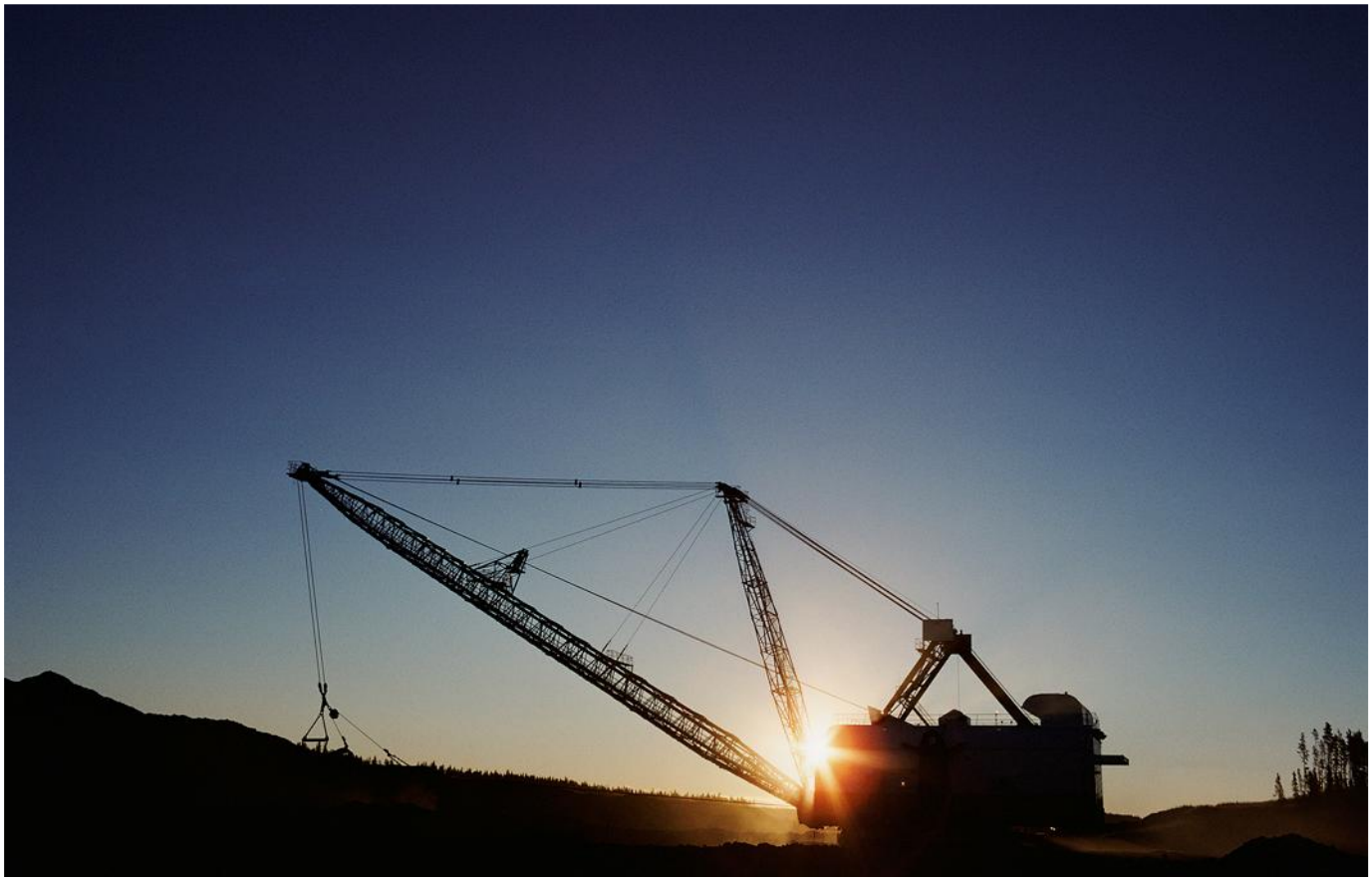
Alinta Energy

Groundwater Monitoring Event - Telford Rail Siding, Leigh Creek, SA

27 August 2015



PARSONS BRINCKERHOFF

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By email
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Dear Ben

Groundwater Monitoring Event - Telford Rail Siding, Leigh Creek, SA

Parsons Brinckerhoff is pleased to provide a report on the May 2015 groundwater monitoring event undertaken at the Telford Rail Siding, Leigh Creek, SA.

A detailed review of the historical data has been undertaken, including a comparison against the proceeding 2013 groundwater monitoring event, with subsequent recommendations provided in relation to the ongoing management of the site.

As requested we have also considered the potential future requirements for assessment and validation given that the site is likely to be divested prior to the next scheduled monitoring round.

If you have any queries in relation to this report, please do not hesitate to contact the undersigned on (08) 8405 4300.

Yours sincerely

Ashlyn Daly
Environmental Scientist

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Abbreviations

ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ANZECC	Australia and New Zealand Environment Conservation Council
AHD	Australian Height Datum
AS	Australian Standard
BTEXN	Benzene, Toluene, Ethylbenzene, Xylenes and Naphthalene
BUA	Beneficial Use Analysis
DEWNR	Department of Environment, Water and Natural Resources
DO	Dissolved Oxygen
EC	Electrical Conductivity
EPA	Environment Protection Authority
EPP	Environmental Protection Policy
ESA	Environmental Site Assessment
GME	Groundwater Monitoring Event
HDPE	High Density Polyethylene
LOR	Limit of Reporting
LNAPL	Light Non Aqueous Phase Liquids
HESP	Health, Environment and Safety Plan
mBTOC	Metres Below Top Of Casing
mBTOS	Metres Below Top Of Standpipe
MW	Monitoring Well
NATA	National Association of Testing Authorities
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
QA	Quality Assurance
QC	Quality Control
RB	Rinsate Blank

RPD	Relative Percentage Difference
RSWL	Reduced Standing Water Level
SWL	Standing Water Level
TB	Trip Blank
TDS	Total Dissolved Solids
TRH	Total Recoverable Hydrocarbons

Executive summary

Parsons Brinckerhoff was commissioned by Alinta Energy in April 2015 to undertake a Groundwater Monitoring Event (GME) at the Telford Rail Siding, Leigh Creek, South Australia. This GME formed part of an ongoing program that has been implemented in order to manage potential human health and environmental risks associated with known hydrocarbon contaminated groundwater at the site.

Historical releases from on-site fuel storage and distribution infrastructure and maintenance activities have resulted in hydrocarbon impacts to groundwater. Previous environmental investigations have identified the presence of light non-aqueous phase liquid (LNAPL) in the subsurface in the vicinity of the on-site fuel storage.

Based on the groundwater results obtained during the 2015 GME investigations undertaken at the site and an assessment of the historical groundwater monitoring events, it is concluded that:

- The dissolved phase hydrocarbon concentrations reported in DMMW2 and TFMW6 indicate the plume appears to be relatively stable and has not migrated beyond the surrounding (ring) network of monitoring wells.
- Fluctuating water levels as a result of the drought of the previous decade lowering groundwater levels and subsequent rainfall returning water levels to pre-drought levels may have resulted in an increase in residual LNAPL retained within the geological formation.
- This increase in residual LNAPL would reduce the likelihood of migration of LNAPL, but may result in an increase in dissolved concentrations.
- Groundwater levels have also been reported above the screened interval for the previous three monitoring events, therefore LNAPL may be trapped below the water table and may be released following a drop in the water table depth.
- TRH C_{10}–C_{36} concentrations (290 µg/L) reported in TFMW10 during the 2013 monitoring event indicated that dissolved concentrations may be gradually migrating laterally from the LNAPL plume. During the 2015 monitoring round TFMW10 was reported below the laboratory LOR, which indicated no significant evidence of plume migration.
- Primary lines of evidence and some secondary lines of evidence indicate that limited natural attenuation may be occurring beneath the site in the vicinity of the LNAPL plume.

Recommendations

It is recommended that the following be undertaken:

- A further groundwater monitoring event at the site should be undertaken in late 2016 to assess the apparent trends in hydrocarbon plume behaviour and natural attenuation, especially due to the high groundwater levels above the screened intervals.
- The proposed groundwater monitoring event should be undertaken during a period of lower groundwater levels in an attempt to assess hydrocarbon concentrations at their highest and to ensure that monitoring occurs when the standing water level is within the screened interval of the monitoring wells.
- Parsons Brinckerhoff recommends that Alinta Energy attempt to gauge the monitoring wells on a monthly basis from July 2015 to July 2016, this data can then be used to determine the optimal time to undertake the 2016 monitoring event.

- All wells should continue to be analysed for TRH, BTEXN and natural attenuation parameters (ferrous iron, dissolved methane, sulfate, and nitrate).
- Site workers proposing to undertake excavations in the vicinity of the hydrocarbon plume should conduct work in accordance with an appropriate construction environmental management plan.

Following the GME in 2016 (and dependent on the results obtained), the following tasks are likely to be warranted to assist with decommissioning and closure of the site:

- Validation of the diesel storage tanks footprint following their removal.
- Removal and disposal of secondary sources of contamination within the tank farm and/or former diesel line to the railway siding.
- Installation of shallow wells with the screen within the groundwater plume (to be considered if gauging indicates no lowering of the water table during seasonal variation).
- Completion of a detailed site investigation and remediation report demonstrating the current and likely future contamination status of the residual soils and groundwater impacts, it is considered that given the beneficial use assessment for groundwater, removal of primary and secondary sources should be sufficient to manage the risk profile of the site contamination status at the rail siding.
- Decommissioning of the monitoring wells in accordance with the mandatory requirements set out in the *Minimum Construction Requirements for Water Bores in Australia* (2012).

1. Introduction

1.1 Background information

Parsons Brinckerhoff was commissioned by Alinta Energy in April 2015 to undertake a Groundwater Monitoring Event (GME) at the Telford Rail Siding, Leigh Creek, South Australia (the site). A site locality map is presented as Figure 1 (Appendix A).

Historical release(s) from on-site fuel storage and distribution infrastructure and maintenance activities have resulted in hydrocarbon impacts to groundwater. As such a network of groundwater monitoring wells was established in 1997 in order to delineate and allow ongoing monitoring of the hydrocarbon impacts.

This GME report forms part of an ongoing program that has been implemented in order to manage potential human health and environmental risks associated with known hydrocarbon contamination at the site.

This work was undertaken in accordance with Parsons Brinckerhoff's proposal (ref 15-0046-00-201503217) dated 9 April 2015, as approved by Alinta Energy in April 2015.

1.2 Objectives

The objectives of the GME were to:

- assess the status of groundwater contamination at the site for the ongoing commercial/industrial use
- make a comparison of the 2015 GME data with the previous events and monitor apparent trends in the hydrocarbon plume behaviour and biodegradation; and
- provide an updated interpretation of the status of the hydrocarbon plume in relation to stability and ongoing potential human health and environmental risks.

2. Site details

2.1 Site identification

Table 2.1 Site identification details

Site Address	Sec 321 Government Road, Lyndhurst, SA, 5731
Certificate of Title Reference	CL 1545/20, Hundred of Copley
Current Owner	NRGenerating Holdings (No. 2) and ORS
Current Occupier	Alinta Energy
Current Land Use	Industrial

2.2 Site topography

The site elevation is approximately 200 m above the Australian Height Datum (AHD) and slopes to the west.

Topography in the vicinity of the site (that which has not been altered by the extensive coal mining operations in the area) is dominated by the Sunday Creek drainage plain which flows to the west and into Leigh Creek.

2.3 Site layout

The Telford tank compound is located within the Leigh Creek coal fields, north of the coal excavation activities. The site is approximately 20 m west of rail lines (which are not in operation), adjacent to the Telford Siding.

The compound currently consists of two above-ground distillate (diesel) storage tanks surrounded by an earthen bund wall. From information supplied by SAGC, each tank has a diameter of 17.38 m and a capacity of 2.3 ML. The earthen bund wall is approximately 2 m high, 4 m wide at the top and has side slope batters of 1 vertical to 1.25 horizontal on both the inside and the outside faces.

A site plan showing the location of the diesel storage tanks is show in Figure 2.

Each tank sits on a raised concrete apron and the two tanks are separated by a distance of 66 m centre to centre. Pipes connect the two tanks and additional pipework connects the tanks to distillate dispensing points outside the bund walls. Two dispensing points are located on both the eastern and western sides of the southern tank. Further pipework continues from the eastern dispensing point across to the adjacent train lines. Generally the pipework is above ground.

It is understood from discussions with Alinta Energy that the present diesel storage tanks were installed following the identification of a historical release of product and replaced the existing storage tanks.

2.4 Regional geology

The Copley 1:250,000 geological map sheet (Geological Survey of South Australia Department of Mines Adelaide, 1973) indicates that the region is underlain by Telford Gravel which comprises rounded to sub angular cobles and pebbles, and includes cross bedded channel sands which are often cemented by white

to pale pink lime of the Bakara soil. Yellow to white crystalline gypsum of an unknown age is also found in this geology group.

2.5 Regional hydrology and hydrogeology

The site is located on Quaternary sediments overlying Adelaidean (Proterozoic) basement between the Telford basin and the North Field coal basin (Kwitko, 1995). The Quaternary sediments are described as alluvial plain gravel, sand, silt and clay, including the Telford Gravel.

The original construction logs of the seven operational groundwater monitoring wells at the site could not be obtained for review, however, the drillers logs were obtained from the DEWNR registered bore database.

The geology encountered in the wells during installation was generally described as clayey alluvium, with alluvium interpreted as comprising sands and gravels. Discrete beds of clayey gravels were encountered in five of the bore logs.

This description is consistent with the anticipated depositional environment, with quaternary sediments being deposited and reworked as a likely result of the meandering stream Sunday Creek, which historically flowed in a westerly direction approximately 500 m to the south of the site (as shown on the Copley 1:250K map sheet).

Recent aerial photography (2015, as reviewed on the Google Earth imagery for the site current at the time of writing), indicates the flow path of Sunday Creek has been diverted, with a surface channel flowing to the north west, approximately 100 m to the west of the site (at its closest point).

Flow in the Sunday Creek (and therefore the channel) is anticipated to be an ephemeral channel, with flow a direct response to rainfall events above a certain intensity over a period. At the time of the 2015 monitoring event it was noted that water was flowing in Sunday Creek and the diversion channel.

Recharge to the water table aquifer (within which the hydrocarbon impacts are present) is likely to occur through surface infiltration. At the location of the investigation site, this is likely to have been dominated by the Sunday Creek and more recently the diversion channel (it is assumed that this surface channel is not lined).

Regional groundwater flow is anticipated to be consistent with the site topography and subsequent surface drainage (i.e. to the west). However infiltration within the drainage channel could result in a temporary north easterly flow component, however once infiltration reduced/ceased flow would revert back to the regional flow direction.

2.5.1 Environmental and Permeability Assessment: PPK 2000

In 2000 PPK undertook an environmental and geotechnical investigation of soil at the site comprising 23 soil bores drilled to a maximum of 4.0 m below ground level (mBGL).

Fill (clay) was encountered across the site to a depth of 0.35 m, comprising gravelly clay, which was interpreted as reworked natural soils.

The natural soil profile within the compound (surrounding the above ground fuel tanks) generally consisted of silty sandy clay of medium to high plasticity overlying silty gravelly clay containing pockets of calcareous silt and fine to medium mixed gravel.

This in turn was observed to overlie clayey gravel/gravelly clay. At some borehole locations alternating layers of clay and gravel were encountered to the full depth of investigation, whereas at other locations only one or two distinct clay or gravel layers were encountered. The clay content of the gravel layers also varied both

within the depth of a given borehole and between borehole locations. Some of the gravel layers contained very little or no clay.

The gravel encountered was mixed in nature, but generally resembled a fine to coarse angular to subangular grey dolomitic gravel with a slight to moderate alkaline reaction.

No groundwater was encountered during this investigation to the maximum depth of drilling, however, perched water tables may be expected to occur within the gravelly strata following a period of wet weather.

Refusal of the drilling due to high resistance was frequently encountered in the gravel or gravelly clay strata.

Hydraulic permeability measurements undertaken in clays from the floor of the diesel storage tank complex indicated a very low hydraulic conductivity between 3.2×10^{-11} to 1.9×10^{-10} m/s (Rust PPK 1997b).

The hydraulic conductivity of the saturated zone was estimated to be 2.5×10^{-7} m/s (mean of three tests, PPK 2000), in the range typical of silt or silty sand.

This description is consistent with the anticipated alluvial deposits expected within the (meandering) Sunday Creek drainage plain.

2.5.2 Groundwater quality

During the 2015 GME groundwater was noted to be of high salinity, with total dissolved solids (TDS) ranging from 14,001 to 29,280 mg/L (note that seawater is approximately 35,000 mg/L), which is generally consistent with the historical TDS values.

3. Summary of previous investigations

A summary of historical investigation and monitoring works at the site is provided below.

3.1 Phase 1 Environmental Audit Report (Rust PPK, May 1996)

Rust PPK was commissioned by Australian National (AN) to conduct a Phase 1 Environmental Audit of the Telford Rail Siding as part of the overall preliminary assessment of AN facilities undertaken prior to the ownership transfer of AN facilities in November 1997.

The Phase 1 Environmental Audit identified the presence of petroleum hydrocarbon staining of surface soils adjacent to the bulk fuel storage tank farm area, and adjacent to the diesel refuelling line.

As a result, Rust PPK recommended further investigation.

3.2 Phase 2 Environmental Site Assessment of the Australian National Telford Facility, SA (Rust PPK, May 1997)

Following the completion of the Phase 1 Environmental Audit Program, PPK was commissioned by AN to undertake a targeted intrusive Environmental Site Assessment (ESA) of the current and former operational, and developed areas of site.

The ESA was undertaken and reported in May 1997 and comprised a soil and groundwater investigation of the nature and extent of hydrocarbon impacts within the underlying groundwater.

Based upon the findings of the phase 2 ESA Rusk PPK concluded the following:

- Surface and subsurface hydrocarbon impacts (predominantly distillate fuel products) were present on the site immediately adjacent to the tank farm and the diesel refuelling manifold.
- Hydrocarbon impacted groundwater (predominantly distillate fuel products) was present under the site in the vicinity of the tank farm and the diesel refuelling manifold.
- The network of seven groundwater monitoring wells (comprising DMMW2, TFMW4, TFMW6, DMMW8, TFMW9, TFMW10 and TFMW11) were installed during this ESA.
- Hydrocarbon sheen was observed in DMMW2 and TFMW6 in the 1997 GME.
- Concentrations of hydrocarbons were below the laboratory limit of reporting (LOR) in groundwater sampled in all (five) remaining wells.

3.3 Groundwater Monitoring November 1999, Telford Rail Siding, SA (PPK, March 2000)

PPK Environment & Infrastructure Pty Ltd (PPK) was commissioned by Flinders Power Pty Ltd to conduct groundwater monitoring at the Telford Railway Siding, comprising gauging and sampling of seven on-site wells.

The results of the November 1999 GME are summarised as follows:

- Light non-aqueous phase liquids (LNAPL) were present in one well, TFMW6 (60 mm apparent thickness), whereas a sheen had been apparent in 1997.
- Dissolved concentrations of hydrocarbons above laboratory detection limits were found in one well, DMMW2, whereas a sheen had been apparent in 1997.
- Some evidence to suggest the occurrence of in-situ biodegradation was detected in well DMMW2.

Based upon the findings of the 1999 GME, PPK concluded the following:

- The extent of phase-separated and dissolved-phase hydrocarbon impacts at the Telford Railway Siding was restricted.
- There was no evidence of lateral movement of impacts beyond groundwater monitoring wells DMMW2 and TFMW6 that were reported as impacted in 1997.
- Biodegradation rates were inferred to be low.
- Overall, the potential for off-site impact was considered low.

Based on the findings of the 1999 GME, PPK recommended the following:

- A recovery campaign be instituted to remove the existing LNAPL from well TFMW6 by manual bailing, followed by placement of an oleophilic 'sock', checked at 2 to 3 month intervals and replaced as necessary.
- Ongoing monitoring at an interval of one to two years.

3.4 Groundwater Monitoring May 2002, Telford Rail Siding, SA (PPK, June 2002)

PPK Environment & Infrastructure (PPK) was commissioned by NRG Flinders to undertake groundwater monitoring at the Telford Railway Siding comprising gauging, sampling and analysis of seven wells for contaminants of concern and sampling of five selected wells for degradation indicators.

The results of the May 2002 GME are summarised as follows:

- LNAPL was observed in wells TFMW6 (80 mm) and DMMW2 (30 mm).
- Water samples from all other wells indicated dissolved-phase hydrocarbons below laboratory detection limits.
- Biodegradation parameters were only available from non-impacted wells and provide background data rather than allow an assessment of the evidence of biodegradation.

Based upon the findings of the 2002 GME, PPK concluded that with the exception of increased LNAPL thickness, results were similar to that identified in the 2000 GME.

Based upon the findings of the 2002 GME, PPK recommended the following:

- Groundwater monitoring should be undertaken in the same calendar month to reduce the possible influence of seasonal effects.
- The results of this groundwater monitoring event be provided to the SA EPA for their information.

3.5 Groundwater Monitoring March 2005, Telford Rail Siding, SA (Parsons Brinckerhoff, July 2005)

Parsons Brinckerhoff was commissioned by NRG Flinders to undertake groundwater monitoring at the Telford Railway Siding comprising gauging and sampling of seven wells for contaminants of concern and the sampling of five selected wells for degradation indicators.

The results of the March 2005 monitoring event are summarised as follows:

- LNAPL had increased in well DMMW2 (200 mm) and had decreased in TFMW6 (field observations indicated a 'broken oily surface' in purge water).
- Concentrations of hydrocarbons in groundwater sampled from well TFMW6 were in excess of solubility limits.
- Concentrations of hydrocarbons in groundwater sampled from well TFMW4 were in marginally above the laboratory limits of reporting (20 µg/L) in the C_{10}–C_{14} fraction (90 µg/L).

Based upon the findings of the 2005 GME, Parsons Brinckerhoff concluded that newly impacted well (TF MW4) may have been the result of lateral migration of contaminants.

Based upon the findings of the 2005 GME, Parsons Brinckerhoff recommended the following:

- A recovery campaign be re-instituted to remove the existing LNAPL from well DMMW2 by manual bailing, followed by placement of an oleophilic 'sock', checked at 2 to 3 month intervals and replaced as necessary.
- The results of previous GMEs should be maintained to allow comparison of trends.

An interval of one to two years between monitoring events was still considered appropriate.

3.6 Groundwater Monitoring October 2007 – Telford Rail Siding, SA (Parsons Brinckerhoff, November 2007)

Parsons Brinckerhoff was commissioned on 2 October 2007 by Flinders Power to undertake a groundwater gauging, sampling and analysis program at the Telford Rail Siding.

Six wells were found to be dry, while one well (DMMW9) was found to be blocked by tree roots. On average groundwater levels within the vicinity of the tank/refuelling area had dropped approximately 1.5 m since the previous monitoring event undertaken in March 2005. It was likely that the dramatic drop in water levels recorded was due to recent drought conditions.

