.080	4.290	0.590		27	0.26	14.2	6.99	3941	2640	25.62
	05.10.11	6.084	4.490	0.390		8	0.56	85.9	6.55	3401	2279	24.10
MW15	11.06.09	5.823	4.421	0.645	2.80	15	1.71	106.0	7.56	1140	764	26.60
	03.12.09	5.836	4.807	0.259		14	0.19	-151.9	6.99	1114	746	25.29
MW15A	05.03.10	6.705	4.798	UC	3.71	20	0.15	-148.0	7.03	1056	708	27.43
	14.04.11	6.122	3.882	UC		10.5	0.36	-152.0	6.90	1361	912	26.74
	06.10.11	6.125	4.311	UC		8	0.83	-120.7	7.83	1503	1007	24.17
MW16	11.06.09	6.071	4.086	0.630	3.05	20	1.99	155.0	7.49	1588	1064	26.10
	03.12.09	6.030	4.460	0.256		36	0.21	27.1	7.06	1351	905	24.41
	13.04.11	5.995	4.132	0.584		17	0.39	-79.0	6.67	2167	1452	25.64
	06.10.11	6.035	4.333	0.383		6	2.84	34.2	6.35	1289	864	23.75
MW17	04.12.09	7.575	4.647	0.249	3.08	36	7.05	53.6	7.14	1356	909	25.57
	13.04.11	7.592	4.311	0.585		16.5	0.51	-74.0	6.82	1724	1155	25.40
	05.10.11	7.583	4.494	0.402		8	0.70	62.7	6.39	1825	1223	23.96
MW18	04.12.09	8.050	4.492	0.231	3.55	36	2.84	27.8	7.10	2496	1672	24.84
	13.04.11	8.065	4.041	0.682		19.5	0.39	-91.0	6.71	2418	1620	25.55
	05.10.11	8.055	4.268	0.455		8	0.43	63.1	6.66	2591	1736	24.14
MW19	04.12.09	6.670	4.401	0.256	3.67	27	0.02	-159.1	7.14	2449	1641	24.67
	14.04.11	6.668	4.040	0.617		field chemistry parameters not obtained due to presence of PSH						
	06.10.11	6.673	4.269	0.388		12	0.31	-162.8	4.88	2991	2004	24.32
MW20	04.12.09	6.005	4.481	0.275	3.01	21	1.06	-70.0	7.06	3506	2349	26.47
	14.04.11	6.045	4.177	0.579		13	0.49	-136.0	6.85	3296	2208	26.70
	06.10.11	5.996	4.357	0.399		8	0.51	14.8	6.97	3455	2315	24.29
MW21	04.12.09	6.588	4.817	0.235	3.59	46	0.66	-4.3	7.21	1371	919	25.97
	13.04.11	5.798 ¹	3.785	UC		23	0.33	-128.0	6.54	1267	849	26.22
	05.10.11	5.721 ¹	3.981	UC		10	0.28	74.3	6.90	1625	1089	24.21
MW22	04.12.09	7.860	5.671	0.238	4.86	24	3.95	79.2	7.26	2674	1792	24.22
	13.04.11	7.885	5.340	0.569		22	1.40	-29.2	6.10	3658	2451	24.38
	05.10.11	7.866	5.526	0.383		8	1.75	61.5	6.72	3956	2651	24.31
MW23	04.12.09	5.332	3.923	0.242	2.33	20	0.49	41.2	7.29	3539	2371	25.55
	13.04.11	5.182	3.572	0.593		30	1.74	85.7	5.90	5144	3446	25.16
	05.10.11	5.163	3.771	0.394		8	1.07	78.0	7.04	4595	3079	24.01

Notes: all results are field measured parameters - YSI 556 multi probe meter
TDS is calculated by multiplying EC by 0.67 (ANZECC 2000)
'UC' denotes unable to be calculated as bore casing damaged / not surveyed
1. monitor well casing has been damaged and repaired

Table 5: Historical & Current Groundwater Field Chemical Data

Monitoring Well	Date	Depth of Well (m BTOC)	Depth to Water (m BTOC)	Reduced Levels (m AHD)	Top of Screen (m BTOC)	Purged volume (L)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	EC (µS/cm)	TDS (mg/L) (Calculated)	Temp (°C)
MW24	14.04.11	6.125	4.056	UC	-	15	0.48	-48.6	6.42	2378	1593	25.67
	05.10.11	6.114	4.259	UC		8	1.6	63.0	6.97	2069	1386	23.56
Recovery Well	04.12.09	4.200	3.920	UC	-	12	0.16	-176.6	7.21	2168	1453	26.28
	14.04.11	3.805 ³	3.770	UC		6.3	0.22	-211.0	6.65	2917	1954	27.71
	05.10.11	3.791 ³	Well dry									

Page 3 of 3

Notes: all results are field measured parameters - YSI 556 multi probe meter
 TDS is calculated by multiplying EC by 0.67 (ANZECC 2000)
 'UC' denotes unable to be calculated as bore casing damaged / not surveyed
 3. well casing appears to be filling with sand

Table 6: Historical Soil Analytical Results Exceedances - BTEX, TPH & Naphthalene

Sample No.	Depth (m)	PID (ppm _v)	Date	BTEX				Total Petroleum Hydrocarbons				Naphthalene
				Benzene	Toluene	Ethylbenzene	Xylenes	C6-C9	C10-C14	C15-C28	C29-C36	
SB2	5.0	-	26.06.07	<0.2	0.9	3.6	28.1	251	140	<100	<100	NT
SB3	5.0	-	26.06.07	<0.2	11.3	54.8	252	2440	1500	110	<100	NT
SB4	4.6	-	26.06.07	<0.2	9.5	12.6	91.4	688	440	<100	<100	NT
SB4	5.0	-	26.06.07	<0.2	14	18.1	163.4	1110	690	<100	<100	NT
SB5	5.0	-	26.06.07	0.7	12.8	5.7	40.5	278	290	<100	<100	NT
SB6	4.5	-	26.06.07	<0.2	<0.5	<0.5	<1	204	500	<100	<100	NT
SB6	5.0	-	26.06.07	<0.2	<0.5	0.6	<1	230	530	<100	<100	NT
MW19	5.0	-	27.11.09	0.6	<0.5	14.7	19.8	956	10400	900	<100	8.8
MW15A	5.0	0.60	05.03.10	<0.2	<0.5	<0.5	0.8	<10	50	1080	1400	NT
			05.03.10	<i>Aromatic >C16-C35</i>						460	NT	
Ecological Investigation Levels - EIL				1	3	5	5	100	500	1000	NE	5
Health Investigation Levels - HIL-D				NE	NE	NE	NE	NE	NE	360 ¹ / 22400 ²	190	
Health Investigation Levels - HIL-F				5.6	5200	230	2600	NE	NE	450 ¹ / 28000 ²	NE	
Laboratory Limit of Reporting				0.2	0.5	0.5	1	10	50	100	100	5
Notes: all concentrations reported in milligrams per kilogram (mg/kg) on a dry weight basis Where applicable the highest concentration of the primary and / or QC sample has been used								1. >C ₁₆ -C ₃₅ aromatic assessment level 2. >C ₁₆ -C ₃₅ aliphatic assessment level				
11.3 shading indicates concentrations exceed the EIL SLs												
900 shading indicates concentrations exceed both the HIL-D and HIL-F aromatic SLs												
'NE' denotes screening level not established or under review												
'NT' denotes sample not subjected to analytical testing												
'Total Xylenes' denotes sum of meta-, para- & ortho-xylene												

Table 7: Historical Soil Analytical Results Exceedances - Organochlorine Pesticides (OCP)