3.7 Groundwater Monitoring Event – Telford Rail Siding, SA (Parsons Brinckerhoff, April 2011)

Parsons Brinckerhoff was commissioned in January 2011 by Alinta Energy to undertake a groundwater gauging, sampling and analysis program at the Telford Rail Siding.

Groundwater levels recorded in March 2011 were significantly higher than the 2005 and 2007 monitoring rounds, with groundwater levels approximately two and a half metres higher in each monitoring well when compared to the 2005 GME.

This rise in groundwater level may be due to heavy rain periods and/or mine dewatering. It should be noted that groundwater levels were shown to fall consistently between 1997 and 2005 and all wells on site were

shown to be dry in 2007. Levels recorded during the 2011 GME were generally consistent with levels recorded in 1999.

The analytical results from the 2011 GME found that DMMW2 had shown an increase in total recoverable hydrocarbon (TRH) C_{10}–C_{36} concentrations when compared to 1999 data. TFMW6 TRH (C_{10}–C_{36}) concentrations decreased considerably since the 2005 GME, while the remaining wells recorded TRH values below the laboratory LOR.

3.8 Groundwater Monitoring Event – Telford Rail Siding, Leigh Creek Coal Field, SA (Parsons Brinckerhoff, April 2012)

Parsons Brinckerhoff was commissioned in January 2012 by Alinta Energy to undertake a groundwater gauging, sampling and analysis program at the Telford Rail Siding located in the Leigh Creek Coalfield, South Australia.

Groundwater levels in 2012 had increased since the previous monitoring round and were significantly higher than historical levels.

Groundwater was interpreted to be flowing in a general north-westerly direction.

Well construction information contained on the DEWNR database indicates the screened interval of the groundwater wells was 6 m at the base in all seven wells constructed. Therefore, water levels gauged in the 2012 GME were above the top of the screen interval in wells DMMW2 and TFMW6. No LNAPL was detected in any of the wells and therefore water samples were able to be obtained.

Dissolved phase impacts were inferred to have been adequately delineated laterally in all directions around the area of impact.

Concentrations of TRH C_{10}–C_{36} exceeding the adopted Dutch (2009) intervention level were identified in one well (DMMW2) and sulfate concentrations exceeding the adopted livestock, potable and recreational guidelines were reported in all wells.

In general concentrations of TRH were found to have decreased or remained below the LORs since the previous monitoring round, which may have been influenced by the rise in groundwater levels.

Primary lines of evidence and some secondary lines of evidence (iron reduction and nitrate reduction) indicated that limited natural attenuation may be occurring beneath the site.

3.9 Groundwater Monitoring Event – Telford Rail Siding, Leigh Creek Coal Field, SA (Parsons Brinckerhoff, March 2013)

Parsons Brinckerhoff was commissioned in January 2013 by Alinta Energy to undertake a groundwater gauging, sampling and analysis program at the Telford Rail Siding located in the Leigh Creek Coalfield, South Australia.

The findings of the 2013 monitoring event can be summarised as follows:

- Groundwater levels encountered during the 2013 monitoring event were consistent with the preceding monitoring round and were significantly above the historical averages. SWLs in all monitoring wells were reported above the top of the screen interval.
- Groundwater was inferred to flow in a north-westerly direction towards Sunday Creek.
- LNAPL was not detected in any of the monitoring wells during the GME.
- Concentrations of TRH C_{10}–C_{36} exceeding the adopted Dutch (2009) intervention level were identified in wells DMMW2 and TFMW6, while sulfate concentrations exceeding the adopted livestock, potable and recreational guidelines were reported in all wells.
- Dissolved phase impacts were inferred to have been generally well delineated laterally in all directions around the area of impact, however TRH (C_{10}–C_{36}) concentrations were reported in TFMW10 (290 µg/L) and TFMW8 (50 µg/L) above LOR for the first time.
- Primary lines of evidence and some secondary lines of evidence (iron reduction and nitrate reduction) indicated that limited natural attenuation may be occurring beneath the site.

Based on the findings of the 2013 GME Parsons Brinckerhoff made the following recommendations:

- Groundwater monitoring at the site biennially (every two years) until 2017 to continue to monitor apparent trends in plume reduction and natural attenuation. Sampling should occur in the same calendar month to reduce the impact of seasonal effects to groundwater.
- All wells should continue to be analysed for TRH, BTEXN and natural attenuation parameters (ferrous iron, dissolved methane, sulfate and nitrate).

4. Scope of work

The groundwater investigation program was undertaken between the 18 and 19 May 2015.

The monitoring event consisted of:

- gauging and sampling of all existing wells
- analysis of all wells for field parameters (electrical conductivity (EC), pH, redox potential, dissolved oxygen (DO) and temperature)
- laboratory analysis of all groundwater samples for TRH, benzene, toluene, ethylbenzene, xylenes and naphthalene (BTEXN), and natural attenuation indicators (sulfate, nitrate, ferrous iron and dissolved methane).

Sampled wells were purged according to Parsons Brinckerhoff's groundwater sampling procedures to obtain representative samples. Dedicated disposable HDPE bailers were used to avoid cross-contamination. It should be noted that due to the large purge volumes required, the casing volume was removed for the first purge volume then subsequent purge volumes were reduced to approximately 10 L with groundwater parameters recorded until three consistent readings were obtained (ensuring at least one bore volume was removed in total, i.e. volume of casing and filter pack).

Samples were sent to National Association of Testing Authorities (NATA) accredited laboratories (ALS and Eurofins MGT). For quality assurance one intra- and one inter-laboratory duplicate sample was analysed as per the primary samples. In addition one trip blank (analysed for TRH (C_6–C_{10}) and BTEXN) and two rinsate blanks (analysed for TRH C_6–C_{40} and BTEXN) were submitted to the primary laboratory. The analysis of the groundwater samples undertaken is summarised in Table 4.1. A summary of the quality control sampling undertaken is presented in Table 4.2.

A plan of the site, showing all groundwater sampling locations, is presented as Figure 2 (Appendix A).

Table 4.1 Groundwater sampling and analytical program

Groundwater well ID	Cased depth (mBGL)	Screened interval (m to base)	Rationale for sampling	Analytes
DMMW2	12.83	6.19	Historically LNAPL impacted	TRH (C_6–C_{40}), BTEXN, sulfate, nitrate, ferrous iron and dissolved methane
TFMW4	12.10	6.12	Delineate hydrocarbon impacts	TRH (C_6–C_{40}), BTEXN, sulfate, nitrate, ferrous iron and dissolved methane
TFMW6	12.32	6.26	Historically LNAPL impacted	TRH (C_6–C_{40}), BTEXN, sulfate, nitrate, ferrous iron and dissolved methane
DMMW8	11.93	5.88	Delineate hydrocarbon impacts	TRH (C_6–C_{40}), BTEXN, sulfate, nitrate, ferrous iron and dissolved methane
TFMW9	12.18	5.91	Delineate hydrocarbon impacts	TRH (C_6–C_{40}), BTEXN, sulfate, nitrate, ferrous iron and dissolved methane
TFMW10	12.46	5.08	Delineate hydrocarbon impacts	TRH (C_6–C_{40}), BTEXN, sulfate, nitrate, ferrous iron and dissolved methane
TFMW11	12.41	5.43	Delineate hydrocarbon impacts	TRH (C_6–C_{40}), BTEXN, sulfate, nitrate, ferrous iron and dissolved methane

Abbreviations: TRH = total recoverable hydrocarbons, BTEXN – benzene, toluene, ethylbenzene, xylene and naphthalene, LNAPL = light non-aqueous phase liquids.

Note: cased depths and screened intervals rounded to 2 decimal places.

4.1 Quality control program

Quality control (QC) sampling undertaken as part of the groundwater investigation program is detailed in Table 4.2.

Table 4.2 Summary of groundwater QC program

Analyte	Number of groundwater samples analysed			% Duplicate samples relative to primary samples	Number of blanks analysed	
	Primary	Field duplicates (intra-lab)	Laboratory splits (inter-lab)		Rinsate	Trip
TRH	7	1	1	29%	2	1*
BTEXN	7	1	1	29%	2	1
Sulfate	7	1	1	29%	–	–
Nitrate	7	1	1	29%	–	–
Ferrous iron	7	1	1	29%	–	–
Dissolved methane	7	1	1	29%	–	–

*TRH C_6–C_{10} only

5. Methodology

Prior to the commencement of the field component of the intrusive investigations, a site specific Health, Environment & Safety Plan (HESP) was prepared. All personnel working at the site were required to read, understand, sign and conform to the HESP.

5.1 Groundwater well sampling

Field methodologies adopted during the groundwater sampling program were consistent with Parsons Brinckerhoff ESA Field Procedures and have been summarised in Table 5.1.

Table 5.1 Groundwater assessment methodology

Activity	Details
Well Gauging	All wells were gauged for standing water level (SWL) and the presence of LNAPL before sampling using a Herron interface meter.
Well Purging	In order to ensure that representative groundwater samples were obtained, each well was purged until stable field parameter readings were obtained. Due to the large purge volumes required, upon removing the casing volume for the first purge volume, subsequent purge volumes were reduced to approximately 10 L.
Sampling Method	Individual disposable HDPE bailers were used to obtain groundwater samples. Water sampling was undertaken in accordance with AS/NZS 5667.11:1998 and SA EPA (2007) *Regulatory Monitoring and Testing Groundwater Sampling*. Field parameters were measured using a TPS 90-FLMV water quality meter, calibrated by ThermoFisher prior to use. Instrument calibration data are included in Appendix B.
Sample Preservation	All samples were collected in bottles which were supplied by the laboratory and contained the appropriate preservatives (where required). All samples were stored on ice in an insulated chest immediately after sampling. Samples were kept chilled prior to and during delivery to the laboratory. Samples collected for nitrate analysis were frozen to extend the laboratory holding time from 48 hrs to seven days.
Equipment Decontamination	In order to minimise the potential for cross-contamination, the Herron interface meter and water quality meter were cleaned with a Decon 90 (phosphate-free) solution between individual groundwater wells.
Wastewater Disposal	Water removed during well purging was disposed of on-site.

5.2 Laboratory analysis

All primary and blind field (intra-laboratory) duplicate samples were submitted to ALS for analysis. Laboratory split (inter-laboratory duplicate) samples were submitted to Eurofins MGT. Both laboratories are accredited by NATA for the analyses performed.

6. Screening criteria

6.1 DEWNR bore search and beneficial use assessment

A DEWNR bore search was undertaken as part of the previous GME and is included in the 2013 report. The results of the DEWNR (2013) database search identified that five mineral bores had been drilled approximately 400 m south-west of the site. These bores were drilled in 1973 to depths of approximately 10 mBGL. As these were mineral bores (utilised for exploration purposes only) no groundwater wells would have been installed.

A detailed beneficial use analysis (BUA) was undertaken as part of the 2012 monitoring event and is summarised in Table 6.1 below. While previous investigations have considered the potable and livestock watering uses of groundwater as realistic environmental values, these criteria have been removed from the 2015 assessment. Due to the high salinity of groundwater beneath the site, it is considered unlikely that groundwater would be used for human or livestock consumption.

Table 6.1 Assessment of groundwater beneficial uses for the Telford Rail Siding

Environmental values/beneficial uses		SA EPA (2003) protected environ-mental value	SA EPA (2009) potential beneficial uses	Beneficial use assessment	
				Considered	Realistic
Aquatic ecosystem	Fresh	✓	✓	✓	Yes
	Marine		✓	✓	No
Recreation and aesthetics/ domestic irrigation	Primary contact	✓	✓	✓	Yes
	Secondary contact	–	–	–	–
	Aesthetics	✓	✓	✓	Yes
Potable		✓	✓	✓	No
Agriculture	Irrigation	✓	✓	✓	Yes
	Livestock	✓	✓	✓	No
	Aquaculture	✓	-	✓	No
Industrial		✓	✓	✓	Yes
Human health in non-use scenarios	Vapour flux	–	✓	✓	Yes
Buildings and structures	Contact	–	✓	✓	No

6.2 Health and ecological criteria

In order to assess the relative concentration and significance of any potential contaminants detected through laboratory analysis it is usual to reference established human health and environmental screening criteria. These contaminant screening criteria represent threshold concentrations of specific contaminants which, if exceeded in a particular sample, may pose a health or environmental risk and may therefore warrant further site specific investigation or risk analysis.

The health and ecological screening criteria used for the assessment of groundwater have been based on the results of the BUA undertaken in 2012.

The SA EPA (2003) *Environment Protection (Water Quality) Policy* (Water Quality EPP) has detailed water quality criteria for a range of protected environmental values for groundwater within South Australia, from which an initial comparison of contaminant concentrations has been made to the criteria contained within Schedule 2 (Table 1) of that document.

These criteria have also been used as the basis for determining whether site contamination is present (refer to Section 10.1), with respect to groundwater, whereby the laboratory LOR has been adopted for an analyte in the absence of a specified Water Quality EPP criterion.

Where criteria are unavailable for certain analytes, reference has been made to alternative Australian and international criteria to assess likely risks to identified beneficial uses.

A summary of the references used to source the health and ecological groundwater screening criteria is provided in Table 6.2.

Table 6.2 Sources of adopted groundwater screening criteria

Beneficial use	Reference
Freshwater Ecosystems	SA EPA (2003) *Environment Protection (Water Quality) Policy* – protected environmental values for freshwater aquatic ecosystems
	NEPM (2013) *National Environmental Protection (Assessment of Site Contamination) Measure Schedule B1 – groundwater investigation levels (freshwater)*
	ANZECC/ARMCANZ (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* – trigger values for freshwaters (95% protection)
Recreation and Aesthetics	NHMRC (2008) *Guidelines for Managing Risks in Recreational Water* – drinking water guidelines (i.e. with an assumed daily consumption rate of 2 L) adjusted by a factor of 10 to account for a more likely (accidental) recreational water consumption of 100 to 200 mL/day*
	ANZECC/ARMCANZ (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* – recreational guidelines
Vapour Intrusion	NEPM (2013) *National Environmental Protection (Assessment of Site Contamination) Measure Schedule B1 – Groundwater health screening levels (HSLs) for commercial/industrial sites above clay*

*Note that this does not take account of substances that can enter the body through skin adsorption.

All criteria adopted for the assessment of the groundwater results are presented in the analytical results tables (Appendix C) and results exceeding the adopted criteria have been highlighted.

7. Results

7.1 Groundwater field parameters

On 18 May 2015, the depth to water within the seven monitoring wells installed at the site ranged from 5.227 to 5.884 m below top of casing (m BTOC) or 5.346 to 5.922 m below top of standpipe (mBTOS).

To be consistent with previous groundwater gauging rounds the standing water level was taken from the top of the standpipe in addition to the well casing, as it is understood that the wells were surveyed from these points.

No LNAPL was detected during the gauging of the wells, however a slight hydrocarbon odour was noted during sampling of DMMW2. No hydrocarbon odour or sheen was noted in any other wells gauged, however all groundwater levels across the site were again reported above the screened interval of the monitoring wells.

Groundwater well gauging data and field parameters measured immediately prior to sampling are presented in Table 7.1 and can be summarised as follows:

- Measured pH values ranged from 6.82 to 7.46, thereby indicating relatively neutral groundwater conditions, which is generally consistent with historical results.
- Electrical conductivity (EC) readings ranged from 23.35 to 48.8 mS/cm (approximating 14,001 to 29,280 mg/L TDS) indicating groundwater within the shallow aquifer is brackish to saline, which is generally consistent with historical results.
- Dissolved oxygen (DO) levels ranged from 0.40 to 4.84 mg/L, indicating low to moderately oxygenated water, which is generally consistent with historical readings.
- Redox potential readings generally ranged from 225 to 315 mV (redox values corrected for a standard hydrogen electrode), indicating moderate oxidising conditions in each of the seven wells.

As indicated in Figure 3 (Appendix A), groundwater within the uppermost aquifer beneath the site was inferred to flow in a westerly direction, consistent to previous investigations.

Groundwater field sampling sheets and historical field parameter data are included in Appendix D.

Table 7.1 Groundwater field parameters – 18 May 2015

Groundwater well	SWL (m BTOS)	RSWL (m AHD)	pH	EC (mS/cm)	Redox (mV)*	DO (mg/L)	Temperature (ºC)
DMMW2	5.762	194.938	6.82	48.8	225	0.40	24.8
TFMW4	5.812	194.688	7.19	43.1	298	4.84	22.9
TFMW6	5.922	194.478	6.96	38.6	310	1.19	21.8
DMMW8	5.863	194.937	7.26	24.89	306	2.69	24.9
TFMW9	5.765	194.835	7.52	45.7	301	4.58	23.7
TFMW10	5.346	194.554	7.46	23.90	311	4.76	22.2
TFMW11	5.450	193.250	7.40	23.35	315	4.14	22.3

*Redox values corrected for standard hydrogen electrode by adding a correction factor of 199mV for an Ag/AgCl electrode

Note: RSWL = reduced standing water level

7.1.1 Groundwater analytical results

The number of groundwater samples analysed, analytes tested for, minimum/maximum constituent concentrations and samples that exceeded the adopted screening criteria are detailed in Table 7.2.

Tables of groundwater analytical results including historical results are included in Appendix C and copies of laboratory certificates are included in Appendix E.

7.1.1.1 Comparison of results with health and ecological criteria

Concentrations of TRH C_{10}–C_{40} were detected in samples DMMW2 (7,420 µg/L) and TFMW6 (950 µg/L), however all samples were reported below the applicable assessment criteria. The assessment criteria however is not limiting indicating the derived HSL exceeds the mixture solubility limit for groundwater and would not result in vapour emissions greater than the allowable acceptable risk.

Concentrations of sulfate ranged from 1,700 to 3,880 mg/L and were reported below the NHMRC (2008) Recreational Guidelines (5,000 mg/L).

Concentrations of nitrate ranged from 0.85 (DMMW2) to 14.4 mg/L (TFMW9) with TFMW9 exceeding the adopted recreational criterion (10 mg/L).

All other analytes were reported below the laboratory LORs and/or below the adopted guidelines.

7.1.1.2 Comparison of results with previous groundwater data

Comparison of the April 2015 concentrations of TRH C_{10}–C_{40} within DMMW2 shows that it is within the same order of magnitude, although slightly higher than the previous two monitoring events. Prior to 2012, different TRH fractions were reported and the concentration of TRH C_{10}–C_{36} was significantly higher (51,400 µg/L).

Concentrations of TRH C_{10}–C_{40} in TFMW6 reported a slight reduction in concentration (950 µg/L) compared to the previous monitoring event (2,750 µg/L) and the concentrations reported in 2015 remained significantly lower than the values historically reported for TFMW6.

During 2013 detectable concentrations of TRH were reported in groundwater sampled from wells DMMW8 (130 µg/L) and TFMW10 (250 µg/L). All concentrations were reported below the laboratory LOR during the 2015 monitoring event.

As with the previous three GMEs, methane was not detected within groundwater. Sulfate concentrations were generally consistent with those reported in the previous monitoring rounds, with all concentrations reported below the recreational criterion.

Ferrous iron concentrations were generally consistent with previous results, with only DMMW2 reporting a detectable concentration, slightly lower than the previous monitoring event. Detectable concentrations were reported in several wells in 2002 and slightly above the detection limit in TFMW6 in 2011 and 2013.

The concentration of nitrate appears consistent to previous results, with only TFMW9 reporting an elevated concentration compared to previous GMEs, exceeding the adopted recreational criterion. DMMW2 again reported the lowest concentration.

Table 7.2 Summary of groundwater results

Number of primary samples	Number of duplicates (intra-lab)	Number of duplicates (inter-lab)	Analyte (µg/L unless otherwise marked)	Min. conc.	Max. conc.	Sample results exceeding screening criteria
7	1	1	C_6–C_9 TRH	<20	<20	No criteria available
7	1	1	C_{10}–C_{14} TRH	<50	410	No criteria available
7	1	1	C_{15}–C_{28} TRH	<100	6520	
7	1	1	C_{29}–C_{36} TRH	<50	200	
7	1	1	C_6–C_{10} TRH	<20	<20	No criteria available
7	1	1	TRH F1 Fraction	<20	<20	None
7	1	1	C_{10}–C_{16} TRH	<20	1390	No criteria available
7	1	1	TRH F2 Fraction	<50	1390	None
7	1	1	C_{16}–C_{34} TRH	<100	6030	No criteria available
7	1	1	C_{34}–C_{40} TRH	<50	<100	No criteria available
7	1	1	Benzene	<1	<1	None
7	1	1	Toluene	<2	<2	None
7	1	1	Ethylbenzene	<2	<2	None
7	1	1	Xylenes	<2	<2	None
7	1	1	Naphthalene	<5	<5	None
7	1	1	Methane	<10	<10	No criteria available
7	1	1	Ferrous iron	<50	750	No criteria available
7	1	1	Nitrate (as N – mg/L)	0.3	**14.4**	ANZECC/ARMCANZ (2000) Recreational: 10 mg/L TFMW9: 14.4 mg/L
7	1	1	Sulfate (as SO_4 – mg/L)	1,700	3,880	None

Note: Numbers in bold exceed adopted assessment criteria

8. Quality Assurance/Quality Control (QA/QC)

Data quality is typically discussed in terms of accuracy, precision and representativeness. In order to assess the quality of the data collected during the investigation program, specific QA/QC procedures were implemented during both the field sampling and laboratory analysis programs, in accordance with the requirements of the following documents:

- Australian/New Zealand Standard AS/NZS 5667.1:1998 *Water Quality Sampling, Part 1: Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Sample*s.
- NEPM (2013) *Schedule B(2) Guideline on Site Characterisation*.
- South Australian Environment Protection Authority (2007) *Regulatory Monitoring and Testing Groundwater Sampling*.

8.1 Field QA/QC

Table 8.1 indicates conformance to field QA/QC procedures.

Field QA procedures generally include the collection of the following QC samples, aimed at assessing possible errors associated with cross contamination as well as inconsistencies in sampling and/or laboratory analytical techniques:

- Intra-laboratory duplicate (blind replicate) samples: submitted to the same (primary laboratory) to assess variation in analyte concentrations between samples collected from the same sampling point and/or the repeatability (precision) of the analytical procedures.
- Inter-laboratory duplicate (split) samples: submitted to a second laboratory to check on the analytical proficiency (accuracy) of the results produced by the primary laboratory.
- Equipment rinsate blank: used to assess whether decontamination procedures have been sufficient and/or whether cross-contamination may have occurred between samples.
- Trip blank: used to assess whether cross-contamination may have occurred between samples during transport.

Whereas analyte concentrations within both the rinsate and trip blanks should be below the laboratory LORs, the duplicate sample results are assessed via the calculation of a relative percentage difference (RPD), as follows:

$$RPD = \frac{(Concentration\,1 - Concentration\,2)\ x\,100}{(Concentration\,1 + Concentration\,2)\ /\ 2}$$

A maximum RPD within the range of 30% to 50% is generally considered acceptable, with higher RPD values often recorded for organic compounds and where low concentrations of an analyte are recorded.

Table 8.1 Field QA/QC procedures

QA/QC requirement	Completed	Comments
Appropriate sampling strategy used and representative samples collected	Yes	Groundwater gauging and sampling was undertaken at all groundwater well locations as proposed.
Field instruments calibrated	Yes	Refer to Table 5.1 as well as Appendix B.
Appropriate and well documented sample collection, handling, logging, transportation and decontamination procedures	Yes	Refer to Table 5.1 for details.
Chain of custody documentation completed	Yes	All samples were transported under strict Parsons Brinckerhoff chain of custody procedures and signed chain of custody documents are included in Appendix E.
Required number (1:10) of blind field duplicates collected	Yes	Refer to Table 4.2 for details.
Acceptable groundwater QC sample RPD results	Mostly	Groundwater RPD results for the intra- and inter-laboratory duplicate sample pairs are included in the analytical results tables in Appendix C. RPDs for the primary and inter-laboratory duplicate pair ranged from 2%–139%, with elevated RPDs predominantly occurring within TRH analysis. These results were reconfirmed by both laboratories and are considered to be due to the differing preparation methods used by the laboratories. As a conservative approach, the higher concentrations were adopted for the purposes of this assessment.
Required numbers of trip and rinsate blank samples collected	Yes	Refer to Table 4.2 for details. Rinsate blanks were analysed for the days sampling occurred and a trip blank sample was sent along with the primary samples for analysis.
Acceptable trip and rinsate blank results	Yes	Trip and rinsate blank results are included in the analytical results tables in Appendix C. All results were below the LORs.
Samples delivered to laboratories within sample holding times and with correct preservative(s)	Yes	Samples were delivered to the laboratories within the sample holding times and in laboratory-supplied containers prepared with the appropriate preservative (where required).

8.1.1 Laboratory QA/QC

Table 8.2 indicates conformance to laboratory QA/QC procedures.

Laboratory QA procedures generally include the performance of a number of internal checks of data precision and accuracy that are aimed at assessing possible errors associated with sample preparation and analytical techniques. Specific types of QC samples analysed by laboratories, and the relevant acceptance criteria are as follows:

- internal laboratory replicate samples: maximum RPD values of 20% to 50%
- spike (matrix[1] and surrogate[2]) recoveries: recoveries of between 75% and 125%; and
- laboratory control blanks: results below the laboratory LORs.

Table 8.2 Laboratory QA/QC procedures

QA/QC requirement	Completed	Comments
Samples extracted and analysed within relevant holding times	Yes	Refer to laboratory reports in Appendix E.
All analyses NATA accredited	Yes	ALS and Eurofins MGT are NATA accredited for all the analyses performed.
Appropriate analytical methodologies used, in accordance with Schedule B(3) of the NEPM	Yes	Refer to laboratory reports in Appendix E. Refer to the Interpretive Quality Control reports for methods used and relevance to Schedule B(3) of the NEPM.
Acceptable laboratory LORs adopted	Yes	Refer to laboratory reports in Appendix E.
Acceptable laboratory QC results	Mostly	The results of internal laboratory quality control procedures are provided within the laboratory analysis reports (Appendix E). Laboratory replicate RPD values at the primary laboratory were generally within the acceptable range, however duplicate recovery for TRH C_6–C_9 fraction was reported at 23% (limits of 0–20%). Laboratory recoveries were within the range of 60 to 130%, with the exception of sulfate which was not able to be determined as background levels were greater than four times the spike level. Laboratory control blank results were all below the LORs. The inter-laboratory replicate RPD values, laboratory recoveries and control blanks were all within the acceptable ranges, with the exception of TRH C_{15}–C_{28}, TRH C_{10}–C_{16} and TRH C_{16}–C_{34} replicate recoveries (39%, 47% and 46% respectively). These RPDs however pass EurofinsMGT internal acceptance criteria.

In summary, it was considered that the QA/QC procedures and results were generally adequate and that the analytical results obtained were of acceptable quality for the purposes of this report.

1 A matrix spike is prepared by splitting a field sample and spiking each portion with a known quantity of a target compound to ascertain the effects of the specific sample matrix on the recovery of the analyte.

2 A surrogate spike comprises a sample spiked with a pure substance that has similar chemical properties to the target analyte, but is unlikely to be found in the environment, such that the spike compound is expected to behave, during analysis, in the same way as the target compound.

9. Conceptual site model

In order to enable an assessment to be made of the potential sources of impact, chemicals of concern, transport mechanisms and receptors, a Conceptual Site Model (CSM) has been developed from the information obtained to date for the site.

9.1 Local and regional setting

The site is located at the Telford Rail Siding, situated at the Leigh Creek Coal Field. This is an industrialised area surrounded by pastoral grazing land.

The Copley 1:250,000 geological map sheet indicates that the region is underlain by Telford Gravel which comprises rounded to sub angular cobles and pebbles, and includes cross bedded channel sands which are often cemented by white to pale pink lime of the Bakara soil. Yellow to white crystalline gypsum of unknown age is also found in this geology group.

Regional hydrogeology investigations of the area revealed Quaternary sediments overlying Adelaidean (Proterozoic) basement between the Telford basin and North Field coal basin (Kwitko, 1995). The Quaternary sediments are described as alluvial plain gravel, sand, silt and clay, including the Telford Gravel.

Drillers logs obtained from the DEWNR registered bore database state the geology encountered in the on-site monitoring wells was generally described as clayey alluvium, with alluvium interpreted as comprising sands and gravels. Discrete beds of clayey gravels were encountered in five of the bore logs.

This description is consistent with the anticipated depositional environment, with quaternary sediments being deposited and reworked as a likely result of the meandering stream Sunday Creek, which historically flowed in a westerly direction approximately 500 m to the south of the site (as shown on the Copley 1:250K map sheet).

Recent aerial photography indicates the flow path of Sunday Creek has been diverted, with a surface channel flowing to the North West, approximately 100 m to the west of the site (at its closest point).

Flow in the Sunday Creek (and therefore the channel) is anticipated to be an ephemeral channel, with flow a direct response to rainfall events above a certain intensity over a period. At the time of the 2015 monitoring water was flowing in Sunday Creek, which may have been as a result of recent rainfall or mine dewatering.

9.2 Current and proposed site use and general condition

The greater site is used by Alinta Energy as an open cut coal mine. The specific site of interest (Telford Rail Siding) is in good condition, comprising of open grass lands.

The infrastructure on site includes:

- two fenced in large above ground diesel storage tanks
- earth bunding surrounding the diesel tanks
- a fuel delivery bay with a sealed concrete basin on the south western portion of the diesel tank fence line
- a disused railway to the east running south east to north west; and
- building material scattered across the site from historically demolished structures.

There are also minor eroded portions surrounding the site, which have been caused by heavy rainfall.

9.3 Sources of groundwater impact and chemicals of concern

Potential sources of impacts identified at the site include:

- current and historical above ground storage tanks, associated fuel transfer lines, fill points, load points and truck filling gantry
- hydrocarbon impacts originating from on-site fuel transfer lines and/or spillage
- adsorbed hydrocarbon impacts to soils on site.

It is Parsons Brinckerhoff's understanding that a hydrocarbon spill may have occurred previous to the 1997 investigation.

As historically identified, potential chemicals of concern associated with the Telford Rail Siding fuel area comprise of petroleum hydrocarbons resulting from potential historical releases from on-site fuel storage and distribution infrastructure and maintenance activities.

LNAPL was identified at the site in 1999, 2002 and 2005 in wells DMMW2 and/or TFMW6, however no LNAPL has been encountered during the investigations since this time, noting however that the groundwater has been above the screen since 2012. Dissolved phase TRH has been identified in groundwater consistently in DMMW2 and TFMW6 since 2005, with the highest concentrations reported from the 2011 and 2005 monitoring events respectively.

In 2015 elevated concentrations of TRH C_{10}-C_{40} were found to be present in DWMW2 (7,420 µg/L) and TFMW6 (950 µg/L). DWMW2 showed a slight increase in concentrations when compared to the previous two monitoring events, while concentrations in TFMW6 were reduced compared to the previous monitoring event. These concentrations were however significantly below the historical results of greater than 50,000 µg/L.

9.4 LNAPL

9.4.1 Background

It is likely that the hydrocarbon release to the subsurface occurred in a relatively short time frame and migrated (driven by gravity) through the soil profile towards the water table. As the LNAPL passed through the vadose (unsaturated) zone, residual concentrations of hydrocarbon move into the available pore space and are retained there by capillary pressure, reducing the total volume of LNAPL available to migrate. This residual proportion becomes immobile within the formation.

LNAPL that is not taken into the pore space in the vadose (mobile LNAPL component) continues to migrate through the capillary fringe and the water table. Capillary pressure causes LNAPL to displace water from the pore space within the capillary fringe and within the saturated zone. For LNAPL to migrate laterally, it must displace water from the pore space near the water table (within the capillary fringe). A minimum, critical LNAPL head (gravitational force), must be present near the edge of the LNAPL plume in order to cause lateral migration of mobile LNAPL (i.e. that which has not been taken up as immobile residual within the formation). When the LNAPL head is in equilibrium with the pressure head no further lateral migration of LNAPL occurs. This equilibrium is generally achieved and maintained for a single event release and the LNAPL plume becomes stable in extent. For an ongoing source (i.e. ongoing product leak) the LNAPL head is continually maintained, which drives lateral LNAPL migration. In unconfined conditions, LNAPL residual is greater below the water table than in the vadose zone.

A falling water table picks up larger amounts of LNAPL 'storage' beneath the water table and LNAPL thickness increases (as observed in monitoring wells). A rising water table leaves greater amounts of LNAPL trapped as residual and the LNAPL thickness observed in monitoring wells decreases. Therefore, given that the last three GMEs have reported a SWL above the screened interval in the most impacted wells (DMMW2 and TFMW9), LNAPL may be trapped in the pore spaces of the formation below the water table as the water table rises and falls.

9.4.2 Historical review

A comparison of historical observational and analytical data of the two most impacted wells (DMMW2 and TFMW6) has been displayed in Figures 4 and 5, which show groundwater levels over time, the reported hydrocarbon impacts (LNAPL or dissolved concentrations) as well as geology and well screen intervals (as presented on the DEWNR database). Reviewing the behaviour of LNAPL/dissolved concentrations against water level indicates a likely correlation in LNAPL behaviour in both wells.

As indicated on Figures 4 and 5, during the drought period of the first half of last decade (2000–2010) water levels decreased significantly in both wells, which corresponded to the appearance of either apparent LNAPL thickness or dissolved TRH well above maximum solubility of diesel in water (generally around 5 mg/L), with the exception of the 1999 result for DM MW2.

Minor anomalies in this behaviour are observed in the relatively low concentration (1,486 µg/L) of TRH C_{10}–C_{36} in groundwater sampled at DMMW2 in 1999. This is attributed to possible problems with the sampling technique. A review of the field notes indicated only a total of 6 litres was purged from the well and therefore the water sampled for analysis cannot be considered representative of groundwater conditions.

In addition, no LNAPL was recorded in TFMW6 in 2005, when the lowest water level was gauged (disregarding 2007 when the well was dry). However, field notes indicate the presence of a 'broken oily surface' forming within the purged water, which was also very thick and silty. The water column within the well in 2005 was recorded as approximately 1m and therefore, this report of no LNAPL in the well is not considered reliable data. The reported concentration of 66,600 µg/L TRH C_{10}–C_{36} (or 6.6% TRH w/w) is well in excess of the solubility limits of diesel in water.

The process of the rising water table resulting in increased residual, may in turn result in an increase in dissolved concentrations in groundwater. Furthermore, as indicated in Figures 4 and 5, groundwater levels have consistently been reported above the screened intervals in the most impacted wells since 2012.

9.5 Fate and transport

9.5.1 Potential receptors and exposure pathways

Identified possible receptors and exposure pathways of the chemicals of concern at the site include:

- Recreational users of the freshwater creeks in surrounding areas through groundwater flows.

  Freshwater creeks (and all other surface water flow channels) in the vicinity of the site are ephemeral and are almost exclusively losing streams, with the exception of during extended prolonged high volume rainfall. This weather event is extremely rare and is unlikely.

- Adjacent site users, including pastoral grazing land users through groundwater extraction.

  No registered bores exist within the vicinity of the site and the salinity of the groundwater precludes any stock watering beneficial use.

- Workers occupying the site (or visitors to the site) through groundwater extraction, dermal contact with LNAPL or dissolved concentrations of diesel in groundwater, or potential vapour exposure.

  Groundwater extraction, in the form of mine dewatering is a potential exposure pathway. Vapour exposure from sub surface impacts is considered unlikely as there are no occupiable structures in the vicinity of the hydrocarbon impacts to groundwater (including LNAPL).

9.5.2 Possible transport mechanisms

Anticipated preferential pathways for the migration of chemicals of concern from the impacted groundwater are:

- Lateral migration of LNAPL.

  Based upon a review of the historical data, the LNAPL at the site appears to be stable. This interpretation is supported by the vertical oscillation of the water table, resulting in an increase in immobile residual LNAPL retained within the formation and a reduction of mobile LNAPL. This is based upon an assumption that the hydrocarbon impacts are the result of a single release event. This is supported by the lack of elevated concentrations of hydrocarbons in the wells surrounding the site.

- Lateral migration of dissolved phase towards the north-west.

  Groundwater monitoring has continued at the site for over 15 years and no significant concentrations of dissolved hydrocarbons have been reported in any of the wells to the west (TFMW11), north-northwest (TFMW4) or north (DMMW8) of the impacted wells.

  Given the range of weather conditions over this period, and the likely associated impact on groundwater flow (northern flow component associated with infiltration from the drainage channel), the lack of LNAPL reported in the network groundwater wells surrounding the two impacted well indicates the LNAPL plume is stable.

  While dissolved phase concentrations of TRH were reported in monitoring well TFMW10 for the first time in 2013, the monitoring well reported concentrations below the laboratory limit of reporting during the 2015 monitoring event, suggesting minimal evidence of migration to the south-west.

- Vapour migration towards the surface.

  The potential for vertical vapour migration upwards through the soil profile exists, primarily in the C_{10}–C_{16} fraction. TRH C_6–C_{10} was reported below LOR (consistent with all historical results) for all samples analysed during the 2015 monitoring event.

9.6 Natural attenuation

Natural attenuation processes result in the reduction in mass or concentration of a compound in groundwater over time or distance from the source. Attenuation of contaminant mass or plume size will occur under suitable conditions through a combination of naturally occurring physical, chemical, and biological processes, including biodegradation, dispersion, dilution, adsorption, and volatilisation.

Primary lines of evidence of natural attenuation occurring can be drawn from historical groundwater and/or soil chemistry data that demonstrate a clear and meaningful trend of declining contaminant mass and/or concentrations. Primary lines of evidence are used to determine whether plumes are shrinking, stable or increasing.

Secondary lines of evidence include data from the site characterisation that indirectly demonstrate the type of natural attenuation processes active at the site. Such an assessment can be achieved by analysis of physical and chemical indicators of natural attenuation processes such as levels of dissolved oxygen, nitrate, ferrous iron, sulfate, methane and other parameters.

Contaminant biodegradation is largely based upon microbial respiration. In respiration, microbes gain energy from the consumption (oxidation) of electron donors coupled to the utilisation (reduction) of electron acceptors. Under anaerobic conditions, alternative electron acceptors, such as nitrate and sulfate, may be used in contaminant oxidation in the absence of oxygen.

Therefore the presence of several chemical species in groundwater samples can be used to infer natural attenuation processes. For example, under anaerobic conditions, low concentrations of nitrate typically indicate denitrification or nitrate reduction is occurring. Reduced sulfate concentrations in impacted samples may indicate sulfate reducing activities at the site.

In the process of iron reduction, ferric iron is reduced to ferrous iron. Therefore, elevated levels of ferrous iron in the groundwater may be indicative of microbial iron reduction.

Natural attenuation indicators (nitrate, sulfate, ferrous iron, and dissolved methane) were analysed in groundwater samples collected from all seven wells. These wells were selected to represent groundwater conditions from within the identified hydrocarbon plume and the surrounding area within the site.

A comparison of these natural attenuation indicators is represented in Table 9.1 and is summarised as follows:

- Lower nitrate levels were reported in hydrocarbon impacted well DMMW2 (0.85 mg/L) than in non-impacted wells (TFMW4, DMMW8, DMMW9, TFMW10 and DMMW11), however impacted well TFMW6 (5.18 mg/L) reported a concentration similar to some non-impacted wells. Therefore, although the utilisation of nitrate as an electron acceptor may be occurring in DMMW2, there is insufficient data to indicate this is likely across the plume.
- Ferrous iron levels were below laboratory LORs in all wells with the exception of hydrocarbon impacted well DMMW2 (750 µg/L), with a lower concentration than that reported in 2013. This provides some evidence of natural attenuation of hydrocarbons occurring through the reduction of iron.
- Sulfate levels were elevated in both hydrocarbon impacted and non-impacted monitoring wells with no trends identifiable. Given the absence of an inverse relationship between TRH and sulfate concentrations, natural attenuation by sulfate reduction does not appear to be occurring.
- All methane levels were reported below laboratory LORs, indicating that methanogenesis is not occurring within the hydrocarbon plume extent.

Primary lines of evidence for natural attenuation such as the absence of volatile hydrocarbons such as C_6–C_{10} and decreasing C_{10}–C_{40} hydrocarbon concentrations indicate that some level of natural attenuation of hydrocarbons may be occurring.

Secondary lines of evidence such as the reduction of iron to ferrous iron in impacted wells and anaerobic dissolved oxygen conditions measured in DMMW2 (0.40 mg/L) and TFMW6 (1.14 mg/L) also indicate that natural attenuation of hydrocarbons may be occurring in the vicinity of these wells.

In general, it is considered that the current results of natural attenuation analysis, as detailed above, provide some evidence that natural attenuation of hydrocarbons may be occurring in the groundwater beneath the site. However this interpretation may be complicated due to the fluctuating water levels.

Table 9.1 Comparison of chemical parameters for natural attenuation (May 2015)

Well ID	TRH C_6–C_{40} (µg/L)	Eh* (mV)	DO (mg/L)	Nitrate (mg/L)	Sulfate (mg/L)	Ferrous Iron (µg/L)	Methane (µg/L)
DMMW02 (moderately impacted)	7,420	225	0.40	0.85	2,790	750	<10
TFMW04 (perimeter well – north)	<100	298	4.84	8.46	2,820	<50	<10
TFMW06 (moderately impacted)	950	310	1.19	5.18	2,100	<50	<10
DMMW08 (perimeter well – east)	<100	306	2.69	3.12	2,210	<50	<10
TFMW09 (perimeter well – south east)	<100	301	4.58	14.4	3,880	<50	<10
TFMW10 (perimeter well – south west)	<100	311	4.76	2.24	1,700	<50	<10
TFMW11 (perimeter well – west)	<100	315	4.14	3.62	2,000	<50	<10

Note: * Field redox values converted to Standard Hydrogen Electrode (SHE) values by adding conversion value of 199 mV

10. Conclusion and recommendations

10.1 Conclusions

Based on the groundwater results obtained during the 2015 GME investigations undertaken at the site and an assessment of the historical groundwater monitoring events, it is concluded that:

- The dissolved phase hydrocarbon concentrations reported in DMMW2 and TFMW6 indicate the plume appears to be relatively stable and has not migrated beyond the surrounding (ring) network of monitoring wells.
- Fluctuating water levels as a result of the drought of the previous decade lowering groundwater levels and subsequent rainfall returning water levels to pre-drought levels may have resulted in an increase in residual LNAPL retained within the geological formation.
- This increase in residual LNAPL would reduce the likelihood of migration of LNAPL, but may result in an increase in dissolved concentrations.
- Groundwater levels have also been reported above the screened interval for the previous three monitoring events, therefore LNAPL may be trapped below the water table and may be released following a drop in the water table depth.
- TRH C_{10}–C_{36} concentrations (290 µg/L) reported in TFMW10 during the 2013 monitoring event indicated that dissolved concentrations may be gradually migrating laterally from the LNAPL plume. During the 2015 monitoring round TFMW10 was reported below the laboratory LOR, which indicated no significant evidence of plume migration.
- Primary lines of evidence and some secondary lines of evidence indicate that limited natural attenuation may be occurring beneath the site in the vicinity of the LNAPL plume.

10.2 Recommendations

It is recommended that the following be undertaken:

- Previously, it was suggested a further groundwater monitoring event at the site should be undertaken in 2017 to assess the apparent trends in hydrocarbon plume behaviour and natural attenuation. However, due to the closure of the Leigh Creek coal fields (proposed for 2017) it is recommended that this is brought forward to late 2016.
- The proposed groundwater monitoring event should be undertaken during a period of lower groundwater levels in an attempt to assess hydrocarbon concentrations at their highest and to ensure that monitoring occurs when the standing water level is within the screened interval of the monitoring wells. Parsons Brinckerhoff recommends that Alinta Energy attempt to gauge the monitoring wells on a monthly basis from July 2015 to July 2016, this data can then be used to determine the optimal time to undertake the 2016 monitoring event.
- All wells should continue to be analysed for TRH, BTEXN and natural attenuation parameters (ferrous iron, dissolved methane, sulfate, and nitrate).
- Site workers proposing to undertake excavations in the vicinity of the hydrocarbon plume should conduct work in accordance with an appropriate construction environmental management plan.

Following the GME in 2016 (and dependent on the results obtained), the following tasks are likely to be warranted to assist with decommissioning and closure of the site:

- Validation of the diesel storage tanks footprint following their removal.
- Removal and disposal of secondary sources of contamination within the tank farm and/or former diesel line to the railway siding.
- Installation of shallow wells with the screen within the groundwater plume (to be considered if gauging indicates no lowering of the water table during seasonal variation).
- Completion of a detailed site investigation and remediation report demonstrating the current and likely future contamination status of the residual soils and groundwater impacts, it is considered that given the beneficial use assessment for groundwater, removal of primary and secondary sources should be sufficient to manage the risk profile of the site contamination status at the rail siding.
- Decommissioning of the monitoring wells in accordance with the mandatory requirements set out in the *Minimum Construction Requirements for Water Bores in Australia* (2012).

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12. Statement of limitations

Scope of services

This environmental site assessment report ("the report") has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Parsons Brinckerhoff ("scope of services"). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

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In preparing the report, Parsons Brinckerhoff has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise stated in the report, Parsons Brinckerhoff has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Parsons Brinckerhoff will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Parsons Brinckerhoff.

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In accordance with the scope of services, Parsons Brinckerhoff has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

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

Also, it should be recognised that site conditions, including the extent and concentration of contaminants, can change with time.