Sample No.	Depth (m)	Date	Time	Organochlorine Pesticides															
				alpha-BHC	beta-BHC	gamma-BHC	delta-BHC	Heptachlor	Aldrin	Heptachlor epoxide	alpha-Endosulfan	4,4'-DDE	Dieldrin	Endrin	beta-Endosulfan	4,4'-DDD	Endosulfan sulfate	4,4'-DDT	
SS4	0.03	15.03.11	07:51	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.6	<0.5	<0.5	<0.5	<0.5	
Ecological Investigation Levels - EIL				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2	0.5	0.5	0.5	0.5	0.5
Health Investigation Levels - HIL-D				NE	NE	NE	NE	NE	NE	40 ¹	NE	NE	800 ²	40 ¹	NE	NE	800 ²	NE	800 ²
Health Investigation Levels - HIL-F				NE	NE	NE	NE	NE	NE	50 ¹	NE	NE	1000 ²	50 ¹	NE	NE	1000 ²	NE	1000 ²
Laboratory Limit of Reporting				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Notes: all concentrations reported in milligrams per kilogram (mg/kg) on a dry weight basis												1. assessment level for aldrin plus dieldrin							
0.6 shading indicates concentrations exceed EIL SL												2. assessment level for DDT + DDD + DDE							
'NE' denotes screening level not established or under review																			

Table 8: Historical Soil Analytical Results Exceedances - Nutrients

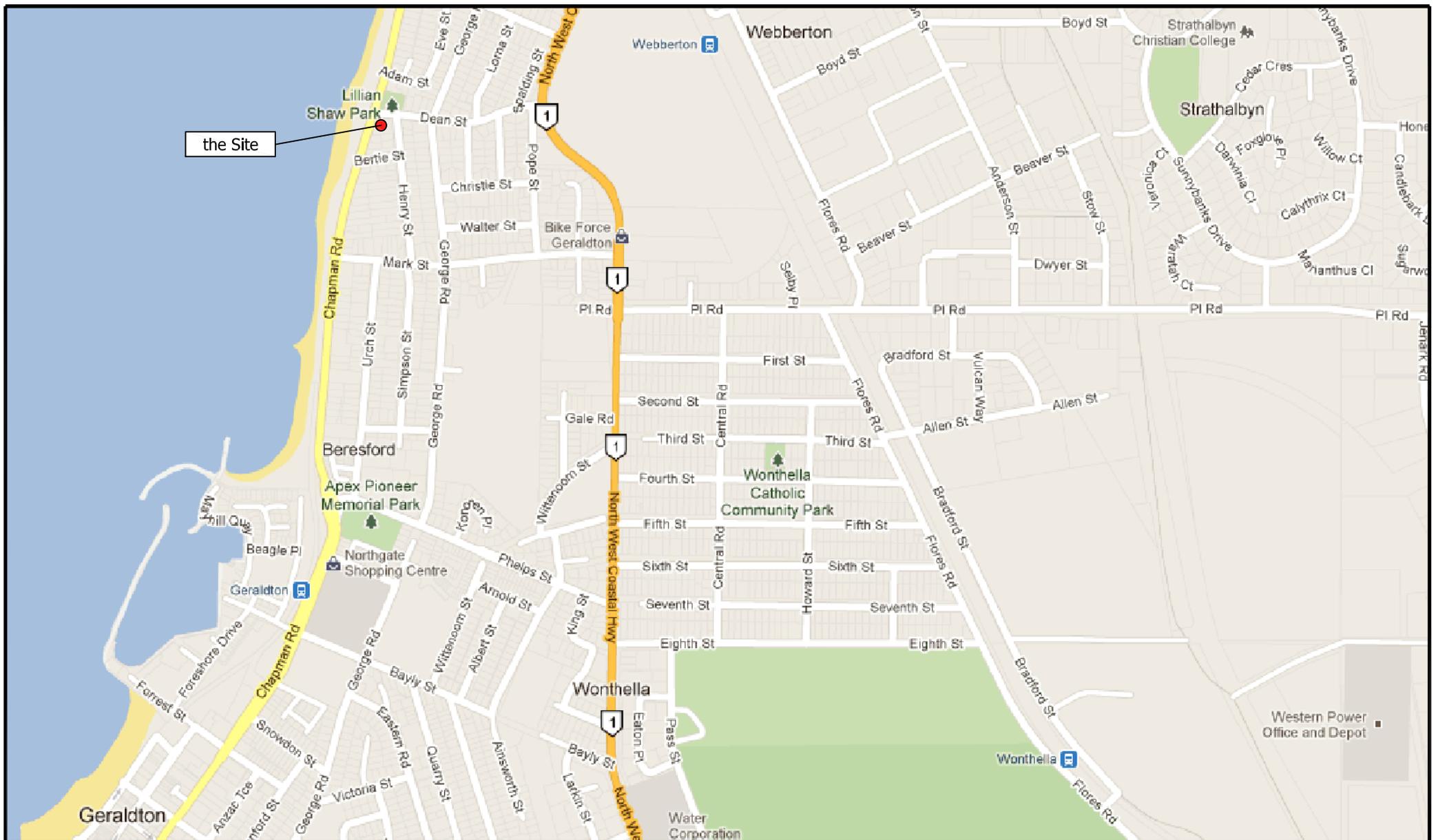
Sample No.	Depth (m)	Date	Time	Nutrients
				Sulfate as SO ₄ ⁻
SS1	0.03	15.03.11	07:38	3150
SS2	0.04	15.03.11	07:47	4100
SS3	0.04	15.03.11	07:49	3310
SS4	0.03	15.03.11	07:51	2830
Ecological Investigation Levels - EIL				2000
Health Investigation Levels - HIL-D				NE
Health Investigation Levels - HIL-F				NE
Laboratory Limit of Reporting				0.2

Notes: all concentrations reported in milligrams per kilogram (mg/kg) on a dry weight basis
3150 shading indicates concentrations exceed EIL SL
 'NE' denotes screening level not established or under review

FIGURES

Figures

- Figure 1: Local Area Map
- Figure 2: Aerial Photograph – October 2011
- Figure 3: Site Layout, Former Infrastructure & Monitoring Well Locations – December 2011
- Figure 4: Soil Gas and Vapour Flux Sample Locations – January 2010 & August 2011
- Figure 5: Historical Soil Sample Exceedance Locations
- Figure 6: Groundwater Concentrations Above LoR: BTEXN & TPH (with silica gel) & Localised Groundwater Contours and Flow Direction – October 2011
- Figure 7: Conceptual Site Model
- Figure 8: Proposed Development Footprint – April 2011



GEMEC PTY LTD

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 Melville W.A. 6956
 Tel: +61 8 9339 8449
 Fax: +61 8 9339 0073
 Web: www.gemec.com.au

● Site Location



0 250 500
 Scale (m), approx.

Local Area Map

source: Google Maps

Former BP Bluff Point Service Station

242 Chapman Road, Beresford, Western Australia

Drawn: TM
 Scale: As Shown

Date: 06.12.11

CHECKED
 RB

APPROVED
 RB

DRG
 No.

Figure

1



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0 20
 Scale (m), approx.

Aerial Photograph - October 2011

source: Google Earth

Former BP Bluff Point Service Station

242 Chapman Road, Beresford, Western Australia

Drawn: TM

Date: 06.12.11

CHECKED
RB

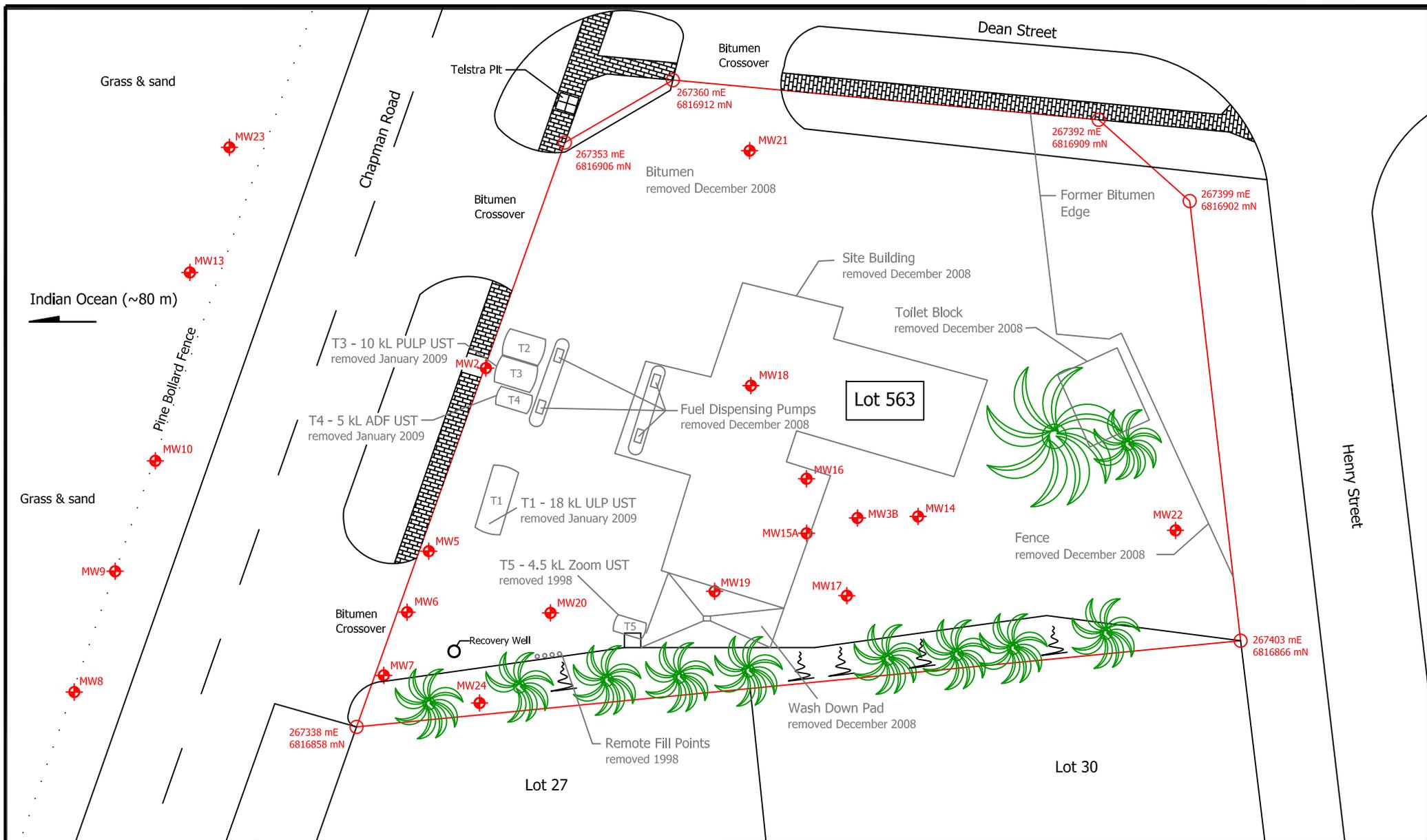
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Figure

2

Scale: As Shown



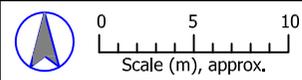
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Site Boundary (approximate)

Former Site Infrastructure

MW1
 Monitoring Well



Site Layout, Former Infrastructure & Monitoring Well Locations - December 2011

Former BP Bluff Point Service Station

242 Chapman Road, Beresford, Western Australia

Drawn: TM

Date: 06.12.11

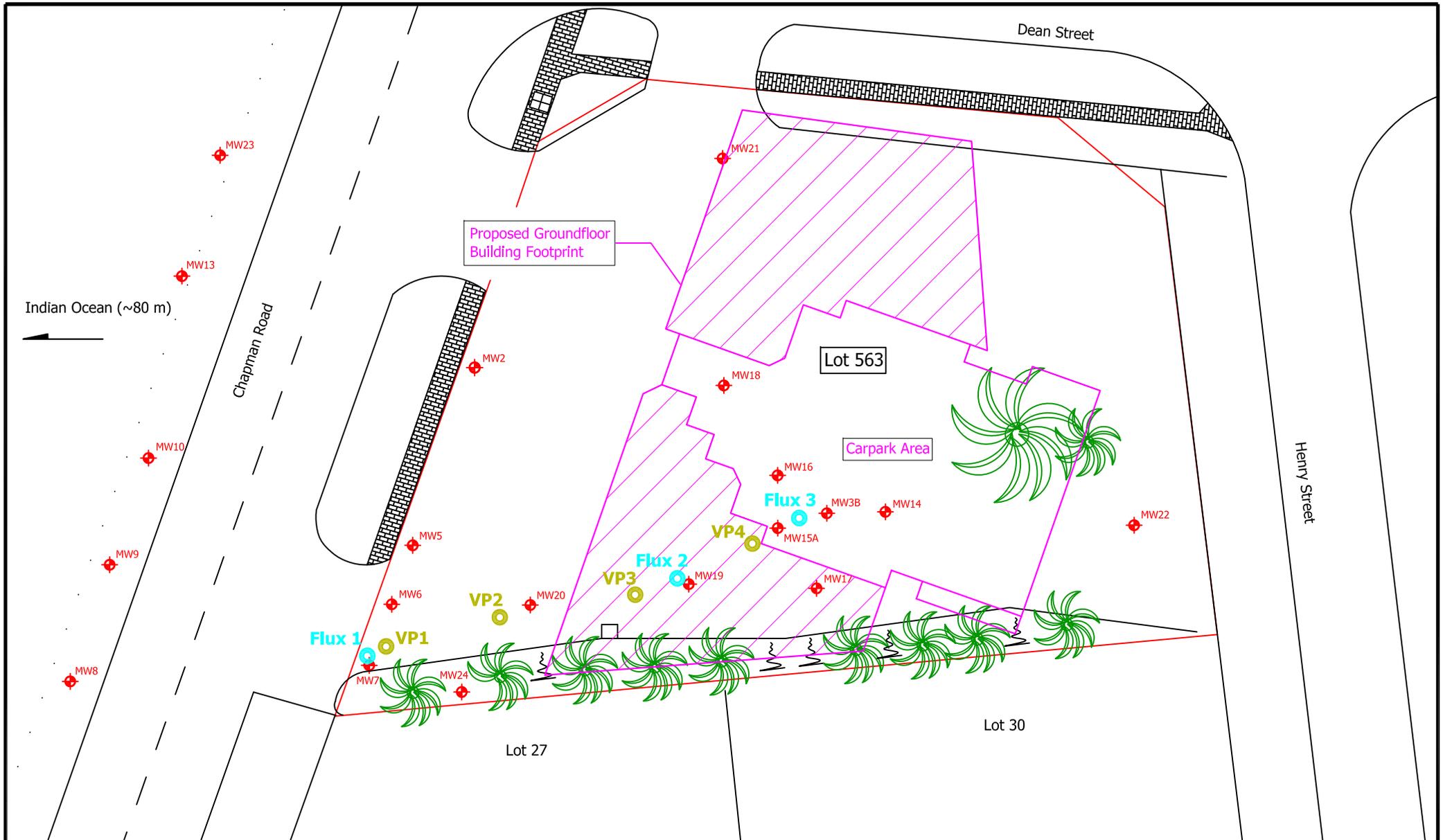
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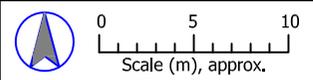
Figure