Within the limitations imposed by the scope of services, the monitoring, testing, sampling and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

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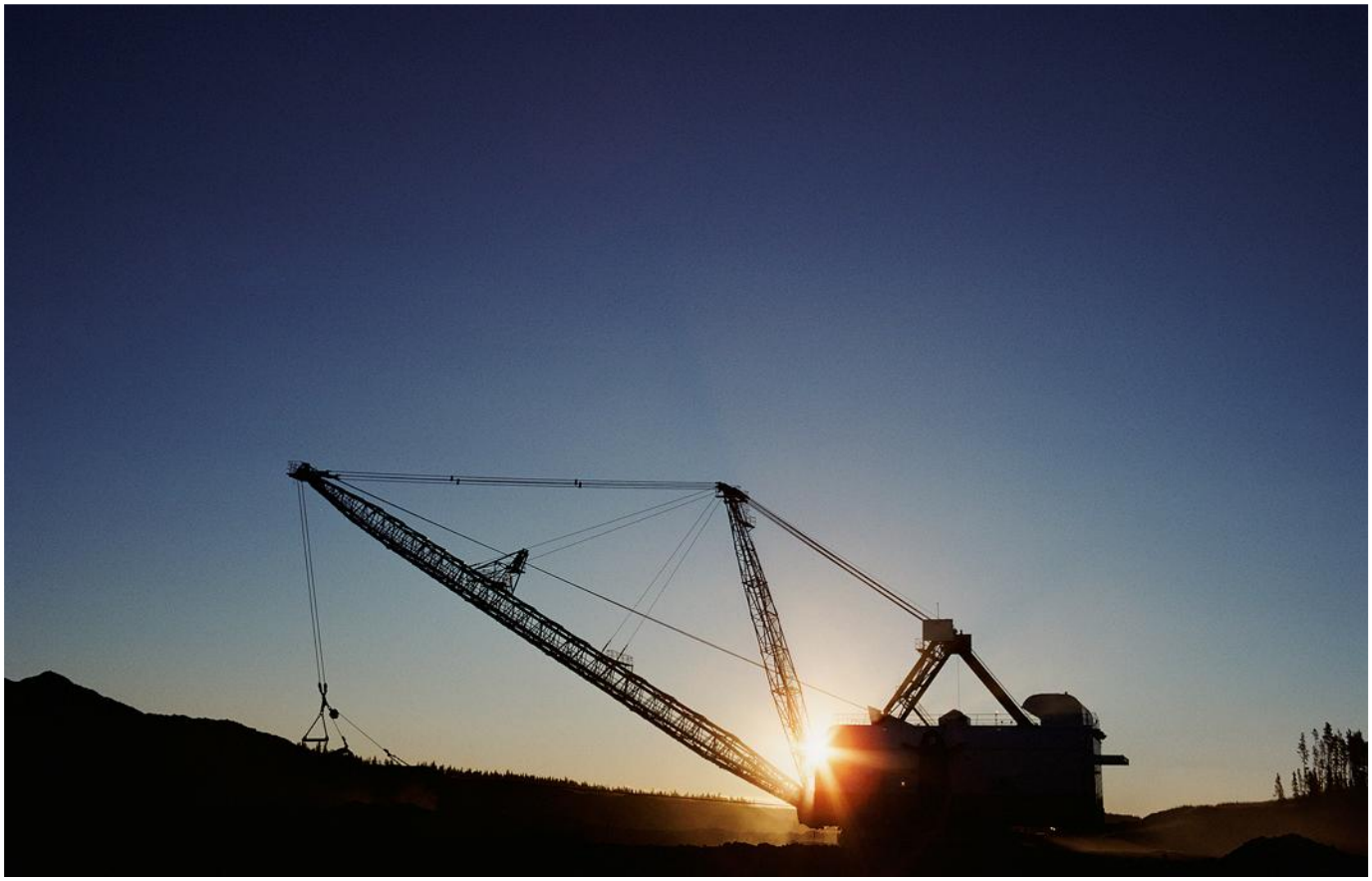
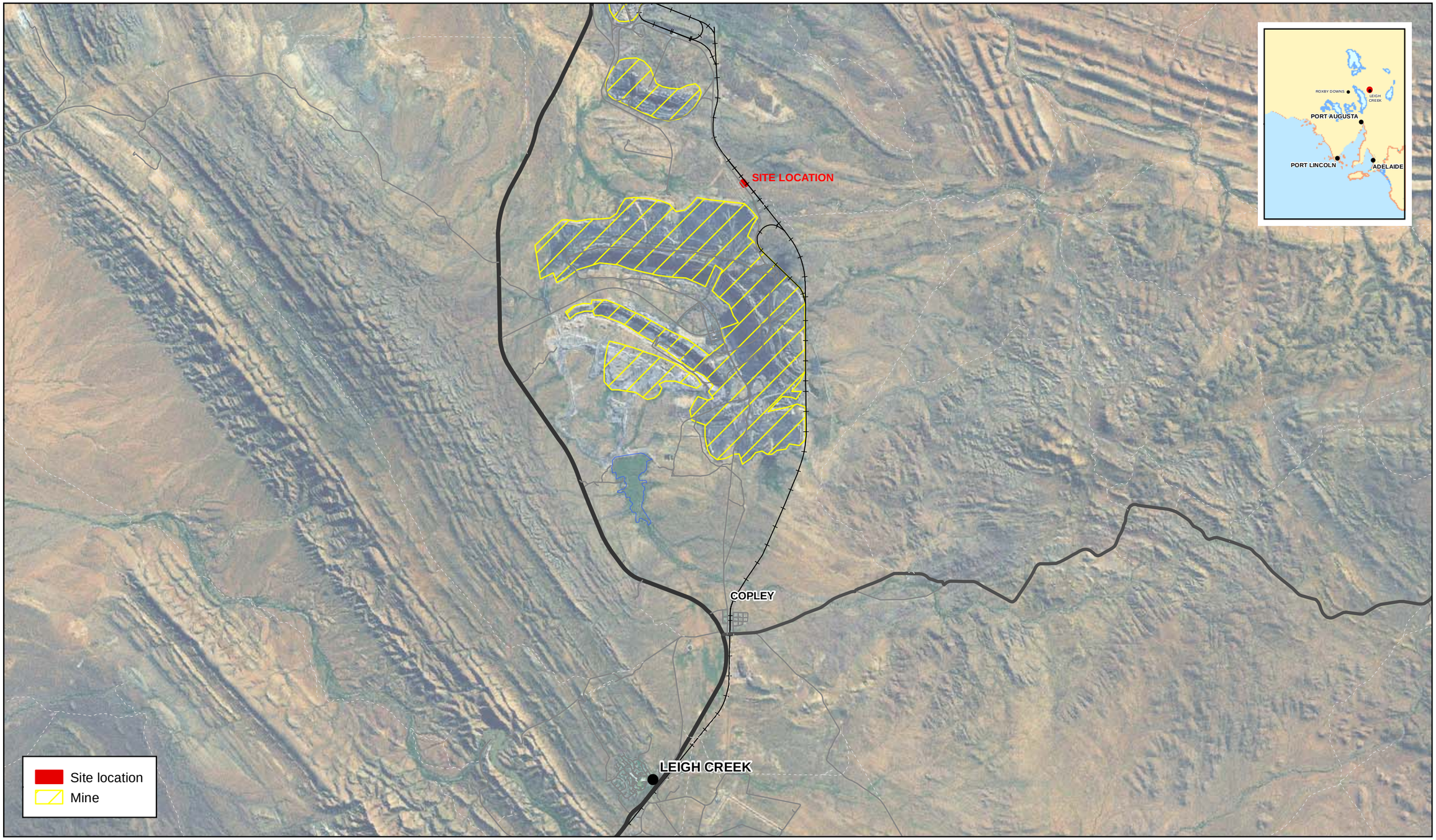
The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

Appendix A

Figures





PARSONS BRINCKERHOFF

Data source: DPTI, DEWNR

Imagery Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

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esri Partner Network Silver

Map no: 2193246A_GIS_F001_A

Author: MB

Approved by: TW

Date: 8/05/2013

0 1 2 km

1:100,000

N

Scale ratio correct when printed at A3

Projection: Transverse Mercator
Coordinate system: GDA 1994 MGA Zone 53

Telford Rail siding
Leigh Creek
Figure 1
Site location map

PARSONS BRINCKERHOFF

Data source: DPTI, DEWNR

Imagery Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

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esri Partner Network Silver

Map no: 2193246A_GIS_F002_A

Author: MB

Approved by: TW

Date: 8/05/2013

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Metres

1:1,500

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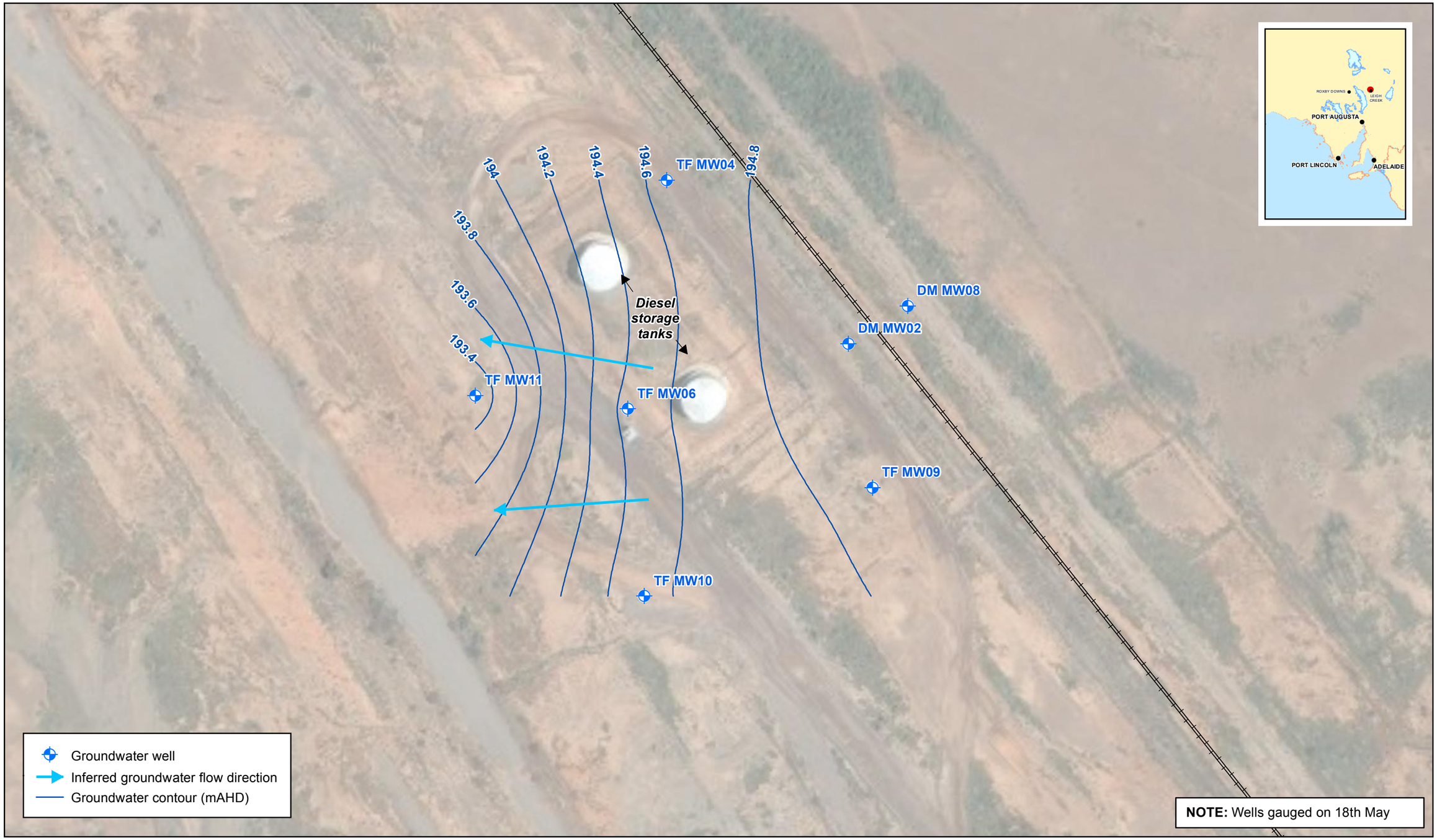
Projection: Transverse Mercator
Coordinate system: GDA 1994 MGA Zone 53

Telford Rail siding
Leigh Creek
Figure 2
Groundwater well location plan



PARSONS BRINCKERHOFF

Data source: DPTI, DEWNR

Imagery Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

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Map no: 2201699A_GIS_001_A

Author: MB

Approved by: JS

Date: 2/06/2015

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1:1,500

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Projection: Transverse Mercator
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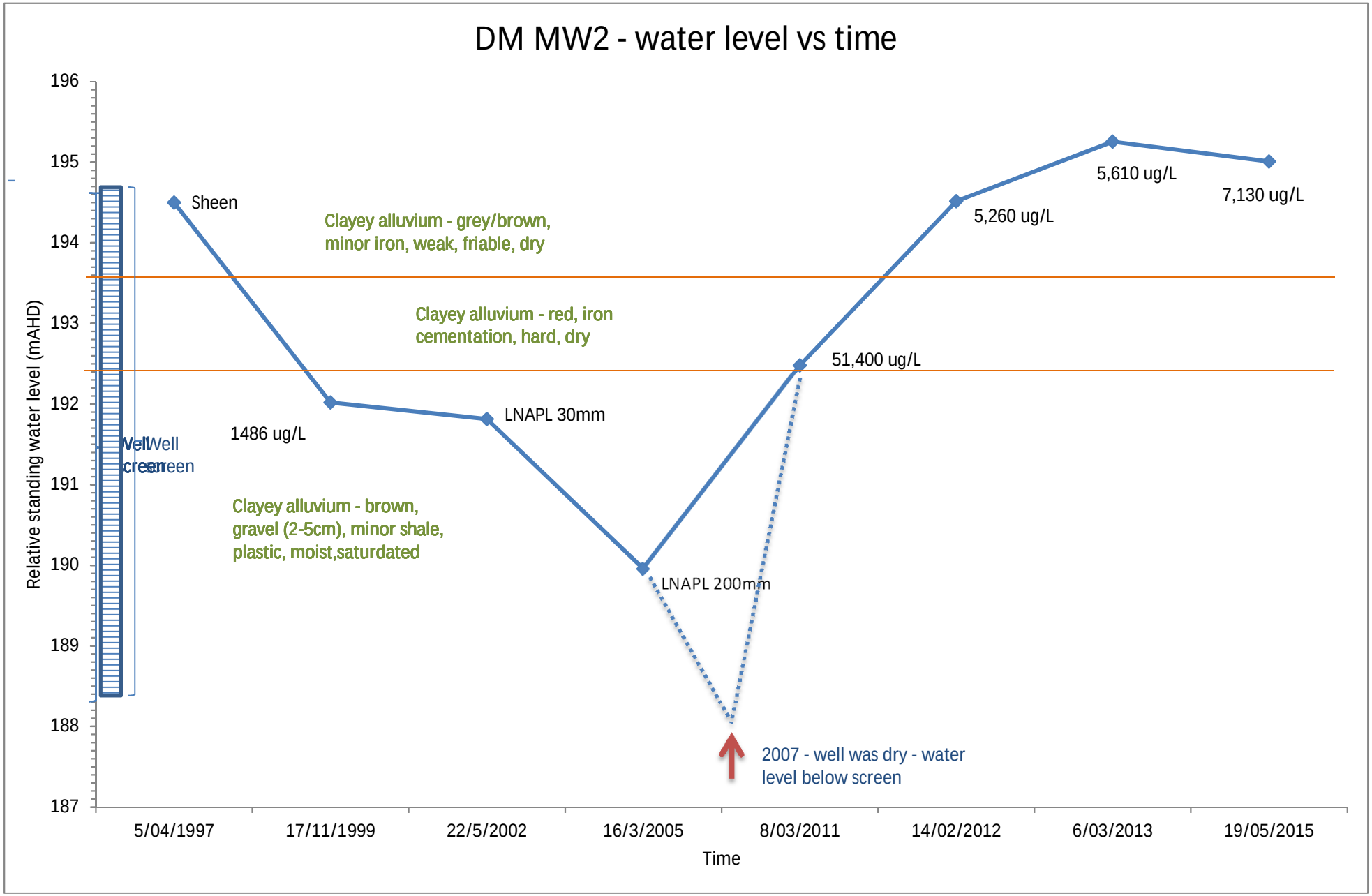
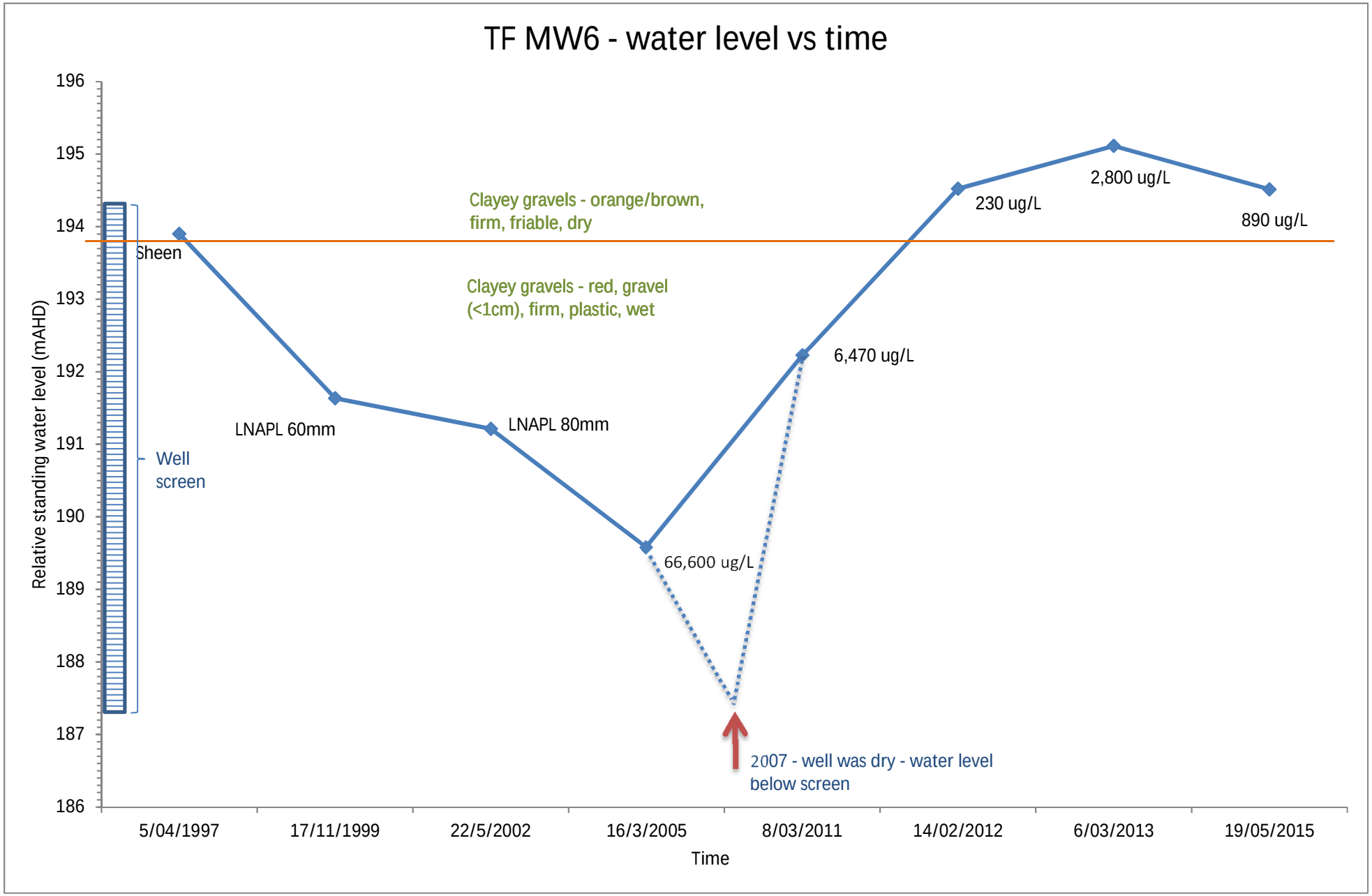
Telford Rail siding
Leigh Creek
Figure 3
Groundwater contour plan



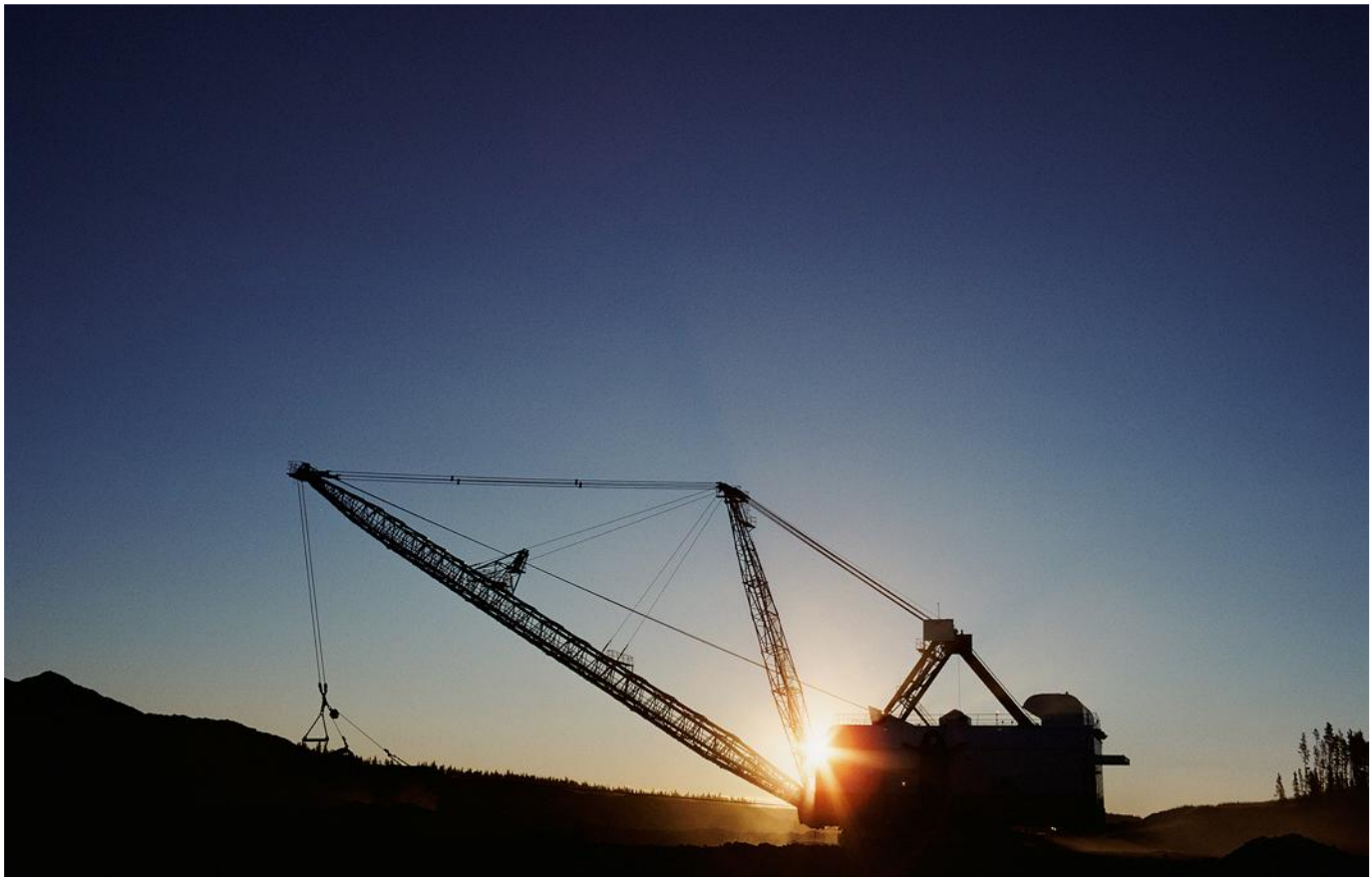
Telford Rail Siding
Leigh Creek, SA
Figure 4



Telford Rail Siding
Leigh Creek, SA
Figure 5

Appendix B

Instrument calibration data



ThermoFisher SCIENTIFIC

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RENTALS

Equipment Certification Report – TPS 90FLMV Water Quality Meter

This Water Quality Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Span 1	Span 2	Traceability Lot #	Pass?
pH	pH 6.88 / pH 4.00	6.88 pH	4.00 pH	/	☑
Conductivity	12.88S/cm	0 mS/cm	12.88 mS/cm		☑
Dissolved Oxygen	Sodium Sulphite / Air	0 ppm in Sodium Sulphite	8.75 ppm Saturation in Air		☑
Check only					
Redox (ORP) *	Electrode operability test	240mV +/- 10%	237 mV		☑

* This meter uses an Ag/AgCl ORP electrode. To convert readings to SHE (Standard Hydrogen Electrode), add 199mV to the mV reading.