3



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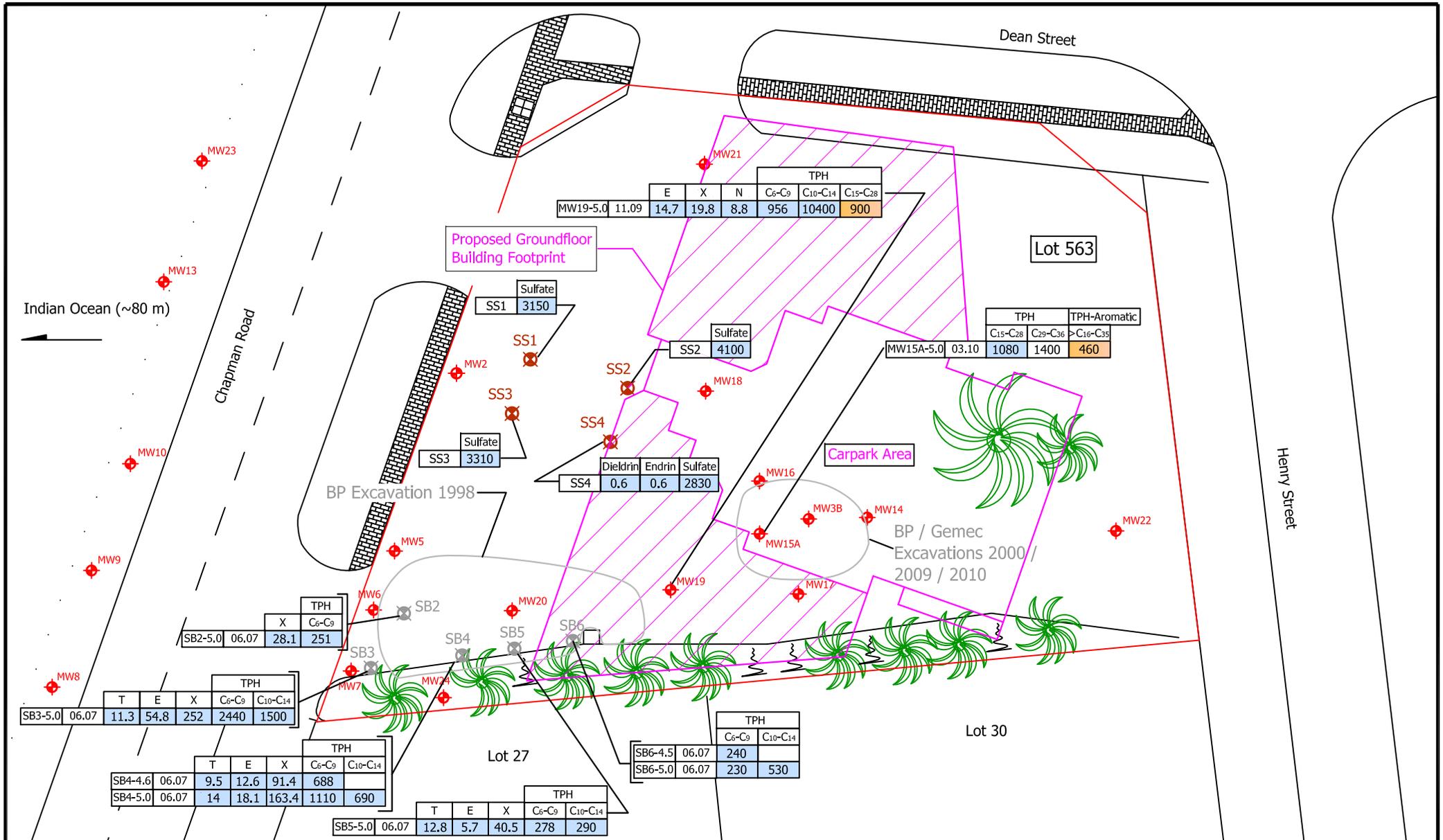
- ◆ MW1 Monitoring Well
- Flux 1 Leeder soil gas sample location (January 2010)
- VP4 Gemec soil gas sample location (August 2011)



Soil Gas and Vapour Flux Sample Locations - January 2010 & August 2011

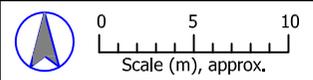
Former BP Bluff Point Service Station
 242 Chapman Road, Beresford, Western Australia

Drawn: TM	Date: 06.12.11	CHECKED RB	APPROVED RB	DRG No. Figure	4
Scale: As Shown					



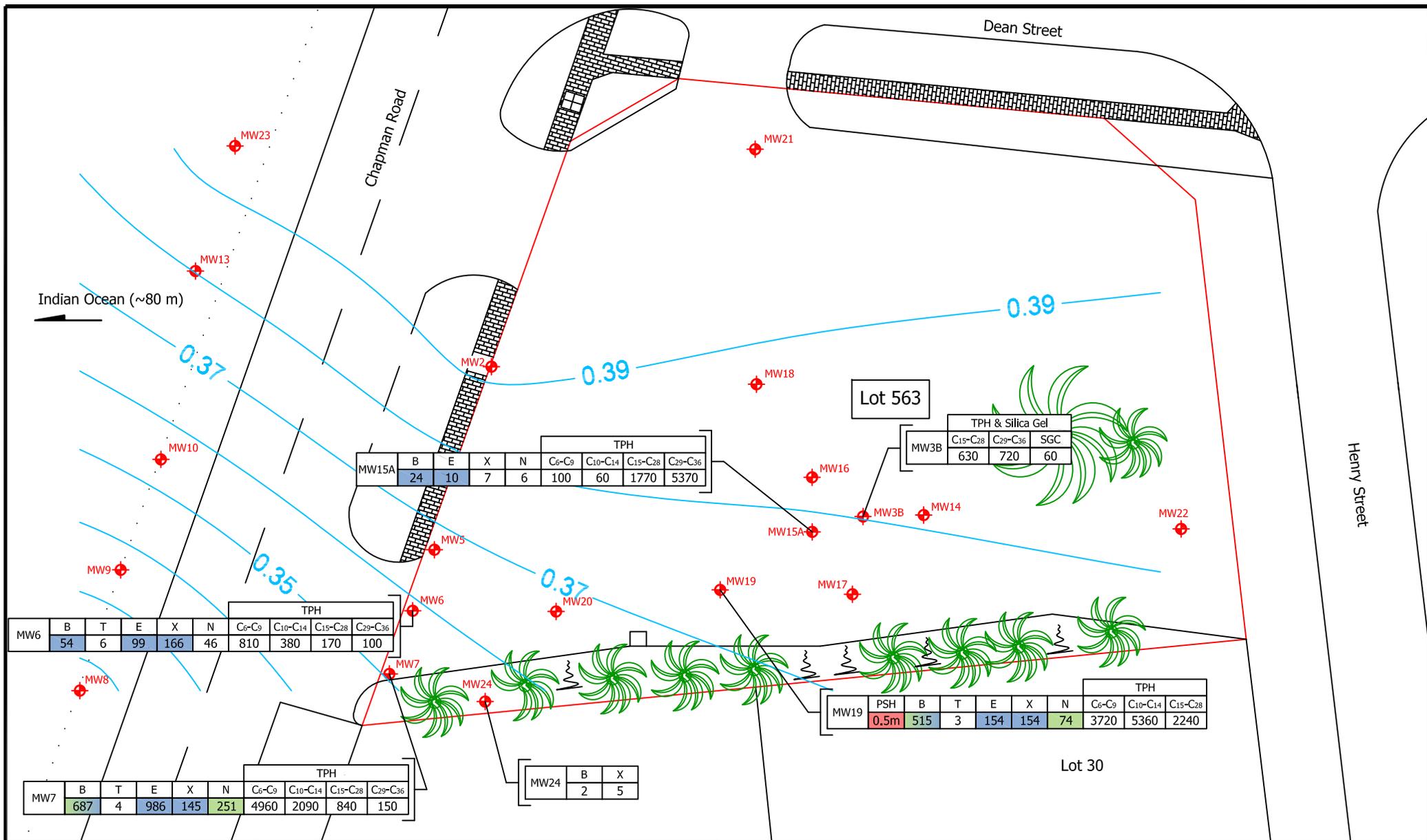
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- MW1 Monitoring Well
- 2007 soil sample location
- 2011 surface sample location
- Concentration exceeding HIL-D & HIL-F (mg/kg)
- Concentration exceeding EIL (mg/kg)



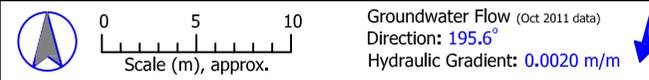
Historical Soil Sample Exceedance Locations
 Former BP Bluff Point Service Station
 242 Chapman Road, Beresford, Western Australia

Drawn: TM	Date: 05.12.11	CHECKED RB	APPROVED RB	DRG No. Figure	5
Scale: As Shown					



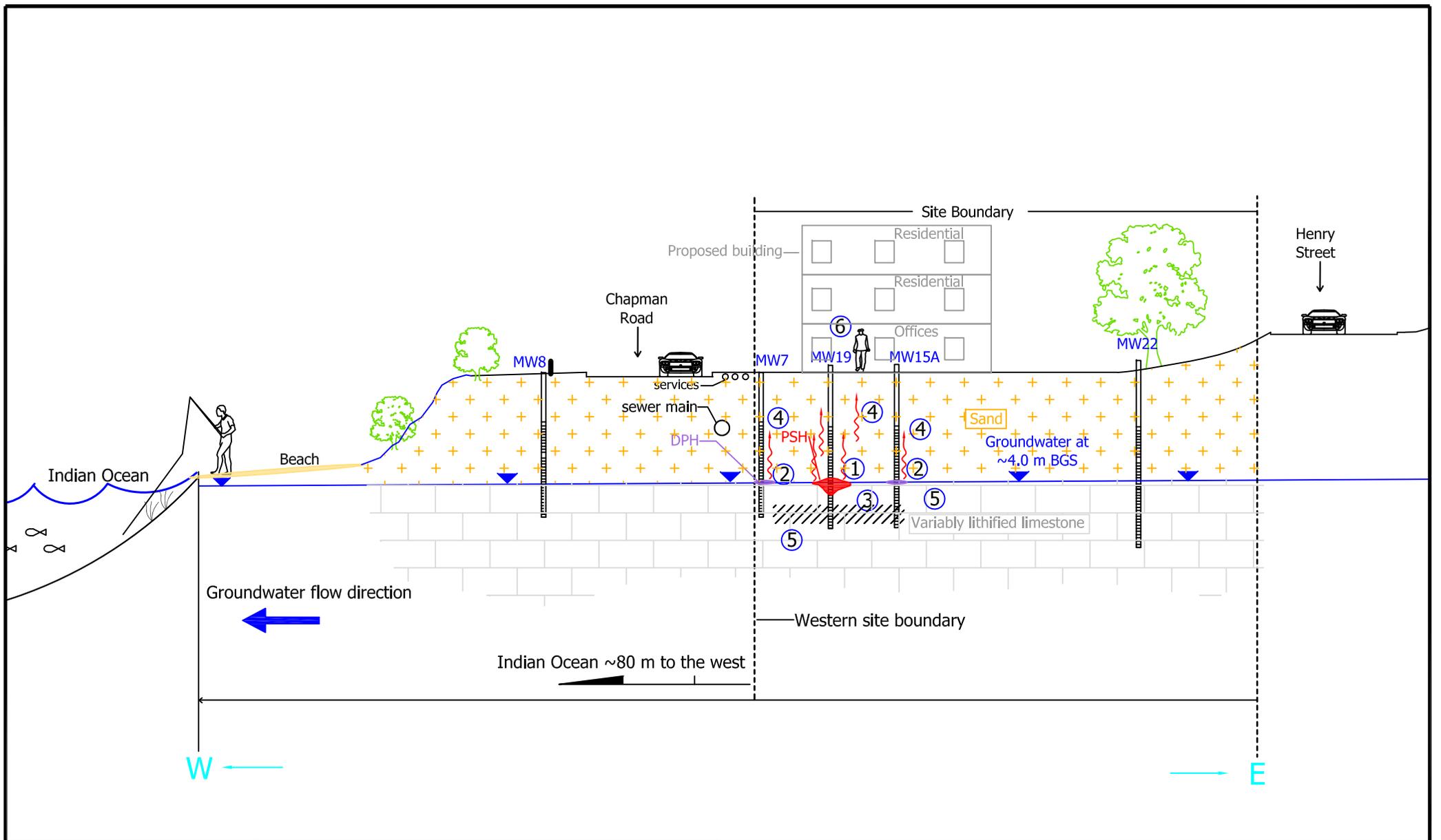
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MW1 Monitor Well ID and Location
 B Groundwater Concentration ($\mu\text{g/L}$)
 <1 Concentration Exceeding MW
 251 Concentration Exceeding DoHG
 986 Concentration Exceeding DoHG
 687 Concentration Exceeding MW & DoHG
 PSH Apparent PSH thickness (m)
 0.5m
 0.39 Groundwater Contours (Surfer generated in m AHD)



Groundwater Concentrations Above LoR (BTEXN & TPH / Silica Gel) & Localised Groundwater Contours & Flow Direction - October 2011
 Former BP Bluff Point Service Station
 242 Chapman Road, Beresford, Western Australia