☐ Battery Status 8.1 (min 7.2V)
☐ Electrical Safety Tag attached (AS/NZS 3760)

Tag No: 144

Valid to: 15/8/15

☐ Temperature 16 °C
☐ Electrodes Cleaned and checked

Date: 15/5/15

Signed: [signature]

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum $30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☑	☐	90FLMV Unit. Ops check/Battery status: 8.2
☑	☐	pH sensor with wetting cap, 5m
☑	☐	Conductivity/TDS/Temperature K=10 sensor, 5m
☑	☐	Dissolved oxygen YSI5739 sensor with wetting cap, 5m
☑	☐	Redox (ORP) sensor with wetting cap, 5m
☑	☐	Power supply 240V to 12V DC 200mA
☑	☐	Instruction Manual
☑	☐	Quick Guide
☑	☐	Carry Case
☑	☐	Check to confirm electrical safety (tag must be valid)

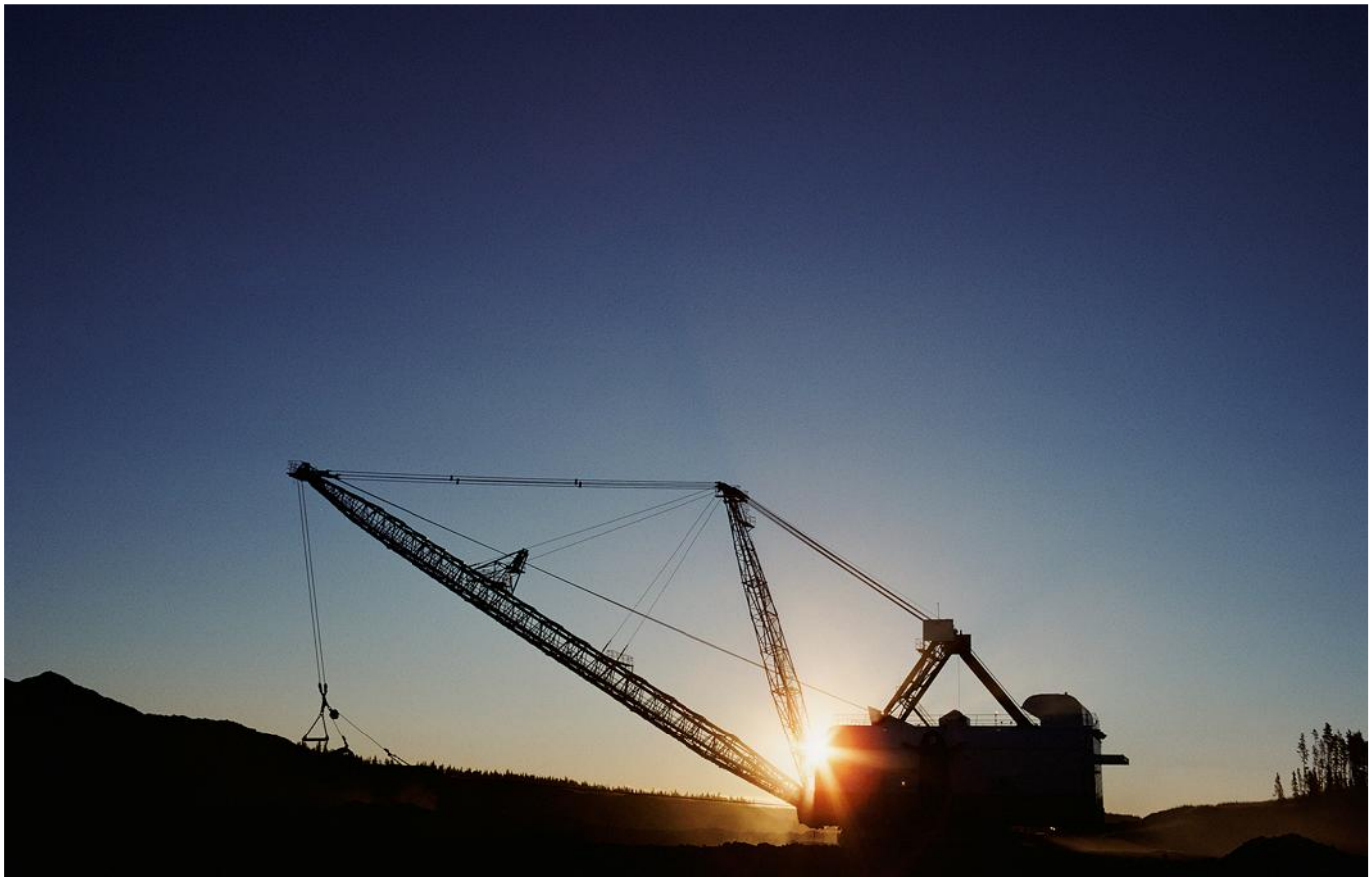
Date: 15/5/15

Signed: [signature]

TFS Reference		Return Date: / /	
Customer Reference	JUSTIN PB	Return Time:	
Equipment ID	90FLMV	Condition on return:	
Equipment Serial No.	W0145		

Appendix C

Analytical results tables



						Field_ID	DMMW2	TFMW4	TFMW6	DMMW8	TFMW9	TFMW10	TFMW11
						Sampled_Date	19/05/2015	19/05/2015	19/05/2015	19/05/2015	18/05/2015	18/05/2015	19/05/2015
Method_Type	ChemName	Units	EQL	NEPM HSL-D Commercial/Industrial for Vapour Intrusion, 4m to <8m, Clay	NHMRC 2008 Recreational Guidelines	SA EPA (2003) Freshwater							
Natural Attenutation Parameters	Ferrous Iron	mg/L	0.05				0.75	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
	Methane	mg/L	0.01				<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Nitrate (as N)	mg/L	0.01		10*		0.85	8.46	5.18	3.12	14.4	2.24	3.62
	Sulfate as SO4 - Turbidimetric (Filtered)	mg/L	1		5000		2790	2820	2100	2210	3880	1700	2000
TRH	C6 - C9 Fraction	µg/L	20				<20	<20	<20	<20	<20	<20	<20
	C10 - C14 Fraction	µg/L	50				410	<50	<50	<50	<50	<50	<50
	C15 - C28 Fraction	µg/L	100				6520	<100	890	<100	<100	<100	<100
	C29-C36 Fraction	µg/L	50				200	<50	<50	<50	<50	<50	<50
	+C10 - C36 (Sum of total)	µg/L	50				7130	<50	890	<50	<50	<50	<50
TRH (NEPM 2013 Fractions)	TRH C6-C10	µg/L	20				<20	<20	<20	<20	<20	<50	<50
	C6 - C10 Fraction minus BTEX (F1)	µg/L	20	NL			<20	<20	<20	<20	<20	<50	<50
	C10 - C16 Fraction	µg/L	100				1390	<100	100	<100	<100	<50	<50
	TRH >C10-C16 less Naphthalene (F2)	µg/L	100	NL			1390	<100	100	<100	<100	<50	<50
	C16 - C34 Fraction	µg/L	100				6030	<100	850	<100	<100	<50	<50
	C34 - C40 Fraction	µg/L	100				<100	<100	<100	<100	<100	<50	<50
	C10 - C40 Fraction (Sum)	µg/L	100				7420	<100	950	<100	<100	<50	<50
BTEXN	Benzene	µg/L	1	30,000	10	300	<1	<1	<1	<1	<1	<1	<1
	Toluene	µg/L	2	NL	8000	300	<2	<2	<2	<2	<2	<2	<2
	Ethylbenzene	µg/L	2	NL	3000		<2	<2	<2	<2	<2	<2	<2
	Xylene (m & p)	µg/L	2				<2	<2	<2	<2	<2	<2	<2
	Xylene (o)	µg/L	2			350**	<2	<2	<2	<2	<2	<2	<2
	Xylene Total	µg/L	2	NL	6000	550*	<2	<2	<2	<2	<2	<2	<2
	Naphthalene	µg/L	5	NL		16**	<5	<5	<5	<5	<5	<5	<5
	Total BTEX	µg/L	1				<1	<1	<1	<1	<1	<1	<1

* ANZECC/ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
** NEPM (2013) Groundwater Investigation Levels (Freshwater)
NL - Not Limiting

SAMPLE LOCATION	Well details	DATE (dd/mm/yy)	Well Depth (mBGL)	DEPTH TO PSH (mBTOC)	DEPTH TO WATER (mBTOC)	PSH THICKNESS (M)	RELATIVE SWL (mAHD)	WATER SUBJECTIVE ANALYSIS				Casing VOLUME (L)	PURGED VOLUME (L)	FINAL PURGE VOLUME RECORD					Comments
								COLOUR	ODOUR	SHEEN	Turbidity			pH	EC (mS/cm)	Redox (mV)	DO (mg/L)	Temp °C	
DM MW2		5/04/1997	-	6.199	6.2	0.001	194.501	--	--	--	--	--	--	--	--	--	--	--	
Casing Diameter (mm)	50	17/11/1999	-	--	8.68	0.000	192.020	clear	yes, HC	--	--	--	--	7.38	--	--	--	18.8	
Casing Height (mAGL*)	200.7	22/5/2002	-	8.88	8.91	0.030	191.813	--	--	--	--	--	--	--	--	--	--	--	
		16/3/2005	-	10.7	10.9	0.200	189.956	--	Strong HC odour	--	--	--	--	--	--	--	--	--	
		30/10/2007							**DRY**										
		8/03/2011	12.830	--	8.221	0.000	192.479	dark brown	Hydrocarbon	yes	high	10.0	50	6.69	47.5	-72	0.46	24.5	Sample tubing removed.
		14/02/2012	12.830	--	6.185	0.000	194.515	Clear	Slight HC/H2S	no	low	13.4	67	7.12	33.3	-199	0.89	23.8	Sampled after 4 volumes due to consistant parameter
		5/03/2013	12.750	--	5.445	0.000	195.255	brown-black	Hydrocarbon	yes	low	14.7	60	6.70	35.6	-108	0.87	28.2	Sampled after 4 volumes due to consistant parameter
		19/05/2015	12.750	--	5.689	0.000	195.011	Cream	very slight HC	no	low	14.0	64	6.82	48.8	26	0.4	24.8	1 casing volume purged, followed by readings at 10lt intervals
TF MW4		5/04/1997	-	--	6	0.000	194.500	--	--	--	--	--	--	--	--	--	--	--	
Casing Diameter (mm)	50	17/11/1999	-	--	8.59	0.000	191.910	cloudy red	none	--	low	--	--	7.52	--	--	--	19	
Casing Height (mAGL*)	200.5	22/5/2002	-	--	9.03	0.000	191.470	orange/brown	none	no	high	--	--	7.29	41.7	--	--	23.2	
		16/3/2005	-	--	10.74	0.000	189.760	brown	none	no	high	--	11	7.02	32.4	-120	5.82	30	
		30/10/2007							**DRY**										
		8/03/2011	12.096	--	8.168	0.000	192.332	red-brown	slight hydrocarbon	no	medium to high	8.0	40	7.30	48.1	90	5.05	24.1	
		14/02/2012	12.096	--	6.256	0.000	194.244	clear/red-brown	none	no	high	11.8	48	7.38	36	70	5.46	24	Sampled after 4 volumes due to consistant parameter
		5/03/2013	12.000	--	5.603	0.000	194.897	clear/brown	none	no	low	12.8	52	6.94	32.2	66	5.7	26.7	Sampled after 4 volumes due to consistant parameter
		19/05/2015	12.000	--	5.769	0.000	194.731	red-brown	none	no	low	12.2	52	7.19	43.1	99	4.84	22.9	1 casing volume purged, followed by readings at 10lt intervals
TF MW6		5/04/1997	-	6.499	6.5	0.001	193.901	--	--	--	--	--	--	--	--	--	--	--	
Casing Diameter (mm)	50	17/11/1999	-	8.75	8.81	0.060	191.637	--	--	--	--	--	--	--	--	--	--	--	
Casing Height (mAGL*)	200.4	22/5/2002	-	9.17	9.25	0.080	191.212	--	--	--	--	--	--	--	--	--	--	--	
		16/3/2005	-	--	10.82	0.000	189.580	dark brown	slight HC odour	yes	high	--	11	6.66	29.5	-169	4.28	29	
		30/10/2007							**DRY**										
		8/03/2011	12.320	--	8.177	0.000	192.223	red-brown	hydrocarbon	yes	medium to high	8.0	48	7.11	42.4	13	2.02	24.1	Bailer dropped in well. Unable to remove. PVC lid broken
		14/02/2012	12.320	--	5.876	0.000	194.524	clear/red-brown	none	no	low	14.0	84	7.20	28.1	44	3.14	24.7	
		5/03/2013	11.100	--	5.286	0.000	195.114	o-brown/red	none	no	low	11.8	47	6.95	25.9	34	1.2	27.8	Reduced well depth likely due the bailer in well (2011). Base of well may be blocked.
		19/05/2015	11.100	--	5.884	0.000	194.516	cream/brown	none	no	low	10.8	55	6.96	38.6	111	1.19	21.8	
DM MW8		5/04/1997	-	--	6.3	0.000	194.500	--	--	--	--	--	--	--	--	--	--	--	
Casing Diameter (mm)	50	17/11/1999	-	--	8.66	0.000	192.140	clear	none	--	--	--	--	7.56	--	--	--	18.6	
Casing Height (mAGL*)	200.8	22/5/2002	-	--	8.9	0.000	191.900	dark brown	none	no	low	--	--	7.34	16.57	--	--	22.6	
		16/3/2005	-	--	--	0.000	--	brown	none	no	high	--	9	6.70	33.3	-110	5	29	
		30/10/2007							**DRY**										
		9/03/2011	11.934	--	8.187	0.000	192.613	red-brown	none	no	medium to high	8.0	40	6.94	60.8	101	3.83	23.9	Top of PVC casing came off. Sample tubing removed.
		14/02/2012	11.934	--	6.155	0.000	194.645	clear/brown	none	no	low	11.6	58	7.41	25.1	1	1.91	25.7	
		5/03/2013	12.200	--	5.499	0.000	195.301	orange/-brown	none	no	low	13.5	67	7.16	24.00	45	2.85	27.3	
		19/05/2015	12.200	--	5.734	0.000	195.066	cream	none	no	low	13.0	53	7.26	24.89	107	2.69	24.9	1 casing volume purged, followed by readings at 10lt intervals
TF MW9		5/04/1997	-	--	6.3	0.000	194.300	--	--	--	--	--	--	--	--	--	--	--	
Casing Diameter (mm)	50	17/11/1999	-	--	8.64	0.000	191.960	cloudy red	none	-	low	--	--	7.50	--	--	--	19.2	
Casing Height (mAGL*)	200.6	22/5/2002	-	--	8.79	0.000	191.810	orange/brown	none	no	low	--	--	7.45	16.98	--	--	22.9	
		16/3/2005	-	--	10.52	0.000	190.080	clear-light brown	none	no	low	--	9	7.38	16.8	-100	6.43	28	
		30/10/2007							**BLOCKED**										
		9/03/2011	12.175	--	8.195	0.000	192.405	pale red-brown	none	no	medium to high	8	40	7.52	24.13	84	5.42	23.3	Sample tubing removed.
		14/02/2012	12.175	--	5.912	0.000	194.688	clear/brown	none	no	low	12.9	52	7.22	18.47	55	5.28	26.1	Sampled after 4 volumes due to consistant parameter
		5/03/2013	11.950	--	5.211	0.000	195.389	o-brown/red	none	no	low	13.8	56	7.33	28.4	30	5.06	29.2	Sampled after 4 volumes due to consistant parameter
		18/05/2015	11.950	--	5.574	0.000	195.026	brown	none	no	low	12.8	53	7.52	45.7	102	4.58	23.7	1 casing volume purged, followed by readings at 10lt intervals
TF MW10		5/04/1997	-	--	6	0.000	193.900	--	--	--	--	--	--	--	--	--	--	--	
Casing Diameter (mm)	50	17/11/1999	-	--	8.42	0.000	191.480	cloudy red	none	--	--	--	--	7.62	--	--	--	18.8	
Casing Height (mAGL*)	199.9	22/5/2002	-	--	8.69	0.000	191.210	orange/brown	none	no	low	--		7.44	14.63	--	--	22.9	
		16/3/2005	-	--	10.36	0.000	189.540	light brown	none	no	low	--	12	7.47	13.26	-95	6.96	27.6	
		30/10/2007							**DRY**										
		9/03/2011	12.460	--	7.684	0.000	192.216	red-brown	none	no	medium to high	10.0	55	7.68	19.69	35	5.77	24.4	
		14/02/2012	12.460	--	5.077	0.000	194.823	clear/brown	none	no	low	15.0	75	7.25	13.72	62	5.42	25.7	
		5/03/2013	12.300	--	4.606	0.000	195.294	clear/brown	none	no	low	15.4	105	7.01	16.10	34	5.36	26.6	
		18/05/2015	12.300	--	5.227	0.000	194.673	cream/red-brown	none	no	low	14.2	54	7.46	23.90	112	4.76	22.2	1 casing volume purged, followed by readings at 10lt intervals
TF MW11		5/04/1997	-	--	6.1	0.000	192.600	--	--	--	--	--	--	--	--	--	--	--	
Casing Diameter (mm)	50	17/11/1999	-	--	8.090	0.000	190.610	cloudy red	none	--	--	--	--	7.58	--	--	--	18.6	
Casing Height (mAGL*)	198.7	22/5/2002	-	--	8.680	0.000	190.020	orange/brown	none	no	high	--	--	7.90	22.2	--	--	22.2	
		16/3/2005	-	--	10.330	0.000	188.370	brown	none	no	high	--	20	7.30	21.45	-80	8.72	27	
		30/10/2007							**DRY**										
		9/03/2011	12.411	--	7.673	0.000	191.027	red-brown	none	no	medium to high	10.0	60	7.35	28.7	69	5.7	23.7	Sample tubing removed.
		14/02/2012	11.411	--	5.426	0.000	193.274	clear	none	no	low	14.3	85	7.44	23.6	112	2.33	24.7	
		5/03/2013	12.250	--	4.936	0.000	193.764	clear	none	no	low	14.6	45	6.98	25.9	45	3.25	27	
		19/05/2015	12.250	--	5.273	0.000	193.427	cream/brown	none	no	low	14.0	64	7.40	23.35	116	4.14	22.3	1 casing volume purged, followed by readings at 10lt intervals

Note
mAGL = metres above ground level
mBGL = metres below ground level
mBTOC = metres below top of casing
mAHD = metres Australian Height Datum (metres above sea level)
HC = hydrocarbon
* = unknown datum level from previous report (1997)