Drawn: TM	Date: 06.12.11	CHECKED RB	APPROVED RB	DRG No. Figure	6
Scale: As Shown					



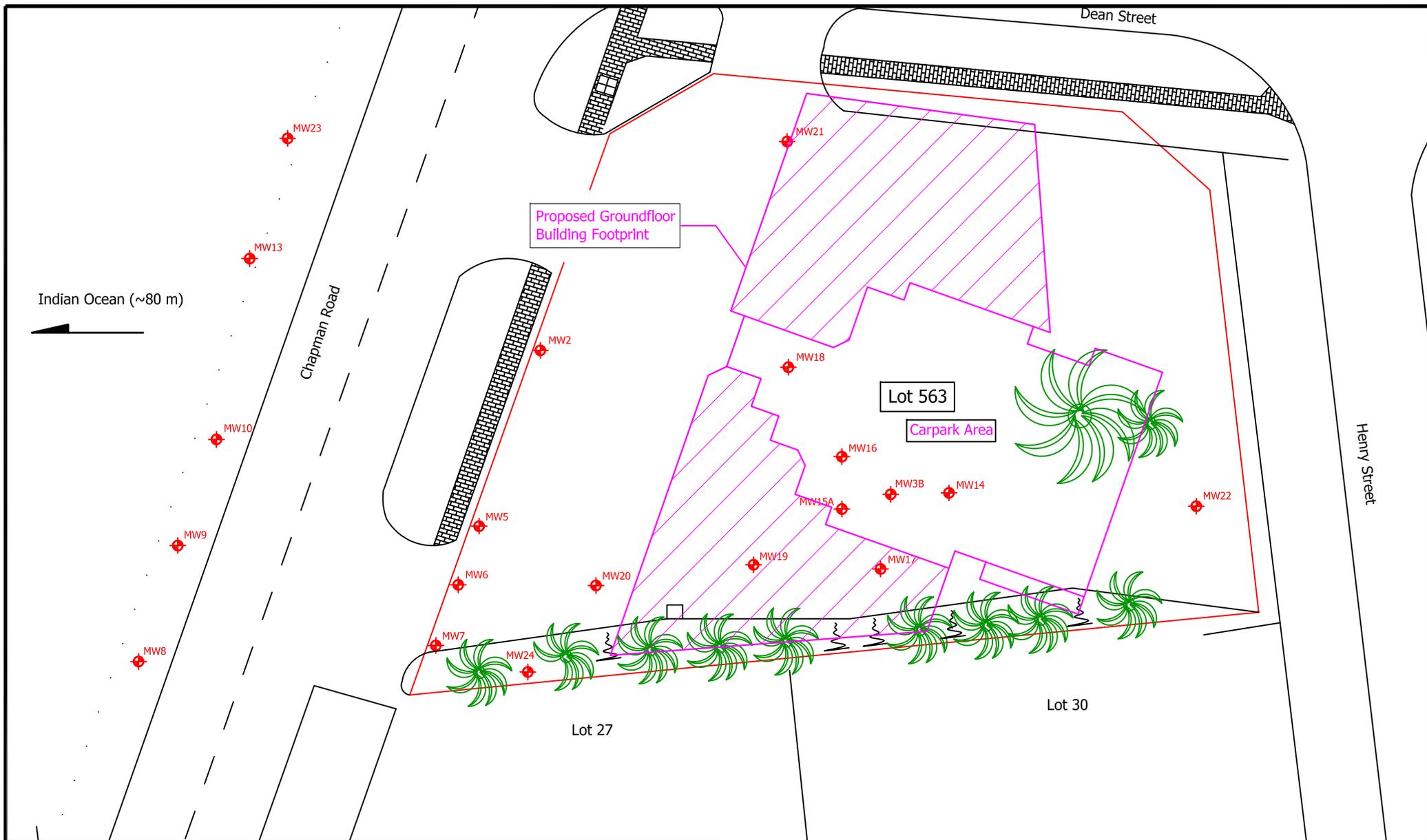
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- SOURCES:**
- ① phase separated hydrocarbons (PSH)
 - ② dissolved phase hydrocarbons (DPH)
 - ③ hydrocarbon impacted soil in the saturated zone
- POTENTIAL RECEPTORS:**
- ⑤ shallow ground water
 - ⑥ workers / residents / customers / public
- PATHWAYS:**
- ④ potential for migration of vapours to surface

Note: drawing not to scale

Conceptual Site Model - October 2011
Former BP Bluff Point Service Station
 242 Chapman Road, Beresford, Western Australia

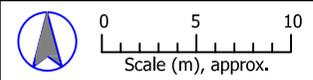
Drawn: RB	Date: 01.03.12	CHECKED RB	APPROVED RB	DRG No. Figure	7
Scale: As Shown					



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◆ MW1 Monitor Well ID and Location



Groundwater Flow (Oct 2011 data)
 Direction: 195.6°
 Hydraulic Gradient: 0.0020 m/m

Proposed Development Footprint - April 2011 *source: Eastman Poletti Sherwood Architects*

Former BP Bluff Point Service Station
 242 Chapman Road, Beresford, Western Australia

Drawn: TM Date: 06.12.11
 Scale: As Shown

CHECKED
RB

APPROVED
RB

DRG No. **Figure**

APPENDIX A

Appendix A

Supporting Data

DEC Site Summary Form

Land Title Details

Basic Summary of Records



DEC SITE SUMMARY FORM



Site Summary Form- Contaminated Site Assessment

For completion by the person(s) submitting a report(s) to be assessed by the Department of Environment and Conservation (DEC) as per the information requirements of the DEC *Reporting on Site Assessments (2001)* guideline. Completing this form enables DEC to maintain accurate records for the site.

Please note: A completed site summary form must accompany each report submitted to DEC for assessment. Each box must be filled out appropriately. Please do not write "refer to report" in any section. Copies of all relevant/current Certificates of Title must accompany this form.

Site location details:

Site name (e.g. where site may be known by a common/ business name)

Lot no. House no. Street

Suburb State Postcode

Crown Reserve (if applicable)

Certificate(s) of Title (or equivalent)

Where the subject site comprises of multiple certificates of title, please list all 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 all 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 all listed sites attached? (Y/N)

WAPC reference no. (where applicable)

Current Owner/Occupier details:

Site owner (Name and address)

Site owner company ACN/ABN

Site occupier (name and address)

Site occupier company ACN/ABN

Site status (at time of reporting): vacant site

Proposed land use (e.g. high density residential/child care facility)

Identified substances and relevant media (e.g. benzene in soil and groundwater, xylene in soil only)

Asbestos (Y/N)	<input type="text" value="N"/>	Health Risk Assessment (Y/N)	<input type="text" value="N"/>	Community health concerns identified (Y/N)	<input type="text" value="N"/>	Radiological issues (Y/N)	<input type="text" value="N"/>
Air quality issues (Y/N)	<input type="text" value="N"/>	Past/present landfill (Y/N)	<input type="text" value="N"/>	Potential human exposure to identified substances > DEC's Health Investigation Levels or equivalent (Y/N)	<input type="text" value="Y"/>	Other human health issues (Y/N)	<input type="text" value="N"/>

Specify other health issues.....

Where 'yes' is recorded for at least one of the above categories, please submit two copies of the report(s) (relevant documentation) to DEC for referral to the Department of Health (or Radiological Council, in the case of radiological issues)

Are site activities licensed under the *Environmental Protection Act 1986*? (Y/N)

Where laboratory analysis has been undertaken, is the laboratory NATA accredited for all analytes and analytical methodologies used? (Y/N) (If not, why not?)

Community Consultation: (as per the DEC's *Community Consultation (December 2006)* guideline)

Community consultation program commenced/proposed (Y/N)

Are consultation program details (e.g. community consultation plan) provided in attached report (Y/N)

History of Investigation:

Have previous site investigations been undertaken? (Y/N - if yes, please provide details below)

Report title, date and author:

Environmental Site Assessment and Remediation Report, December 2000 – BP Australia <i>Soil Investigation Report</i> , July 2007 - Gemec Pty Ltd <i>Tank Pit & Excavation Validation Report</i> , January 2009 - Gemec Pty Ltd <i>Targeted Groundwater Investigation Report</i> , August 2008 – June 2009 - Gemec Pty Ltd <i>Soil & Groundwater Investigation Report</i> , November 2009 – May 2010 - Gemec Pty Ltd <i>Former Waste Oil Sump Area Excavation & Validation Report</i> , February – March 2010- Gemec Pty Ltd <i>Addendum to Former Waste Oil Sump Area Excavation & Validation Report</i> , February – March 2010 - Gemec Pty Ltd Risk Assessment Stage 2, June 2010- Environment Business Solutions <i>Soil & Groundwater Investigation Report</i> , March, April & October 2011 – Gemec Pty Ltd Health Risk Assessment, 27 March 2012 – Environmental Risk Sciences
--

Declaration:

The information contained in this site summary form is a true representation of the information contained in the attached report(s)/document(s).