Monitoring Well ID	Date	Natural Attenuation Parameters					Total Recoverable Hydrocarbons (µg/L)									
		Nitrate (mg/L)	Sulfate (mg/L)	Ferrous Iron (µg/L)	Bicarbonate (mg/L)	Dissolved Methane (µg/L)	C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}	C_6-C_{10}	C_6-C_{10} minus BTEX (F1)	C_{10}-C_{16}	C_{10}-C_{16} less naphthalene (F2)	C_{16}-C_{34}	C_{34}-C_{40}
NEPM HSL-D												NL		NL		
Recreational		10	5,000													
DM MW2	5/04/1997	17.0	2,700	<20	120	0	Sheen				-	-	-	-	-	-
	17/11/1999	0.76	2,470	<50	152	<1	<20	**326**	**1,160**	<100	-	-	-	-	-	-
	22/5/2002	-	-	-	-	-	LNAPL 30 mm				-	-	-	-	-	-
	16/3/2005	-	-	-	-	-	LNAPL 200 mm				-	-	-	-	-	-
	8/03/2011	-	-	-	NA	-	-	**4,340**	**45,800**	**1,260**	**-**	**-**	**-**	**-**	**-**	**-**
	14/02/2012	0.08	2,100	440	NA	<10	<20	**170**	**4,850**	**240**	<20	<20	830	-	4,220	<100
	6/03/2013	0.3	2,230	2320	NA	<10	<20	**260**	**5,030**	**280**	<20	<20	1160	-	4350	100
	19/05/2015	0.85	2,790	750	NA	<10	<20	**410**	**6,520**	**200**	<20	<20	1390	1390	6030	<100
TF MW4	5/04/1997	-	-	-	-	-	<20	<40	<200	<200	-	-	-	-	-	-
	17/11/1999	7.23	2,500	<50	206	<1	<20	<20	<100	<100	-	-	-	-	-	-
	22/5/2002	7.94	2,600	<50	6	-	<20	<20	<100	<100	-	-	-	-	-	-
	16/3/2005	8.00	2,200	<500	110	3	<40	90	<100	<100	-	-	-	-	-	-
	8/03/2011	9.45	2,950	<50	NA	<10	<20	<50	<100	<50	-	-	-	-	-	-
	14/02/2012	8.37	2,500	<50	NA	<10	<20	<20	<100	<50	<20	<20	<100	-	<100	<100
	6/03/2013	7.89	1,710	<50	NA	<10	<20	<20	<100	<50	<20	<20	<100	-	<100	<100
	19/05/2015	8.46	2,820	<50	NA	<10	<20	<50	<100	<50	<20	<20	<100	<100	<100	<100
TF MW6	5/04/1997	8.30	1,900	<20	89	<0.01	Sheen				-	-	-	-	-	-
	17/11/1999	-	-	-	-	-	LNAPL 60 mm				-	-	-	-	-	-
	22/5/2002	-	-	-	-	-	LNAPL 80 mm				-	-	-	-	-	-
	16/3/2005	3.80	1,600	<500	180	4	<40	**12,000**	**54,000**	**600**	**-**	**-**	**-**	**-**	**-**	**-**
	8/03/2011	2.36	2,510	120	NA	<10	<20	**280**	**5,980**	**210**	**-**	**-**	**-**	**-**	**-**	**-**
	14/02/2012	4.39	2,030	<50	NA	<10	<20	<20	230	<50	<20	<20	<100	-	240	<100
	6/03/2013	4.52	1,710	60	NA	<10	<20	**60**	**2580**	**160**	<20	<20	390	-	2,360	<100
	19/05/2015	5.18	2,100	<50	NA	<10	<20	**<50**	**890**	<50	<20	<20	100	100	850	<100
DM MW8	5/04/1997	6.20	2,700	<20	84	0	<20	<40	<200	<200	-	-	-	-	-	-
	17/11/1999	3.35	2,020	<50	187	<1	<20	<20	<100	<100	-	-	-	-	-	-
	22/5/2002	3.20	2,100	204	110	1	<20	<20	<100	<100	-	-	-	-	-	-
	16/3/2005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	9/3/2011	6.48	3,620	<50	NA	<10	<20	<50	<100	<50	-	-	-	-	-	-
	14/2/2012	2.49	2,250	<50	NA	<10	<20	<20	<100	<50	<20	<20	<100	-	<100	<100
	6/03/2013	3.62	2,090	<50	NA	<10	<20	<50	<100	50	<20	<20	<100	-	130	<100
	19/05/2015	3.12	2,210	<50	NA	<10	<20	<20	<100	<50	<20	<20	<100	<100	<100	<100
TF MW9	5/04/1997	-	-	-	-	-	<20	<40	<200	<200	-	-	-	-	-	-
	17/11/1999	4.08	1,990	<50	171	<1	<20	<20	<100	<100	-	-	-	-	-	-
	22/5/2002	4.05	2,000	360	150	1	<20	<20	<100	<100	-	-	-	-	-	-
	16/3/2005	2.50	1,600	<500	190	4	<40	<40	<100	<100	-	-	-	-	-	-
	9/3/2011	3.65	2,400	<50	NA	<10	<20	<50	<100	<50	-	-	-	-	-	-
	14/2/2012	4.10	1,990	<50	NA	<10	<20	<20	<100	<50	<20	<20	<100	-	<100	<100
	6/03/2013	7.90	2,770	<50	NA	<10	<20	<20	<100	<50	<20	<20	<100	-	<100	<100
	18/05/2015	14.4	3,880	<50	NA	<10	<20	<20	<100	<50	<20	<20	<100	<100	<100	<100
TF MW10	5/04/1997	-	-	-	-	-	<20	<40	<200	<200	-	-	-	-	-	-
	17/11/1999	2.57	1,780	<50	192	<1	<20	<20	<100	<100	-	-	-	-	-	-
	22/5/2002	2.23	1,900	330	190	2	<20	<20	<100	<100	-	-	-	-	-	-
	16/3/2005	1.30	1,600	<500	260	4	<40	<40	<100	<100	-	-	-	-	-	-
	9/3/2011	1.97	2,150	<50	NA	<10	<20	<50	<100	<50	-	-	-	-	-	-
	14/2/2012	1.95	1,650	<50	NA	<10	<20	<20	<100	<50	<20	<20	<100	-	<100	<100
	6/03/2013	2.46	1,600	<50	NA	<10	<20	<20	180	110	<20	<20	<100	-	250	<100
	18/05/2015	2.24	1,700	<50	NA	<10	<20	<20	<100	<50	<20	<20	<100	<100	<100	<100
TF MW11	5/04/1997	7.20	1,900	<20	130	0	<20	<40	<200	<200	-	-	-	-	-	-
	17/11/1999	4.78	1,890	<50	282	<1	<20	<20	<100	<100	-	-	-	-	-	-
	22/5/2002	5.10	2,100	260	150	1	<20	<20	<100	<100	-	-	-	-	-	-
	16/3/2005	2.30	1,700	<500	180	34	<40	<40	<100	<100	-	-	-	-	-	-
	9/3/2011	4.23	2,420	<50	NA	<10	<20	<50	<100	<50	-	-	-	-	-	-
	14/2/2012	3.24	2,210	<50	NA	<10	<20	<20	<100	<50	<20	<20	<100	-	<100	<100
	6/03/2013	4.30	2,360	<50	NA	<10	<20	<20	<100	<50	<20	<20	<100	-	<100	<100
	19/05/2015	3.62	2,000	<50	NA	<10	<20	<20	<100	<50	<20	<20	<100	<100	<100	<100

NA = not analysed

NL = Not Limiting

Bold denotes exceedance of historical criteria (Dutch Intervention Level (2009))

Field Duplicates (WATER)

			SDG	66135	66135		66135	Interlab_D	
			Field ID	MW2	QC01	**RPD**	MW2	QC02	**RPD**
			Sampled Date/Time	19/05/2015 15:00	19/05/2015 15:00		19/05/2015 15:00	19/05/2015 15:00	
Method_Type	**ChemName**	**Units**	**EQL**						
Natural Attenuation Parameters	Ferrous Iron	mg/l	0.05	0.75	0.7	7	**0.75**	**1.1**	**38**
	Methane	mg/l	0.01 : 0.05 (Interlab)	<0.01	<0.01	na	<0.01	<0.05	na
	Nitrate (as N)	mg/l	0.01 : 0.02 (Interlab)	0.85	0.9	6	0.85	0.9	6
	Sulfate as SO4 - Turbidimetric (Filtered)	mg/l	1	2790	2790	0	2790	2730	2
TRH	C6 - C9 Fraction	µg/L	20	<20	<20	na	<20	<20	na
	C10 - C14 Fraction	µg/L	50	410	500	20	410	<50	na
	C15 - C28 Fraction	µg/L	100	6520	7250	11	**6520**	**1300**	**134**
	C29-C36 Fraction	µg/L	50 : 100 (Interlab)	200	160	22	200	<100	na
	+C10 - C36 (Sum of total)	µg/L	50 : 100 (Interlab)	7130	7910	10	**7130**	**1300**	**138**
NEPM (2013 Fractions)	C6-C10 Fraction	µg/L	20	<20	<20	na	<20	<20	na
	C6 - C10 Fraction minus BTEX (F1)	µg/L	20	<20	<20	na	<20	<20	na
	TRH >C10-C16 less Naphthalene (F2)	µg/L	100 : 50 (Interlab)	1390	1640	17	**1390**	**250**	**139**
	C10 - C16 Fraction	µg/L	100 : 50 (Interlab)	1390	1640	17	**1390**	**250**	**139**
	C16 - C34 Fraction	µg/L	100	6030	6620	9	**6030**	**1100**	**138**
	C34 - C40 Fraction	µg/L	100	<100	<100	na	<100	<100	na
	C10 - C40 Fraction (Sum)	µg/L	100	7420	8260	11	**7420**	**1350**	**138**
BTEXN	Benzene	µg/L	1	<1	<1	na	<1	<1	na
	Toluene	µg/L	2 : 1 (Interlab)	<2	<2	na	<2	<1	na
	Ethylbenzene	µg/L	2 : 1 (Interlab)	<2	<2	na	<2	<1	na
	Xylene (m & p)	µg/L	2	<2	<2	na	<2	<2	na
	Xylene (o)	µg/L	2 : 1 (Interlab)	<2	<2	na	<2	<1	na
	Xylene Total	µg/L	2 : 3 (Interlab)	<2	<2	na	<2	<3	na
	Total BTEX	µg/L	1	<1	<1	na	<1	<1	na
	Naphthalene	µg/L	5 : 20 (Interlab)	<5	<5	na	<5	<20	na

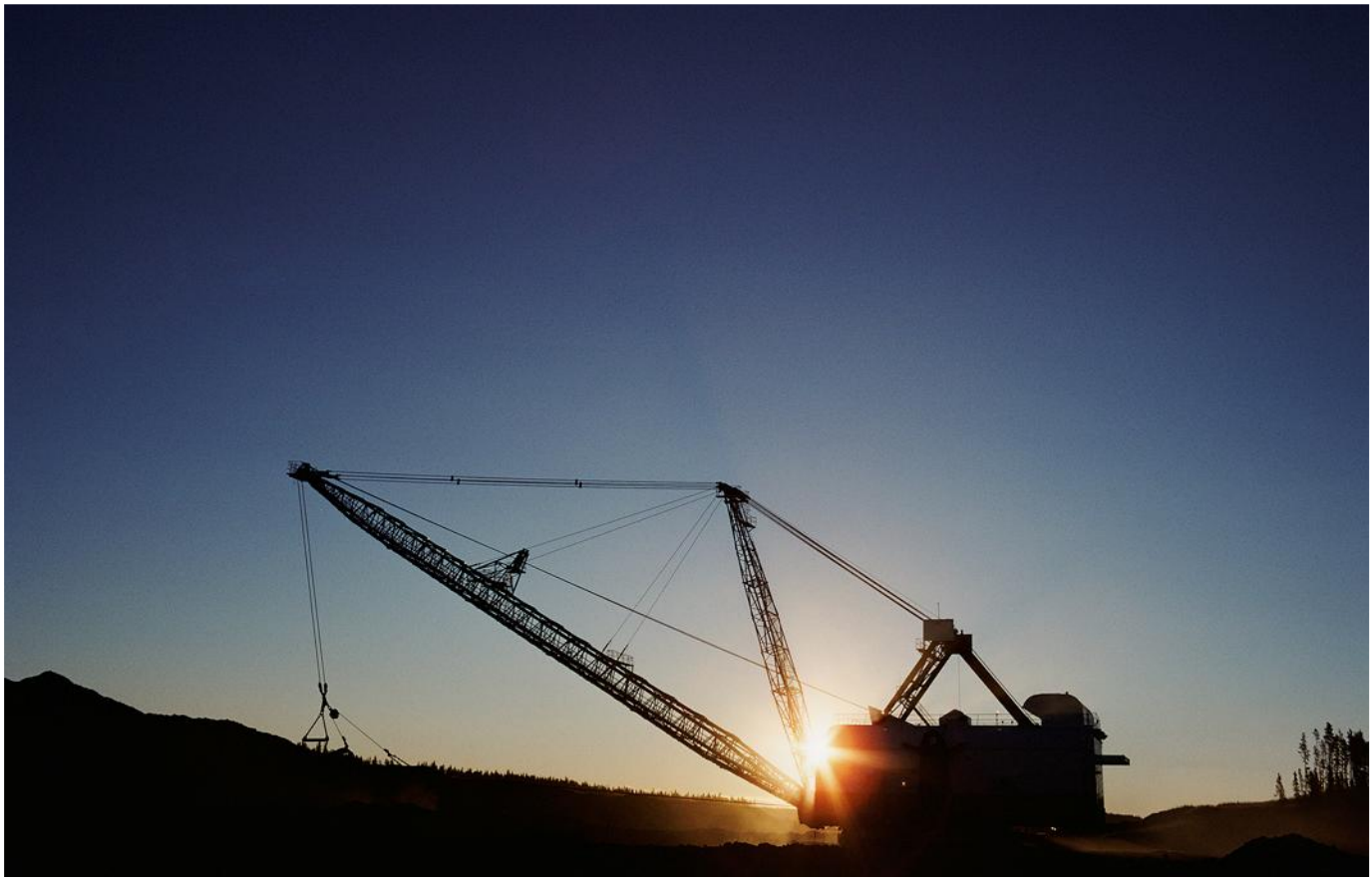
*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 30 (1-10 x EQL); 30 (10-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories.

Field Blanks (WATER)

SDG			66135	66135	66135
Field ID			RB01	RB02	TB01
Sampled_Date			18/05/2015 15:00	19/05/2015 15:00	18/05/2015 15:00
Sample Type			Rinsate	Rinsate	Trip_B
Method_Type	**ChemName**	**Units**	**EQL**			
TRH	C6 - C9 Fraction	µg/L	20	<20	<20	<20
	C10 - C14 Fraction	µg/L	50	<50	<50	
	C15 - C28 Fraction	µg/L	100	<100	<100	
	C29-C36 Fraction	µg/L	50	<50	<50	
	C10 - C36 (Sum of total)	µg/L	50	<50	<50	
TRH (NEPM 2013) Fraction	C6-C10 Fraction	µg/L	20	<20	<20	<20
	C6 - C10 Fraction minus BTEX (F1)	µg/L	20	<20	<20	<20
	C10 - C16 Fraction	µg/L	100	<100	<100	
	TRH >C10-C16 less Naphthalene (F2)	µg/L	100	<100	<100	
	C16 - C34 Fraction	µg/L	100	<100	<100	
	C34 - C40 Fraction	µg/L	100	<100	<100	
	C10 - C40 Fraction (Sum)	µg/L	100	<100	<100	
BTEXN	Benzene	µg/L	1	<1	<1	<1
	Toluene	µg/L	2	<2	<2	<2
	Ethylbenzene	µg/L	2	<2	<2	<2
	Xylene (m & p)	µg/L	2	<2	<2	<2
	Xylene (o)	µg/L	2	<2	<2	<2
	Xylene Total	µg/L	2	<2	<2	<2
	Naphthalene	µg/L	5	<5	<5	<5
	Total BTEX	µg/L	1	<1	<1	<1

Appendix D

Groundwater field sampling sheets



PARSONS BRINCKERHOFF

Groundwater Quality Parameters

Job Number: 2201699A **Well No.** mw2

Client: Alinta Energy	**Purging Date:** 19/5/15
Site Location: Telford Rail Siding	**Sampling Date:** 19/5/15
Casing Diameter (mm): 50 mm	Depth to groundwater from TOC Before Sampling (m): 5.089
Depth to floating product (m): –	Depth to groundwater from TOC After Sampling (m):
Product thickness (mm): –	Purge 5 casing volumes or until 'dry'. ~7m
Method: Bailer	1 casing volume = 2 L/m for 50 mm wells or 8 L/m for 100 mm wells.
Start time (2400 hr): 1035	Depth to be purged: Casing volume: 14/L
Well depth from TOC (m): 12.75	Planned purge volume: 54 L (5 casing volumes)
Well condition: OK	Actual purge volume: 64
	Did well purge 'dry'? Y/N (N) If so, volume? L

Water Quality Parameters

Volume Purged (L)	pH	EC (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
14	6.77	47.7	77	0.65	23.7
24	6.77	49.0	69	0.61	24.4
34	6.77	49.0	55	0.30	24.8
44	6.80	49.2	28	0.71	24.6
54	6.78	49.3	24	0.51	25.1
64	6.82	48.8	26	0.40	24.8

Measurements for pH should be within 0.1 pH units and measurements for conductivity, salinity and dissolved oxygen should be within 10% and temperature within 0.5 °C before the well is sampled.

Water quality meter:	90FLMV Hire	ID no: Thermofisher Hire		Calibration date:	15/05/15

Are the water quality results acceptable to allow sampling? (circle): Yes

Sampling Details		Analysis Required	
Method type: bailer		TRH ✓	
Material: HDPE		BTEXN ✓	
Sampling equipment: Dedicated ✓ Decontaminated O		Biodegs ✓	
Hydrocarbon sheen observed?: Yes No (No)			
Colour: Creamy	Odour: Y/N HC		
Turbidity: (L) M H		Metals *(see custody form for list)*	
Sample ID: mw2.		QC Samples: QC01 / QC02	

Weather Conditions

Rain: –	Temperature: 22 °C	Cloud cover: 0 %	Windy: (Y)/N Mod.

Other comments and observations (i.e. photos, objects in well/blockages, variances to sampling procedure):

mod recharge

* 1vol purged then 10 H readings to reduce total purge volume.

Samplers name: JS	Signature: JS

PARSONS BRINCKERHOFF

Groundwater Quality Parameters

Job Number: 2201699A **Well No.** MW04.

Client: Alinta Energy	**Purging Date:** 19/5/15
Site Location: Telford Rail Siding	**Sampling Date:** 19/5/15.
Casing Diameter (mm): 50 mm	Depth to groundwater from TOC Before Sampling (m): 5.884
Depth to floating product (m): —	Depth to groundwater from TOC After Sampling (m):
Product thickness (mm): —	Purge 5 casing volumes or until 'dry'. 12 − 5.884
Method: Bailer	1 casing volume = 2 L/m for 50 mm wells or 8 L/m for 100 mm wells.
Start time (2400 hr): 800	Depth to be purged: = 6.1 Casing volume: 12.2
Well depth from TOC (m): 12	Planned purge volume: 52 L (5 casing volumes)
Well condition: OK.	Actual purge volume: 52
	Did well purge 'dry'? Y/N If so, volume? L

Water Quality Parameters

Volume Purged (L)	pH	EC (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
12	7.17	40.6	89	4.77	21.9
22	7.27	42.6	98	5.45	22.5
32	7.18	42.1	95	4.99	22.6
42	7.19	42.8	98	4.81	22.5
52.	7.19.	43.1	99	4.84	22.9

Measurements for pH should be within 0.1 pH units and measurements for conductivity, salinity and dissolved oxygen should be within 10% and temperature within 0.5 °C before the well is sampled.

Water quality meter: 90FLMV Hire	ID no: Thermofisher Hire	Calibration date: 15/05/15

Are the water quality results acceptable to allow sampling? (circle): Yes

Sampling Details	Analysis Required	
Method type: bailer	TRH ✓	
Material: HDPE	BTEXN ✓	
Sampling equipment: Dedicated ✓ O Decontaminated O	Biodegs ✓	
Hydrocarbon sheen observed?: Yes (No)		
Colour: dark-brown. Odour: —		
Turbidity: (L) M H	Metals *(see custody form for list)*	
Sample ID: MW04	QC Samples: —	

Weather Conditions

Rain: —	Temperature: 18. °C	Cloud cover: 50 %	Windy: (Y/N) Mod.

Other comments and observations (i.e. photos, objects in well/blockages, variances to sampling procedure):

Samplers name: JS	Signature: JS

PARSONS BRINCKERHOFF

Groundwater Quality Parameters

Job Number: 2201699A **Well No.** MW06

Client: Alinta Energy	**Purging Date:** 19/5/15
Site Location: Telford Rail Siding	**Sampling Date:** 19/5/15
Casing Diameter (mm): 50 mm	Depth to groundwater from TOC Before Sampling (m): 5.734
Depth to floating product (m):	Depth to groundwater from TOC After Sampling (m):
Product thickness (mm): —	Purge 5 casing volumes or until 'dry'. 11.1 – 5.734
Method: Bailer	1 casing volume = 2 L/m for 50 mm wells or 8 L/m for 100 mm wells. = 5.4
Start time (2400 hr): 855	Depth to be purged: Casing volume: 10.8
Well depth from TOC (m): 11.1	Planned purge volume: 55. L (5 casing volumes)
Well condition: ok	Actual purge volume: 55
	Did well purge 'dry'? Y/N If so, volume? L

Water Quality Parameters

Volume Purged (L)	pH	EC (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
11	6.86	35.3	100	0.75	22.2
22	6.95	37.7	105	0.54	23.2
33	6.95	38.0	111	1.09	22.0
44	6.94	38.1	112	1.28	22.1
55.	6.96	38.6	111	1.19	21.8

Measurements for pH should be within 0.1 pH units and measurements for conductivity, salinity and dissolved oxygen should be within 10% and temperature within 0.5 °C before the well is sampled.

Water quality meter: 90FLMV Hire	ID no: Thermofisher Hire	Calibration date: 15/05/15

Are the water quality results acceptable to allow sampling? (circle): Yes

Sampling Details	Analysis Required	
Method type: bailer	TRH ✓	
Material: HDPE	BTEXN ✓	
Sampling equipment: Dedicated ✓ Decontaminated O	Biodegs ✓	
Hydrocarbon sheen observed?: Yes No		
Colour: cream/brown Odour: —		
Turbidity: L M H	Metals *(see custody form for list)*	
Sample ID: MW06	QC Samples: —	

Weather Conditions

Rain: —	Temperature: 18 °C	Cloud cover: 15 %	Windy: Y/N light

Other comments and observations (i.e. photos, objects in well/blockages, variances to sampling procedure):

Sampler's name: JS	Signature: JS

PARSONS BRINCKERHOFF

Groundwater Quality Parameters

Job Number: 2201699A **Well No.** mw8

Client: Alinta Energy	**Purging Date:** 19/5/15
Site Location: Telford Rail Siding	**Sampling Date:** 19/5/15
Casing Diameter (mm): 50 mm	Depth to groundwater from TOC Before Sampling (m): 5.769
Depth to floating product (m):	Depth to groundwater from TOC After Sampling (m):
Product thickness (mm):	Purge 5 casing volumes or until 'dry'.
Method: Bailer	1 casing volume = 2 L/m for 50 mm wells or 8 L/m for 100 mm wells.
Start time (2400 hr): 1150.	Depth to be purged: 6.5. (12.2 − 5.77 ~) Casing volume: 13
Well depth from TOC (m): 12.2	Planned purge volume: 53 L (5 casing volumes)
Well condition: OK.	Actual purge volume: 53
	Did well purge 'dry'? Y/N (N) If so, volume? L

Water Quality Parameters

Volume Purged (L)	pH	EC (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
13	7.19	22.66	82	2.33	24.2
23	7.23	22.33	92	2.04	24.2
33	7.22	23.35	102	2.46	25.4
43	7.26	25.40	103	2.45	25.1
53.	7.26	24.89	107	2.69	24.9

Measurements for pH should be within 0.1 pH units and measurements for conductivity, salinity and dissolved oxygen should be within 10% and temperature within 0.5 °C before the well is sampled.

Water quality meter: 90FLMV Hire	ID no: Thermofisher Hire	Calibration date: 15/05/15

Are the water quality results acceptable to allow sampling? (circle): Yes

Sampling Details	Analysis Required	
Method type: bailer	TRH ✓	
Material: HDPE	BTEXN ✓	
Sampling equipment: Dedicated ✓ Decontaminated O	Biodegs ✓	
Hydrocarbon sheen observed?: Yes (No)		
Colour: clear/cream Odour: –		
Turbidity: (L) M H	Metals *(see custody form for list)*	
Sample ID: mw8.	QC Samples: RB02 / TB01.	