Full name (print)

Position held

Signature Date

Please ensure that a hardcopy of the current Certificate(s) of Title and associated sketch accompanies the site summary form. DEC cannot proceed with the assessment of the report if this information is not provided.

DEC Registrar Only

Registrar name: Signature:

CoT verified (Y/N) Owner details verified (Y/N) Complete form (Y/N)

Awaiting Classification (Y/N)
Awaiting Re-Classification (Y/N)
Incomplete Form (Y/N)

LWQB Assessment Officer:

Comments/Actions:

Date of data entry:

LAND TITLE DETAILS

WESTERN



AUSTRALIA

REGISTER NUMBER 563/DP222471	
DUPLICATE EDITION N/A	DATE DUPLICATE ISSUED N/A

RECORD OF CERTIFICATE OF TITLE
UNDER THE TRANSFER OF LAND ACT 1893

VOLUME **1228** FOLIO **115**

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.

B. Roberts



REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 563 ON DEPOSITED PLAN 222471

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ROSS KEVIN JOHNSON
SANDRA JOY JOHNSON
BOTH OF 8 HEMSLEY PLACE, BLUFF POINT
AS JOINT TENANTS

(T H657799) REGISTERED 1 FEBRUARY 2001

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

1. H657801 MORTGAGE TO NATIONAL AUSTRALIA BANK LTD REGISTERED 1.2.2001.
2. *K235725 MEMORIAL. CONTAMINATED SITES ACT 2003 (CONTAMINATED SITE - REMEDIATION REQUIRED) REGISTERED 21.6.2007.

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: 1228-115 (563/DP222471).
PREVIOUS TITLE: 663-56.
PROPERTY STREET ADDRESS: 242 CHAPMAN RD, BERESFORD.
LOCAL GOVERNMENT AREA: CITY OF GREATER GERALDTON.

NOTE 1: A000001A LAND PARCEL IDENTIFIER OF GERALDTON TOWN LOT/LOT 563 (OR THE PART THEREOF) ON SUPERSEDED PAPER CERTIFICATE OF TITLE CHANGED TO LOT 563 ON DEPOSITED PLAN 222471 ON 08-JUL-02 TO ENABLE ISSUE OF A DIGITAL CERTIFICATE OF TITLE.

NOTE 2: THE ABOVE NOTE MAY NOT BE SHOWN ON THE SUPERSEDED PAPER CERTIFICATE OF TITLE OR ON THE CURRENT EDITION OF DUPLICATE CERTIFICATE OF TITLE.

END OF PAGE 1 - CONTINUED OVER

RECORD OF CERTIFICATE OF TITLE

REGISTER NUMBER: 563/DP222471

VOLUME/FOLIO: 1228-115

PAGE 2

NOTE 3: K718768 DUP CT NOT PRODUCED FOR DOCUMENT K718768

DEC BASIC SUMMARY OF RECORDS



Search Results

This response relates to a search request received for:

242 Chapman Rd
Beresford WA 6530

This parcel belongs to a site that contains 1 parcel(s).

According to Department of Environment and Conservation records, this land has been reported as a known or suspected contaminated site.

Address	242 Chapman Rd Beresford WA 6530
Lot on Plan Address	Lot 563 On Plan 222471
Parcel Status	<p>Classification: 12/04/2007 - Contaminated - remediation required</p> <p>Nature and Extent of Contamination:</p> <p>Hydrocarbons are present in the soil approximately 1 m below ground towards the southern boundary of the Site.</p> <p>Hydrocarbons are present in groundwater towards the southern boundary of the Site.</p> <p>Restrictions on Use:</p> <p>Access to soils below 1 metre depth is restricted until further chemical testing and an assessment of the risk to Site users, is undertaken.</p> <p>A Site-specific health and safety plan is required to address the risks to the health of any workers undertaking intrusive works towards the southern boundary (below 1 metre depth) until further notice.</p> <p>Groundwater abstraction is not permitted at this Site because of the nature and extent of groundwater contamination.</p> <p>Reason for Classification:</p> <p>This Site was originally reported to the Department of Environment and Conservation (DEC) prior to the commencement of the 'Contaminated Sites Act 2003'. The Site classification is based on information submitted to the Department by March, 2007.</p> <p>This Site has historically, and is still presently used as a service station, a land use that has the potential to cause contamination, as specified in the Contaminated Site Management Series guideline 'Potentially Contaminating Activities, Industries and Landuses' (Department of Environment, 2004).</p>

Disclaimer

This Summary of Records has been prepared by Department of Environment and Conservation (DEC) as a requirement of the *Contaminated Sites Act 2003*. DEC makes every effort to ensure the accuracy, currency and reliability of this information at the time it was prepared, however advises that due to the ability of contamination to potentially change in nature and extent over time, circumstances may have changed since the information was originally provided. Users must exercise their own skill and care when interpreting the information contained within this Summary of Records and, where applicable, obtain independent professional advice appropriate to their circumstances. In no event will DEC, its agents or employees be held responsible for any loss or damage arising from any use of or reliance on this information. Additionally, the Summary of Records must not be reproduced or supplied to third parties except in full and unabridged form.



Contaminated Sites Act 2003 Basic Summary of Records Search Response

Report Generated at: 2:10:53PM, 03/04/2012

A contamination assessment was conducted in 2000 to determine environmental conditions at the Site, following an earlier assessment in 1996.

Hydrocarbons (such as from petrol/diesel/oil) were present in soils at concentrations exceeding Ecological Investigation Levels and Health-based Investigation Levels for commercial and industrial Sites, as published in 'Assessment Levels for Soil, Sediment and Water' (Department of Environment, 2003). The hydrocarbons present may be acting as an ongoing source of impact to the groundwater. The hydrocarbon impact is present in the soil approximately 1 m below ground towards the southern boundary of the Site.

Hydrocarbons were present in groundwater at concentrations exceeding Australian Drinking Water Guidelines and Aquatic Ecosystems - Freshwater/Marine, as published in 'Assessment Levels for Soil, Sediment and Water' (Department of Environment, 2003). The concentration of dissolved-phase hydrocarbons still present in groundwater in January 2007 indicates that free-phase hydrocarbons may be present at the Site. Further groundwater investigations are required to delineate the lateral and vertical extent of the groundwater impact off-site.

Remedial works, including excavation and off-site disposal, were partially conducted on the soils in 1998 and 2000, however some soil and groundwater impact still remains at the Site towards the southern boundary. Monitored Natural Attenuation of the contaminants does not appear to be working under present conditions and this is reflected in high concentrations of hydrocarbons in groundwater.

A Screening Risk Assessment has demonstrated that residual contamination is present on the Site above relevant human health and environmental criteria, however at the time of classification the contamination was assessed to not pose an unacceptable risk to human health under the current land use of a service station. This is because of the contamination being present at a depth of at least 1 m below ground, and the absence of direct human exposure to contaminants due to the sealed drive surface and landscaped embankment.

Based on the information provided, the Site appears suitable for commercial/industrial use, but may not be suitable for more sensitive land uses (e.g. residential housing, day care centres). Monitoring of the on-Site and off-Site groundwater bores is being conducted on a periodic basis, however because of the close proximity to the ocean and persisting high levels of hydrocarbons in groundwater, further delineation of contamination and remediation is required. As the Site has been shown to be contaminated, and remediation is required to reduce unacceptable off-Site risks to human health, the environment or any environmental value to acceptable levels, the Site is classified as 'contaminated - remediation required'.

A memorial stating the Site's classification has been placed on the Certificate of Title, and will notify any prospective owners of the contamination status of the Site.