Weather Conditions

Rain: –	Temperature: 23 °C	Cloud cover: 0 %	Windy: (Y)/N light/mod

Other comments and observations (i.e. photos, objects in well/blockages, variances to sampling procedure):

Samplers name: JS	Signature: JS

PARSONS BRINCKERHOFF

Groundwater Quality Parameters

Job Number: 2201699A **Well No.** MW 9

Client: Alinta Energy	**Purging Date:** 18/5/15
Site Location: Telford Rail Siding	**Sampling Date:** 18/5/15 5.574
Casing Diameter (mm): 50 mm	Depth to groundwater from TOC Before Sampling (m): 5.574
Depth to floating product (m): —	Depth to groundwater from TOC After Sampling (m):
Product thickness (mm): —	Purge 5 casing volumes or until 'dry'.
Method: Bailer	1 casing volume = 2 L/m for 50 mm wells or 8 L/m for 100 mm wells. 11.95 − 5.574 = 6.4
Start time (2400 hr): 230.	Depth to be purged: 6.4 Casing volume: 12.8
Well depth from TOC (m): 11.95	Planned purge volume: 53 L (5 casing volumes)
Well condition: OK	Actual purge volume: 53
	Did well purge 'dry'? Y/N If so, volume? L

Water Quality Parameters

Volume Purged (L)	pH	EC (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
13	7.03	46.6	80	5.34	24.3
23	7.56	46.4	86	5.55	23.5
33	7.44	45.8	100	4.57	23.4
43	7.44	45.6	102	4.52	23.7
53	7.52	45.7	102	4.58	23.7

Measurements for pH should be within 0.1 pH units and measurements for conductivity, salinity and dissolved oxygen should be within 10% and temperature within 0.5 °C before the well is sampled.

Water quality meter: 90FLMV Hire	ID no: Thermofisher Hire	Calibration date: 15/05/15

Are the water quality results acceptable to allow sampling? (circle): Yes

Sampling Details	Analysis Required	
Method type: bailer	TRH ✓	
Material: HDPE	BTEXN ✓	
Sampling equipment: Dedicated ✓ Decontaminated O	Biodegs ✓	
Hydrocarbon sheen observed?: Yes No		
Colour: clear/brown Odour: —		
Turbidity: L M H	Metals *(see custody form for list)* —	
Sample ID: MW9.	QC Samples: —	

Weather Conditions

Rain: —	Temperature: 20 °C	Cloud cover: 70 %	Windy: Y/N Mod

Other comments and observations (i.e. photos, objects in well/blockages, variances to sampling procedure):

* w. lt readings to reduce volumes required.

Samplers name: JS	Signature: JS

PARSONS BRINCKERHOFF

Groundwater Quality Parameters

Job Number: 2201699A **Well No.** MW10

Client: Alinta Energy	**Purging Date:** 18/5/15
Site Location: Telford Rail Siding	**Sampling Date:** 18/5/15
Casing Diameter (mm): 50 mm	Depth to groundwater from TOC Before Sampling (m): 5.227
Depth to floating product (m): —	Depth to groundwater from TOC After Sampling (m):
Product thickness (mm): —	Purge 5 casing volumes or until 'dry'. 12.3-5-23
Method: Bailer	1 casing volume = 2 L/m for 50 mm wells or 8 L/m for 100 mm wells.
Start time (2400 hr): 340	Depth to be purged: ~7.1 Casing volume: 14.2
Well depth from TOC (m): 12.3	Planned purge volume: 54 L (5 casing volumes)
Well condition: OK	Actual purge volume: 54
	Did well purge 'dry'? Y/N If so, volume? L

Water Quality Parameters

Volume Purged (L)	pH	EC (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
~~28~~ 14	7.38	24.67	96	4.75	24.0
~~38~~ 24	7.45	25.70	99	4.87	23.6
~~48~~ 34	7.37	26.07	108	4.58	22.1
~~58~~ 44	7.42	24.67	109	4.86	22.4
~~68~~ 54	7.46	23.90	102	4.76	22.2

Measurements for pH should be within 0.1 pH units and measurements for conductivity, salinity and dissolved oxygen should be within 10% and temperature within 0.5 °C before the well is sampled.

Water quality meter: 90FLMV Hire	ID no: Thermofisher Hire	Calibration date: 15/05/15

Are the water quality results acceptable to allow sampling? (circle): Yes

Sampling Details	Analysis Required	
Method type: bailer	TRH ✓	
Material: HDPE	BTEXN ✓	
Sampling equipment: Dedicated ~~O~~ ✓ Decontaminated ~~O~~ ✓	Biodegs ✓	
Hydrocarbon sheen observed?: Yes (No)		
Colour: med brown Odour: —		
Turbidity: (L) M H	Metals *(see custody form for list)*	
Sample ID: MW10	QC Samples: AB01	

Weather Conditions

Rain: —	Temperature: °C	Cloud cover: %	Windy: Y/N

Other comments and observations (i.e. photos, objects in well/blockages, variances to sampling procedure):

* 10lt readings.

Samplers name: JS	Signature: JS

PARSONS BRINCKERHOFF

Groundwater Quality Parameters

Job Number: 2201699A **Well No.** mw11

Client: Alinta Energy	**Purging Date:** 19/5/15
Site Location: Telford Rail Siding	**Sampling Date:** 19/5/15.
Casing Diameter (mm): 50 mm	Depth to groundwater from TOC Before Sampling (m): 5.273
Depth to floating product (m): —	Depth to groundwater from TOC After Sampling (m):
Product thickness (mm): —	Purge 5 casing volumes or until 'dry'. 12.75 - 5.273 ~
Method: Bailer	1 casing volume = 2 L/m for 50 mm wells or 8 L/m for 100 mm wells.
Start time (2400 hr): 945	Depth to be purged: 7m Casing volume: 14
Well depth from TOC (m):	Planned purge volume: 54 L (5 casing volumes)
Well condition: OK	Actual purge volume: 64
	Did well purge 'dry'? Y/N (N) If so, volume? L

Water Quality Parameters

Volume Purged (L)	pH	EC (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
14	7.44	22.72	97	4.19	22.7
24	7.41	22.69	106	4.16	23.1
34	7.38	23.11	111	4.23	21.7
44	7.37	22.94	115	4.03	22.7
54.	7.40	23.26	115	4.02	22.4
64	7.40	23.35	116	4.14	22.3

Measurements for pH should be within 0.1 pH units and measurements for conductivity, salinity and dissolved oxygen should be within 10% and temperature within 0.5 °C before the well is sampled.

Water quality meter: 90FLMV Hire	ID no: Thermofisher Hire	Calibration date: 15/05/15

Are the water quality results acceptable to allow sampling? (circle): (Yes)

Sampling Details	Analysis Required	
Method type: bailer ✓	TRH ✓	
Material: HDPE	BTEXN ✓	
Sampling equipment: Dedicated ✓ Decontaminated O	Biodegs ✓	
Hydrocarbon sheen observed?: Yes (No)		
Colour: Green/brown Odour: —		
Turbidity: (L) M H	Metals *(see custody form for list)*	
Sample ID: mw11	QC Samples: —	

Weather Conditions

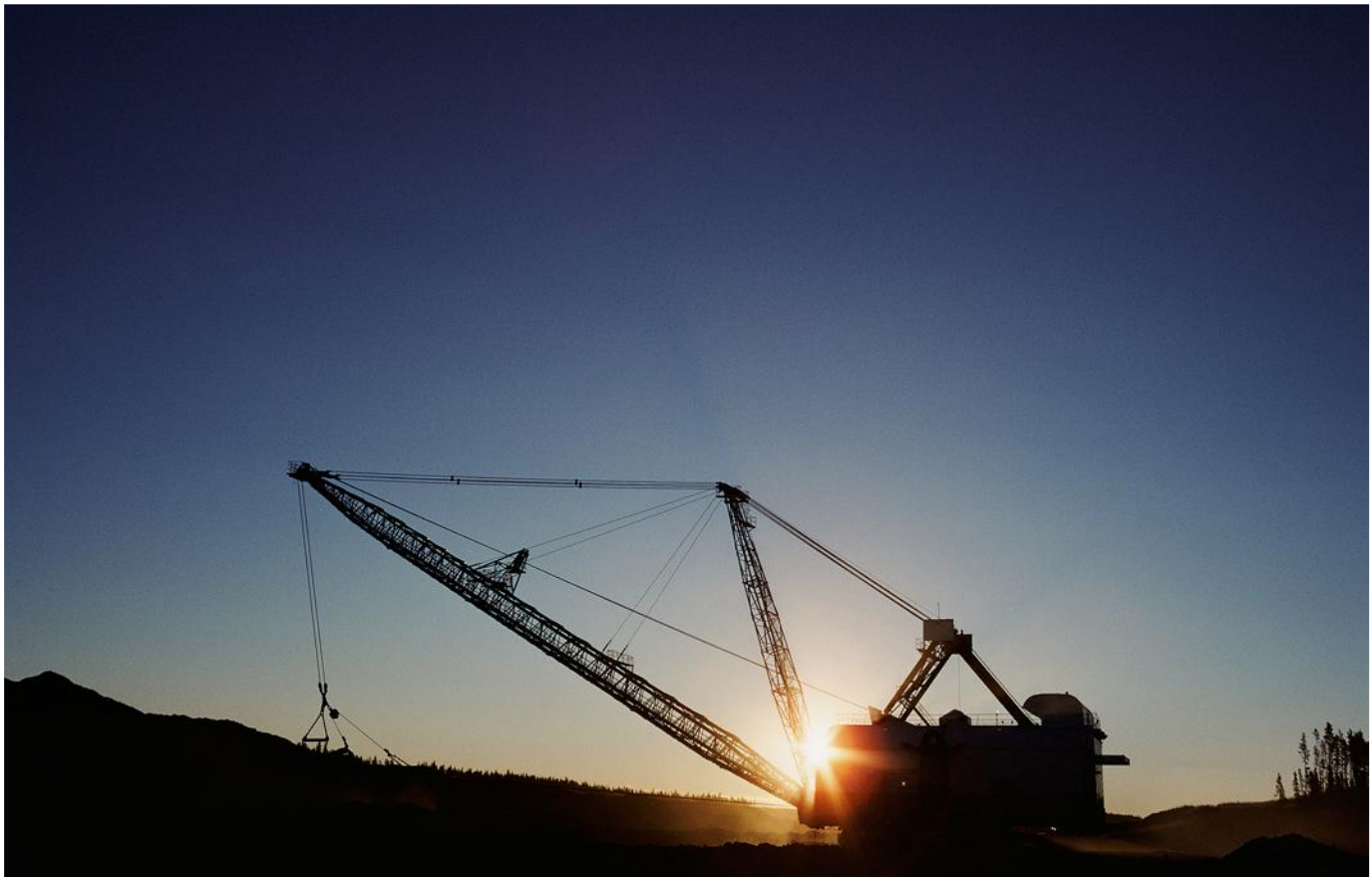
Rain: —	Temperature: 20 °C	Cloud cover: 10 %	Windy: Y/N (N) flat

Other comments and observations (i.e. photos, objects in well/blockages, variances to sampling procedure):

ers name: JS	Signature: JS

Appendix E

Certified laboratory results and chain of custody documentation



PB 125 YEARS

White Page - Laboratory Copy
Yellow Page - Project File Copy
Pink Page - Remains in Book

ABN 80 078 004 798

☐ **Adelaide** Level 11 King William Street, GPO Box 398 Adelaide SA 5001 Tel: (08) 8405 4300 Fax: (08) 8405 4301

☐ **Perth** Level 5, 503 Murray Street, PO Box 7181 Cloisters Square WA 6850 Tel: (08) 9489 9700 Fax: (08) 9489 9777

☐ **Brisbane** Level 4, Northbank Plaza 69 Ann Street, GPO Box 2907 Brisbane QLD 4001 Tel: (07) 3854 6200 Fax: (07) 3854 6500

☐ **Singleton** 188 John Street, PO Box 115 Singleton NSW 2330 Tel: (02) 6572 3377 Fax: (02) 6572 4080

☐ **Melbourne** Level 15, 28 Freshwater Place, PO Box 19016 Southbank VIC 3006 Tel: (03) 9861 1111 Fax: (03) 9861 1144

☐ **Newcastle** Level 3, 51-55 Bolton Street, PO Box 1182 Newcastle NSW, 2300 Tel: (02) 4929 8300 Fax: (02) 4929 8382

☐ **Sydney** Level 27, Ernst & Young Centre 680 George Street, GPO Box 5394, Sydney NSW 2001 Tel: (02) 9272 5100 Fax: (02) 9272 5101

Chain of Custody

Order No: 66135

Job Title: ALINTA - TEPORD RAIL SIDING

PB Job Number: 2201699A

Job Location: Leigh creek

Project Manager: Ashlyn Daly

Results Expected by/on: std.

Fax Results to: A. daly, J. Symonds

Laboratory Name: ALS melb

Address: 24 westall rd springvale.

Fax Number:

Phone Number: (08) 84054300

Contact Name: Bronwyn Steer.

Delivery Method: Star track

Quote Number:

Terms of Business	PB	Other	Checked
	✓		

Spreadsheet of Results Required: (Y) / N

Format: ESDAT

Turnaround Time Required: Std.

Invoice to: Accounts

Comments: Call Justin Mp for any issue

	Date Sampled	Time	Sample I.D.	Container Size	Sample Location	Medium*	Preservative Type	Filtered (X)	TPH	BTEX	PAH's	OC/OP/PCB's	Metals**	Bodegs						Initials	Comments/Additional Information and/or Analysis Required
1	19/5		MW2			W			X	X				X							• B'degs = Nitrate, sulphate, ferrous iron, methane.
2	↓		MW4			↓			↓	↓				↓						↓	• Greenie frozen to extend hold times.
3			MW6																		
4	↓		MW8																		* hold extra MW10 Greenie
5	18/5		MW9																		
6	18/5		MW10																		
7	19/5		MW11																		
8	19/5		QC01																		
9	19/5		QC02																		← Please forward to MGT
10	18/5		TB01																		← Co-Co TRH only + BTEXN.
11	18/5		RB01																		
12	19/5		RB02			↓			↓	↓				↓						↓	

Environmental Division Melbourne Work Order **EM1505166** AM 21/5

Telephone : +61-3-8549 9600

Relinquished by:	Relinquished by:	Relinquished by:
Date & Time: 20/5 1030	Date & Time:	Date & Time:
Company: PB	Company:	Company:
Signature:	Signature:	Signature:
Received in Good Order & Condition by (Name): Nawa	Received in Good Order & Condition by (Name):	Received in Good Order & Condition by (Name):
Date & Time: 21/5, 10.30	Date & Time:	Date & Time:
Company: ALS	Company:	Company:
Signature:	Signature:	Signature:

Samples sent to lab for Micro Nitrate BOD pH Colour Turbidity RP Other B.R Date 21/05/15

Forwarded to Secondary Lab

Initials B.R **Date** 21/05

Medium*: S = Soil, W = Water, V = Vapour

Legend**: (circle the following to be tested)

Metals: Al As Be Cd Co Cr Cu Fe Hg Li Mg Mn Ni Pb Se Sn V Zn

Samples on Ice: ☑ Yes ☐ No

Please fax back a signed copy when samples are received at the laboratory

CERTIFICATE OF ANALYSIS

Work Order	: **EM1505166**	Page	: 1 of 8
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Melbourne
Contact	: MS ASHLYN DALY	Contact	: Client Services
Address	: GPO BOX 398 ADELAIDE SA, AUSTRALIA 5001	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: adaly@pb.com.au	E-mail	: Melbourne.Enviro.Services@alsglobal.com
Telephone	: +61 08 8405 4300	Telephone	: +61-3-8549 9600
Facsimile	: +61 08 8405 4301	Facsimile	: +61-3-8549 9601
Project	: 2201699A ALINTA - TELFORD RAIL SIDING	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: 66135	Date Samples Received	: 21-MAY-2015
Sampler	: JS	Issue Date	: 27-MAY-2015
Site	: Leigh Creek		
		No. of samples received	: 11
Quote number	: EN/008/14	No. of samples analysed	: 11

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics
Herman Lin	Laboratory Manager	Melbourne Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Steven McGrath	Technical Manager - Client Services	Melbourne Organics

General Comments

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

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

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

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

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **Methane (EP033) conducted by ALS Sydney, NATA accreditation no. 825, site no 10911.**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	MW2	MW4	MW6	MW8	MW9
			Client sampling date / time	19-MAY-2015 15:00	19-MAY-2015 15:00	19-MAY-2015 15:00	19-MAY-2015 15:00	18-MAY-2015 15:00
Compound	CAS Number	LOR	Unit	EM1505166-001	EM1505166-002	EM1505166-003	EM1505166-004	EM1505166-005
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	2790	2820	2100	2210	3880
EG051G: Ferrous Iron by Discrete Analyser								
Ferrous Iron	----	0.05	mg/L	0.75	<0.05	<0.05	<0.05	<0.05
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	0.85	8.46	5.18	3.12	14.4
EP033: C1 - C4 Hydrocarbon Gases								
Methane	74-82-8	10	µg/L	<10	<10	<10	<10	<10
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L	410	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L	6520	<100	890	<100	<100
C29 - C36 Fraction	----	50	µg/L	200	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L	7130	<50	890	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	µg/L	1390	<100	100	<100	<100
>C16 - C34 Fraction	----	100	µg/L	6030	<100	850	<100	<100
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L	7420	<100	950	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	1390	<100	100	<100	<100
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	µg/L	<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	104	101	102	103	87.0

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	MW2	MW4	MW6	MW8	MW9
			Client sampling date / time	19-MAY-2015 15:00	19-MAY-2015 15:00	19-MAY-2015 15:00	19-MAY-2015 15:00	18-MAY-2015 15:00
Compound	CAS Number	LOR	Unit	EM1505166-001	EM1505166-002	EM1505166-003	EM1505166-004	EM1505166-005
EP080S: TPH(V)/BTEX Surrogates - Continued								
Toluene-D8	2037-26-5	0.1	%	**102**	**97.5**	**99.3**	**101**	**84.7**
4-Bromofluorobenzene	460-00-4	0.1	%	**92.4**	**86.1**	**89.4**	**89.6**	**74.9**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	MW10	MW11	QC01	TB01	RB01
			Client sampling date / time	18-MAY-2015 15:00	19-MAY-2015 15:00	19-MAY-2015 15:00	18-MAY-2015 15:00	18-MAY-2015 15:00
Compound	CAS Number	LOR	Unit	EM1505166-006	EM1505166-007	EM1505166-008	EM1505166-009	EM1505166-010
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**1700**	**2000**	**2790**	----	----
EG051G: Ferrous Iron by Discrete Analyser								
Ferrous Iron	----	0.05	mg/L	<0.05	<0.05	**0.70**	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**2.24**	**3.62**	**0.90**	----	----
EP033: C1 - C4 Hydrocarbon Gases								
Methane	74-82-8	10	µg/L	<10	<10	<10	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L	<50	<50	**500**	----	<50
C15 - C28 Fraction	----	100	µg/L	<100	<100	**7250**	----	<100
C29 - C36 Fraction	----	50	µg/L	<50	<50	**160**	----	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	**7910**	----	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	µg/L	<100	<100	**1640**	----	<100
>C16 - C34 Fraction	----	100	µg/L	<100	<100	**6620**	----	<100
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	----	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	**8260**	----	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	**1640**	----	<100
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	µg/L	<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	**102**	**102**	**104**	**105**	**91.8**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	MW10	MW11	QC01	TB01	RB01
			Client sampling date / time	18-MAY-2015 15:00	19-MAY-2015 15:00	19-MAY-2015 15:00	18-MAY-2015 15:00	18-MAY-2015 15:00
Compound	CAS Number	LOR	Unit	EM1505166-006	EM1505166-007	EM1505166-008	EM1505166-009	EM1505166-010
EP080S: TPH(V)/BTEX Surrogates - Continued								
Toluene-D8	2037-26-5	0.1	%	**96.0**	**101**	**99.6**	**103**	**88.6**
4-Bromofluorobenzene	460-00-4	0.1	%	**83.7**	**88.4**	**88.4**	**91.8**	**78.0**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	RB02	----	----	----	----
			Client sampling date / time	19-MAY-2015 15:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM1505166-011	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	----	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	----	----	----	----
>C10 - C16 Fraction	>C10_C16	100	µg/L	<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	----	----	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	----	----	----	----
Toluene	108-88-3	2	µg/L	<2	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	----	----	----	----
^ Total Xylenes	1330-20-7	2	µg/L	<2	----	----	----	----
^ Sum of BTEX	----	1	µg/L	<1	----	----	----	----
Naphthalene	91-20-3	5	µg/L	<5	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	**95.3**	----	----	----	----
Toluene-D8	2037-26-5	0.1	%	**92.9**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	**81.5**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	Recovery Limits (%) High
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	129
Toluene-D8	2037-26-5	70	125
4-Bromofluorobenzene	460-00-4	71	129

QUALITY CONTROL REPORT

Work Order	: **EM1505166**	Page	: 1 of 6
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Melbourne
Contact	: MS ASHLYN DALY	Contact	: Client Services
Address	: GPO BOX 398 ADELAIDE SA, AUSTRALIA 5001	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: adaly@pb.com.au	E-mail	: Melbourne.Enviro.Services@alsglobal.com
Telephone	: +61 08 8405 4300	Telephone	: +61-3-8549 9600
Facsimile	: +61 08 8405 4301	Facsimile	: +61-3-8549 9601
Project	: 2201699A ALINTA - TELFORD RAIL SIDING	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: Leigh Creek		
C-O-C number	: 66135	Date Samples Received	: 21-MAY-2015
Sampler	: JS	Issue Date	: 27-MAY-2015
Order number	: ----		
		No. of samples received	: 11
Quote number	: EN/008/14	No. of samples analysed	: 11

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

This Quality Control Report contains the following information:

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

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out ir compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics
Herman Lin	Laboratory Manager	Melbourne Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Steven McGrath	Technical Manager - Client Services	Melbourne Organics