DEC has classified this Site based on the information available at the time of classification. It is acknowledged that the contamination status may have changed since this time, and as such the usefulness of this information may be limited.

Under the Contaminated Sites Act 2003, this Site has been classified as "Contaminated - remediation required". An instrument affecting land which comprises all, or part of, this Site will not be registered or accepted for registration, unless the CEO of the Department of Environment & Conservation consents to the registration in writing. For further information

Certificate of Title
Memorial

Disclaimer

This Summary of Records has been prepared by Department of Environment and Conservation (DEC) as a requirement of the *Contaminated Sites Act 2003*. DEC makes every effort to ensure the accuracy, currency and reliability of this information at the time it was prepared, however advises that due to the ability of contamination to potentially change in nature and extent over time, circumstances may have changed since the information was originally provided. Users must exercise their own skill and care when interpreting the information contained within this Summary of Records and, where applicable, obtain independent professional advice appropriate to their circumstances. In no event will DEC, its agents or employees be held responsible for any loss or damage arising from any use of or reliance on this information. Additionally, the Summary of Records must not be reproduced or supplied to third parties except in full and unabridged form.



Contaminated Sites Act 2003
Basic Summary of Records Search Response

Report Generated at: 2:10:53PM, 03/04/2012

Current Regulatory Notice Issued
General

on the contamination status of this Site, or this restriction, please contact the Contaminated Sites section of the Department of Environment & Conservation.

Type of Regulatory Notice: Nil

Date Issued: Nil

No other information relating to this parcel.

Disclaimer

This Summary of Records has been prepared by Department of Environment and Conservation (DEC) as a requirement of the *Contaminated Sites Act 2003*. DEC makes every effort to ensure the accuracy, currency and reliability of this information at the time it was prepared, however advises that due to the ability of contamination to potentially change in nature and extent over time, circumstances may have changed since the information was originally provided. Users must exercise their own skill and care when interpreting the information contained within this Summary of Records and, where applicable, obtain independent professional advice appropriate to their circumstances. In no event will DEC, its agents or employees be held responsible for any loss or damage arising from any use of or reliance on this information. Additionally, the Summary of Records must not be reproduced or supplied to third parties except in full and unabridged form.

APPENDIX B

Appendix B

Soil Gas Vapour Port Construction Details

CLIENT : Mr Ross Johnson
 CONSULTANT : Gemec Pty Ltd
 PROJECT : Former BP Service Station Bluff Point
 LOCATION : 242 Chapman Road, Beresford
 DRILLING CO : NA

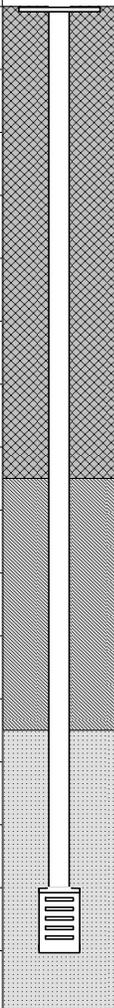
SOIL BORING NO : VP1
 DRILL DATE : 13.07.11
 EASTING : 267343.09 m E
 NORTHING : 6816863.41 m N
 DRILL RIG : NA
 DRILL METHOD : Hand Auger

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID (ppmv)	SAMPLE (X)	OBSERVATIONS
0.0			Ground Surface				
			FILL SANDS Medium grain, beige, dry, well sorted	NO	-	-	Cement grout between 0.0 and 0.8 m BGS (mix of cement, bentonite and sand)
1.0				NO	-	-	Bentonite seal between 0.8 and 1.1 m BGS
				NO	-	-	Gravel pack between 1.1 and 1.6 m BGS
2.0							

REMARKS: NO=No Odour; WO=Weak Odour; DO=Distinct Odour; SO=Strong Odour; VSO=Very Strong Odour;
 m BGS=metres Below Ground Surface; m AGS=metres Above Ground Surface; EOH=End of Hole;
 NR=No Response.

CLIENT : Mr Ross Johnson
 CONSULTANT : Gemec Pty Ltd
 PROJECT : Former BP Service Station Bluff Point
 LOCATION : 242 Chapman Road, Beresford
 DRILLING CO : NA

SOIL BORING NO : VP2
 DRILL DATE : 13.07.11
 EASTING : 267349.11 m E
 NORTHING : 6816865.75 m N
 DRILL RIG : NA
 DRILL METHOD : Hand Auger

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID (ppmv)	SAMPLE (X)	OBSERVATIONS
0.0			Ground Surface FILL SANDS Medium grain, beige, dry, well sorted				
				NO	-	-	Cement grout between 0.0 and 0.75 m BGS (mix of cement, bentonite and sand)
1.0				NO	-	-	Bentonite seal between 0.75 m and 1.15 m BGS
				NO	-	-	Gravel pack between 1.15 m and 1.6 m BGS
2.0				NO	-	-	

REMARKS: NO=No Odour; WO=Weak Odour; DO=Distinct Odour; SO=Strong Odour; VSO=Very Strong Odour;
 m BGS=metres Below Ground Surface; m AGS=metres Above Ground Surface; EOH=End of Hole;
 NR=No Response.

CLIENT : Mr Ross Johnson
 CONSULTANT : Gemec Pty Ltd
 PROJECT : Former BP Service Station Bluff Point
 LOCATION : 242 Chapman Road, Beresford
 DRILLING CO : NA

SOIL BORING NO : VP3
 DRILL DATE : 13.07.11
 EASTING : 267364.30 m E
 NORTHING : 6816866.51 m N
 DRILL RIG : NA
 DRILL METHOD : Hand Auger

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID (ppmv)	SAMPLE (X)	OBSERVATIONS
0.0			Ground Surface				
			FILL SANDS Medium grain, beige, dry, well sorted	NO	-	-	Cement grout between 0.0 and 0.8 m BGS (mix of cement, bentonite and sand)
1.0				NO	-	-	Bentonite seal between 0.8 and 1.1 m BGS
				NO	-	-	Gravel pack between 1.1 and 1.6 m BGS
2.0							

REMARKS: NO=No Odour; WO=Weak Odour; DO=Distinct Odour; SO=Strong Odour; VSO=Very Strong Odour;
 m BGS=metres Below Ground Surface; m AGS=metres Above Ground Surface; EOH=End of Hole;
 NR=No Response.

CLIENT : Mr Ross Johnson
 CONSULTANT : Gemec Pty Ltd
 PROJECT : Former BP Service Station Bluff Point
 LOCATION : 242 Chapman Road, Beresford
 DRILLING CO : NA

SOIL BORING NO : VP4
 DRILL DATE : 13.07.11
 EASTING : 267369.18 m E
 NORTHING : 6816871.35 m N
 DRILL RIG : NA
 DRILL METHOD : Hand Auger

DEPTH (mBGS)	SOIL BORING	LITHOLOGY	DESCRIPTION	ODOUR	PID (ppmv)	SAMPLE (X)	OBSERVATIONS
0.0			Ground Surface				
			FILL SANDS Medium grain, beige, dry, well sorted	NO	-	-	Cement grout between 0.0 and 0.8 m BGS (mix of cement, bentonite and sand)
1.0				NO	-	-	Bentonite seal between 0.8 and 1.1 m BGS
				NO	-	-	Gravel pack between 1.1 and 1.6 m BGS
2.0							

REMARKS: NO=No Odour; WO=Weak Odour; DO=Distinct Odour; SO=Strong Odour; VSO=Very Strong Odour;
 m BGS=metres Below Ground Surface; m AGS=metres Above Ground Surface; EOH=End of Hole;
 NR=No Response.

GEMEC