General Comments

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

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

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

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

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3940565)									
EM1505164-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	208	208	0.0	0% - 20%
EM1505166-006	MW10	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	1700	1810	6.2	0% - 20%
EG051G: Ferrous Iron by Discrete Analyser (QC Lot: 3941701)									
EM1505141-001	Anonymous	EG051G: Ferrous Iron	----	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EM1505170-001	Anonymous	EG051G: Ferrous Iron	----	0.05	mg/L	0.33	0.34	3.5	No Limit
EP033: C1 - C4 Hydrocarbon Gases (QC Lot: 3943029)									
EM1505166-001	MW2	EP033: Methane	74-82-8	10	µg/L	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3940506)									
EM1505159-027	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	4370	3480	# 22.7	0% - 20%
EM1505166-009	TB01	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 3940506)									
EM1505159-027	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	6480	5410	18.1	0% - 20%
EM1505166-009	TB01	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 3940506)									
EM1505159-027	Anonymous	EP080: Benzene	71-43-2	1	µg/L	9	8	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	8	8	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	264	256	2.7	0% - 20%
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	1160	1120	3.7	0% - 20%
		EP080: ortho-Xylene	95-47-6	2	µg/L	73	72	1.7	0% - 20%
		EP080: Naphthalene	91-20-3	5	µg/L	167	161	3.3	0% - 20%
EM1505166-009	TB01	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3940565)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	109	90	116
				----	100 mg/L	102	80	120
EG051G: Ferrous Iron by Discrete Analyser (QCLot: 3941701)								
EG051G: Ferrous Iron	----	0.05	mg/L	<0.05	2 mg/L	96.8	89	111
EP033: C1 - C4 Hydrocarbon Gases (QCLot: 3943029)								
EP033: Methane	74-82-8	10	µg/L	<10	28.48 µg/L	105	86	114
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3940474)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	3980 µg/L	92.7	53	123
EP071: C15 - C28 Fraction	----	100	µg/L	<100	17006 µg/L	114	57	133
EP071: C29 - C36 Fraction	----	50	µg/L	<50	8662 µg/L	109	55	141
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3940506)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	360 µg/L	90.9	67	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3940474)								
EP071: >C10 - C16 Fraction	>C10_C16	100	µg/L	<100	5753 µg/L	106	54	122
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	24516 µg/L	109	56	132
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	828 µg/L	124	51	137
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3940506)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	450 µg/L	90.4	65	125
EP080: BTEXN (QCLot: 3940506)								
EP080: Benzene	71-43-2	1	µg/L	<1	20 µg/L	94.5	76	120
EP080: Toluene	108-88-3	2	µg/L	<2	20 µg/L	92.4	76	124
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	20 µg/L	87.0	72	124
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	40 µg/L	88.2	72	130
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	20 µg/L	94.4	75	127
EP080: Naphthalene	91-20-3	5	µg/L	<5	5 µg/L	91.4	71	129

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3940565)							
EM1505164-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	70	130
EG051G: Ferrous Iron by Discrete Analyser (QCLot: 3941701)							
EM1505166-001	MW2	EG051G: Ferrous Iron	----	2 mg/L	87.0	70	128
EP033: C1 - C4 Hydrocarbon Gases (QCLot: 3943029)							
EM1505166-002	MW4	EP033: Methane	74-82-8	28.48 µg/L	100	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3940506)							
EM1505162-001	Anonymous	EP080: C6 - C9 Fraction	----	280 µg/L	75.5	43	125
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3940506)							
EM1505162-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	330 µg/L	73.0	44	122
EP080: BTEXN (QCLot: 3940506)							
EM1505162-001	Anonymous	EP080: Benzene	71-43-2	20 µg/L	94.8	68	130
		EP080: Toluene	108-88-3	20 µg/L	98.6	72	132

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

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

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3940506)										
EM1505162-001	Anonymous	EP080: C6 - C9 Fraction	----	280 µg/L	75.5	----	43	125	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 3940506)										
EM1505162-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	330 µg/L	73.0	----	44	122	----	----
EP080: BTEXN (QCLot: 3940506)										
EM1505162-001	Anonymous	EP080: Benzene	71-43-2	20 µg/L	94.8	----	68	130	----	----
		EP080: Toluene	108-88-3	20 µg/L	98.6	----	72	132	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3940565)										
EM1505164-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	# Not Determined	----	70	130	----	----
EG051G: Ferrous Iron by Discrete Analyser (QCLot: 3941701)										

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EG051G: Ferrous Iron by Discrete Analyser (QCLot: 3941701) - continued										
EM1505166-001	MW2	EG051G: Ferrous Iron	----	2 mg/L	87.0	----	70	128	----	----
EP033: C1 - C4 Hydrocarbon Gases (QCLot: 3943029)										
EM1505166-002	MW4	EP033: Methane	74-82-8	28.48 µg/L	100	----	70	130	----	----

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EM1505166**	Page	: 1 of 6
Client	: PARSONS BRINCKERHOFF AUST P/L	Laboratory	: Environmental Division Melbourne
Contact	: MS ASHLYN DALY	Contact	: Client Services
Address	: GPO BOX 398 ADELAIDE SA, AUSTRALIA 5001	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: adaly@pb.com.au	E-mail	: Melbourne.Enviro.Services@alsglobal.com
Telephone	: +61 08 8405 4300	Telephone	: +61-3-8549 9600
Facsimile	: +61 08 8405 4301	Facsimile	: +61-3-8549 9601
Project	: 2201699A ALINTA - TELFORD RAIL SIDING	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: Leigh Creek		
C-O-C number	: 66135	Date Samples Received	: 21-MAY-2015
Sampler	: JS	Issue Date	: 27-MAY-2015
Order number	: ----		
		No. of samples received	: 11
Quote number	: EN/008/14	No. of samples analysed	: 11

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

This Interpretive Quality Control Report contains the following information:

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

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with recommended holding times (USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) MW9, MW10	**18-MAY-2015**	---	15-JUN-2015	----	**25-MAY-2015**	15-JUN-2015	✓
Clear Plastic Bottle - Natural (ED041G) MW2, MW4, MW6, MW8, MW11, QC01	**19-MAY-2015**	---	16-JUN-2015	----	**25-MAY-2015**	16-JUN-2015	✓
EG051G: Ferrous Iron by Discrete Analyser							
Clear Plastic Bottle - HCl - Filtered (EG051G) MW9, MW10	**18-MAY-2015**	----	----	----	**25-MAY-2015**	25-MAY-2015	✓
Clear Plastic Bottle - HCl - Filtered (EG051G) MW2, MW4, MW6, MW8, MW11, QC01	**19-MAY-2015**	----	----	----	**25-MAY-2015**	26-MAY-2015	✓
EP033: C1 - C4 Hydrocarbon Gases							
Amber VOC Vial - Sulfuric Acid (EP033) MW9, MW10	**18-MAY-2015**	----	----	----	**26-MAY-2015**	01-JUN-2015	✓
Amber VOC Vial - Sulfuric Acid (EP033) MW2, MW4, MW6, MW8, MW11, QC01	**19-MAY-2015**	----	----	----	**26-MAY-2015**	02-JUN-2015	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber Glass Bottle - Unpreserved (EP071) MW9, MW10, RB01	**18-MAY-2015**	**22-MAY-2015**	25-MAY-2015	✓	**25-MAY-2015**	01-JUL-2015	✓
Amber Glass Bottle - Unpreserved (EP071) MW2, MW4, MW6, MW8, MW11, QC01, RB02	**19-MAY-2015**	**22-MAY-2015**	26-MAY-2015	✓	**25-MAY-2015**	01-JUL-2015	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080) MW9, MW10, TB01, RB01	**18-MAY-2015**	**22-MAY-2015**	01-JUN-2015	✓	**22-MAY-2015**	01-JUN-2015	✓
Amber VOC Vial - Sulfuric Acid (EP080) MW2, MW4, MW6, MW8, MW11, QC01, RB02	**19-MAY-2015**	**22-MAY-2015**	02-JUN-2015	✓	**22-MAY-2015**	02-JUN-2015	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber VOC Vial - Sulfuric Acid (EP080) MW9, MW10, TB01, RB01	**18-MAY-2015**	**22-MAY-2015**	01-JUN-2015	✓	**22-MAY-2015**	01-JUN-2015	✓
Amber VOC Vial - Sulfuric Acid (EP080) MW2, MW4, MW6, MW8, MW11, QC01, RB02	**19-MAY-2015**	**22-MAY-2015**	02-JUN-2015	✓	**22-MAY-2015**	02-JUN-2015	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
C1 - C4 Gases	EP033	1	8	12.5	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ferrous Iron by Discrete Analyser	EG051G	2	20	10.0	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.1	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	2	16	12.5	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
C1 - C4 Gases	EP033	1	8	12.5	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ferrous Iron by Discrete Analyser	EG051G	1	20	5.0	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	18	11.1	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH - Semivolatile Fraction	EP071	1	12	8.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	1	16	6.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
C1 - C4 Gases	EP033	1	8	12.5	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ferrous Iron by Discrete Analyser	EG051G	1	20	5.0	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.6	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH - Semivolatile Fraction	EP071	1	12	8.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	1	16	6.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
C1 - C4 Gases	EP033	1	8	12.5	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Ferrous Iron by Discrete Analyser	EG051G	1	20	5.0	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	18	5.6	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TRH Volatiles/BTEX	EP080	1	16	6.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Ferrous Iron by Discrete Analyser	EG051G	WATER	In house: Referenced to APHA 3500 Fe-B. A colorimetric determination based on the reaction between phenanthroline and ferrous iron at pH 3.2-3.3 to form an orange-red complex that is measured against a five-point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
C1 - C4 Gases	EP033	WATER	Technical Guidance for the Natural Attenuation Indicators: Methane, Ethane, and Ethene, US EPA - Region 1, EPA New England, July 2001. Automated static headspace, dual column GC/FID. A 12 mL sample is pipetted into a 20 mL headspace vial containing 3g of sodium chloride and sealed. Each sample is equilibrated with shaking at 40 degrees C for 10 minutes prior to analysis by GC/FID using a pair of PLOT columns of different polarity.
TRH - Semivolatile Fraction	EP071	WATER	USEPA SW 846 - 8015A The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	USEPA SW 846 - 8260B Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Separatory Funnel Extraction of Liquids	ORG14	WATER	USEPA SW 846 - 3510B 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (2013) Schedule B(3) . ALS default excludes sediment which may be resident in the container.

Summary of Outliers

Outliers : Quality Control Samples

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

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EP080/071: Total Petroleum Hydrocarbons	EM1505159-027	Anonymous	**C6 - C9 Fraction**	----	22.7 %	0-20%	**RPD exceeds LOR based limits**
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	EM1505164-002	Anonymous	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**

Regular Sample Surrogates

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

Outliers : Analysis Holding Time Compliance

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

- **No Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

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

- **No Quality Control Sample Frequency Outliers exist.**

PB 125 YEARS · ABN 80 078 004 798

White Page - Laboratory Copy
Yellow Page - Project File Copy
Pink Page - Remains in Book

☑ **Adelaide** Level 1, 11 King William Street, GPO Box 398 Adelaide SA 5001 Tel: (08) 8405 4300 Fax: (08) 8405 4301

☐ **Perth** Level 5, 503 Murray Street, PO Box 7181 Cloisters Square WA 6850 Tel: (08) 9489 9700 Fax: (08) 9489 9777

☐ **Brisbane** Level 4, Northbank Plaza 69 Ann Street, GPO Box 2907 Brisbane QLD 4001 Tel: (07) 3854 6200 Fax: (07) 3854 6500

☐ **Singleton** 188 John Street, PO Box 115 Singleton NSW 2330 Tel: (02) 6572 3377 Fax: (02) 6572 4080

☐ **Melbourne** Level 15, 28 Freshwater Place, PO Box 19016 Southbank VIC 3006 Tel: (03) 9861 1111 Fax: (03) 9861 1144

☐ **Newcastle** Level 3, 51-55 Bolton Street, PO Box 1162 Newcastle NSW, 2300 Tel: (02) 4929 8300 Fax: (02) 4929 8382

☐ **Sydney** Level 27, Ernst & Young Centre 680 George Street, GPO Box 5394, Sydney NSW 2001 Tel: (02) 9272 5100 Fax: (02) 9272 5101

(2)

Chain of Custody

Order No: 66135

Job Title: ALINTA - TEFORD RAIL SIDING	PB Job Number: 22016994	Job Location: Leigh creek -	Project Manager: Ashlyn Daly
Laboratory Name: ALS melb	Terms of Business	PB ✓ / Other / Checked	Results Expected by/on: std.
Address: 24 westall rd springvale.			Fax Results to: A. daly, J. Symonds
Fax Number:			Fax Number:
Phone Number:			Phone Number: (08) 84054300
Contact Name: Bronwyn Steer.			Spreadsheet of Results Required: (Y) / N
Delivery Method: star track			Format: ESDAT
Quote Number:			Turnaround Time Required: Std.
			Invoice to: Accounts
			Comments: call Justin for any issues

	Date Sampled	Time	Sample I.D.	Container Size	Sample Location	Medium*	Preservative Type	Filtered (X)	TPH	BTEX	PAH's	OC/OP/PCB's	Metals**	B'degs					Initials	Comments/Additional Information and/or Analysis Required
1	19/5		MW2			W			X	X				X						• B'degs = Nitrate, sulphate, ferrous iron, methane.
2	↓		MW4			↓			↓	↓				↓						• Greenie frozen to extend hold times.
3			MW6																	
4			MW8.																	
5	18/5		MW9																	* hold extra MW10 Greenie
6	18/5		MW10																	
7	19/5		MW11																	
8	19/5		QC01																	Report: 458723
9	19/5		QC02											↓						← Please forward to MGT
10	20/5		TB01																	← Ca-Ca TRH only + BTEXN
11	18/5		RB01																	
12	19/5		RB02.			↓			↓	↓									↓	

Environmental Division Melbourne
Work Order
EM1505166
Telephone : +61-3-8549 9600

AM 21/5

Relinquished by:	Relinquished by:	Relinquished by:	Medium*: S = Soil, W = Water, V = Vapour
Date & Time: 20/5 1030	Date & Time: 22/5 12 pm	Date & Time:	Legend**: (circle the following to be tested)
Company: PB	Company:	Company:	Metals: Al As Be Cd Co Cr Cu Fe Hg Li Mg Mn Ni Pb Se Sn V Zn
Signature:	Signature:	Signature:	
Received in Good Order & Condition by (Name): Karen	Received in Good Order & Condition by (Name): Tony W	Received in Good Order & Condition by (Name):	Samples on Ice: ☑ Yes ☐ No
Date & Time: 21/5, 10.30	Date & Time: 22/5 3:26 pm	Date & Time:	***Please fax back a signed copy when samples are received at the laboratory***
Company: AM	Company: EF/mgt	Company:	
Signature:	Signature:	Signature:	

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ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com.au web : www.eurofins.com.au

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3-5 Kingston Town Close
Oakleigh Vic 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
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16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Sample Receipt Advice

Company name:	**Parsons Brinckerhoff Aust P/L SA**
Contact name:	Ashlyn Daly
Project name:	ALINTA - TELFORD RAIL SIDING
Project ID:	2201699A
COC number:	66135
Turn around time:	5 Day
Date/Time received:	May 22, 2015 3:26 PM
Eurofins | mgt reference:	**458723**

Sample information

- ☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- ☑ All samples have been received as described on the above COC.
- ☑ COC has been completed correctly.
- ☑ Attempt to chill was evident.
- ☑ Appropriately preserved sample containers have been used.
- ☑ All samples were received in good condition.
- ☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- ☑ Appropriate sample containers have been used.
- ☑ Sample containers for volatile analysis received with zero headspace.
- ☒ Some samples have been subcontracted.
- N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Sarah Gould on Phone : (+61) (8) 8154 3100 or by e.mail: SarahGould@eurofins.com.au

Results will be delivered electronically via e.mail to Ashlyn Daly - adaly@pb.com.au.

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ABN : 50 005 085 521

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Company Name:	Parsons Brinckerhoff Aust P/L SA	**Order No.:**		**Received:**	May 22, 2015 3:26 PM
Address:	Level 16, 1 King William St Adelaide SA 5000	**Report #:**	458723	**Due:**	May 29, 2015
		Phone:	08 8405 4300	**Priority:**	5 Day
		Fax:	08 8405 4301	**Contact Name:**	Ashlyn Daly
Project Name:	ALINTA - TELFORD RAIL SIDING				
Project ID:	2201699A				

Eurofins | mgt Client Manager: Sarah Gould

Sample Detail					Ferrous Iron - Fe2+	Methane	Nitrate (as N)	Sulphate (as S)	BTEX	Total Recoverable Hydrocarbons
Laboratory where analysis is conducted										
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217										
Brisbane Laboratory - NATA Site # 20794										
External Laboratory										
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
C02	May 19, 2015		Water	M15-My20567	X	X	X	X	X	X

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Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Parsons Brinckerhoff Australia P/L SA
Level 16, 1 King William St
Adelaide
SA 5000

Attention: **Ashlyn Daly**

Report **458723-W**
Project name ALINTA - TELFORD RAIL SIDING
Project ID 2201699A
Received Date May 22, 2015

Client Sample ID			**QC02**
Sample Matrix			**Water**
Eurofins | mgt Sample No.			**M15-My20567**
Date Sampled			**May 19, 2015**
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons - 1999 NEPM Fractions			
TRH C6-C9	0.02	mg/L	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05
TRH C15-C28	0.1	mg/L	1.3
TRH C29-C36	0.1	mg/L	< 0.1
TRH C10-36 (Total)	0.1	mg/L	1.3
BTEX			
Benzene	0.001	mg/L	< 0.001
Toluene	0.001	mg/L	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002
o-Xylene	0.001	mg/L	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003
4-Bromofluorobenzene (surr.)	1	%	84
Total Recoverable Hydrocarbons - 2013 NEPM Fractions			
Naphthalene[N02]	0.02	mg/L	< 0.02
TRH C6-C10	0.02	mg/L	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02
TRH >C10-C16	0.05	mg/L	0.25
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	0.25
TRH >C16-C34	0.1	mg/L	1.1
TRH >C34-C40	0.1	mg/L	< 0.1
Dissolved Gases			
Methane	0.05	mg/L	< 0.05
Ferrous Iron - Fe2+	0.05	mg/L	1.1
Nitrate (as N)	0.02	mg/L	0.90
Sulphate (as S)	5	mg/L	910

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Melbourne	May 26, 2015	7 Day
- Method: TRH C6-C36 - LTM-ORG-2010			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Melbourne	May 26, 2015	7 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
BTEX	Melbourne	May 22, 2015	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Dissolved Gases	Melbourne	May 22, 2015	7 Day
- Method: LTM-ORG-2070 by Headspace GC-FID			
Ferrous Iron - Fe2+	Melbourne	May 25, 2015	28 Day
- Method: APHA 3500-Fe B. (Iron Speciation)			
Nitrate (as N)	Melbourne	May 25, 2015	7 Day
- Method: APHA 4500-NO3 Nitrate Nitrogen by FIA			
Sulphate (as S)	Melbourne	May 25, 2015	28 Day
- Method: In house MGT1110A (SO4 by Discrete Analyser)			

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Site # 1254 & 14271

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ABN : 50 005 085 521

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Company Name:	Parsons Brinckerhoff Aust P/L SA	**Order No.:**	
Address:	Level 16, 1 King William St Adelaide SA 5000	**Report #:**	458723
		Phone:	08 8405 4300
		Fax:	08 8405 4301
Project Name:	ALINTA - TELFORD RAIL SIDING		
Project ID:	2201699A		

Received:	May 22, 2015 3:26 PM
Due:	May 29, 2015
Priority:	5 Day
Contact Name:	Ashlyn Daly

Eurofins | mgt Client Manager: Sarah Gould

Sample Detail					Ferrous Iron - Fe2+	Methane	Nitrate (as N)	Sulphate (as S)	BTEX	Total Recoverable Hydrocarbons
Laboratory where analysis is conducted										
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217										
Brisbane Laboratory - NATA Site # 20794										
External Laboratory										
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**						
C02	May 19, 2015		Water	M15-My20567	X	X	X	X	X	X

Eurofins | mgt Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

MPN/100mL: Most Probable Number of organisms per 100 millilitres

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Nephelometric Turbidity Units

TERMS

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - ACCEPTANCE CRITERIA

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC DATA GENERAL COMMENTS

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

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Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.02			0.02	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
TRH C6-C10 less BTEX (F1)	mg/L	< 0.02			0.02	Pass	
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Dissolved Gases							
Methane	mg/L	< 0.05			0.05	Pass	
Method Blank							
Ferrous Iron - Fe2+	mg/L	< 0.05			0.05	Pass	
Nitrate (as N)	mg/L	< 0.02			0.02	Pass	
Sulphate (as S)	mg/L	< 5			5	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	104			70-130	Pass	
TRH C10-C14	%	74			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	118			70-130	Pass	
Toluene	%	121			70-130	Pass	
Ethylbenzene	%	115			70-130	Pass	
m&p-Xylenes	%	115			70-130	Pass	
Xylenes - Total	%	113			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	88			75-125	Pass	
TRH C6-C10	%	93			70-130	Pass	
TRH >C10-C16	%	73			70-130	Pass	
LCS - % Recovery							
Dissolved Gases							
Methane	%	86			70-130	Pass	
LCS - % Recovery							
Ferrous Iron - Fe2+	%	101			70-130	Pass	
Nitrate (as N)	%	94			70-130	Pass	
Sulphate (as S)	%	105			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	M15-My19713	NCP	%	101			70-130	Pass	
TRH C10-C14	M15-My20714	NCP	%	93			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	M15-My19713	NCP	%	119			70-130	Pass	
Toluene	M15-My19713	NCP	%	122			70-130	Pass	
Ethylbenzene	M15-My19713	NCP	%	110			70-130	Pass	
m&p-Xylenes	M15-My19713	NCP	%	111			70-130	Pass	
o-Xylene	M15-My19713	NCP	%	104			70-130	Pass	
Xylenes - Total	M15-My19713	NCP	%	109			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	M15-My19713	NCP	%	86			70-130	Pass	
TRH C6-C10	M15-My19713	NCP	%	90			70-130	Pass	
TRH >C10-C16	M15-My20714	NCP	%	93			70-130	Pass	
Spike - % Recovery									
Dissolved Gases				Result 1					
Methane	M15-My21459	NCP	%	79			70-130	Pass	
Spike - % Recovery									
				Result 1					
Ferrous Iron - Fe2+	M15-My20952	NCP	%	102			70-130	Pass	
Nitrate (as N)	M15-My20565	NCP	%	96			70-130	Pass	
Sulphate (as S)	M15-My19601	NCP	%	99			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	M15-My20694	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C10-C14	M15-My20713	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH C15-C28	M15-My20713	NCP	mg/L	0.80	0.52	39	30%	Fail	Q15
TRH C29-C36	M15-My20713	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	M15-My20694	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	M15-My20694	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	M15-My20694	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	M15-My20694	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	M15-My20694	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total	M15-My20694	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	M15-My20694	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C6-C10	M15-My20694	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH C6-C10 less BTEX (F1)	M15-My20694	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH >C10-C16	M15-My20713	NCP	mg/L	0.17	0.10	47	30%	Fail	Q15
TRH >C16-C34	M15-My20713	NCP	mg/L	0.70	0.43	46	30%	Fail	Q15
TRH >C34-C40	M15-My20713	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
Dissolved Gases				Result 1	Result 2	RPD			
Methane	M15-My19288	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	

Duplicate									
				Result 1	Result 2	RPD			
Ferrous Iron - Fe2+	M15-My20952	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Nitrate (as N)	M15-My20565	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Sulphate (as S)	M15-My19601	NCP	mg/L	120	120	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
Q15	The RPD reported passes Eurofins | mgt's Acceptance Criteria as stipulated in SOP 05. Refer to Glossary Page of this report for further details

Authorised By

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Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

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