

## **Appendix D**

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Groundwater Contamination  
Assessment



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NCSI Certified Quality System ISO 9001

Our reference: 2118506A\_PR\_1119\_rev01  
Your reference:

20 September 2005

Tibor de Jong  
Transpacific Industries Pty Ltd  
PO Box 1824  
Milton  
Queensland 4064

## **Re Groundwater investigation**

### **Introduction**

In August 2005 Transpacific Industries Pty Ltd (TPI) commissioned Parsons Brinckerhoff Australia Pty Ltd (PB) to complete a groundwater investigation at their proposed waste facility at Kyle Street, Rutherford.

Groundwater assessment was conducted on 24 August 2005.

This letter report summarises the activities and results of the monitoring event.

### **Scope of Works**

Nine monitoring wells were installed. Eight shallow wells were to intercept any perched groundwater and one deeper bore that would sample the phreatic groundwater in the underlying alluvium.

### **Site Specific Geology**

Lithology encountered during drilling works consisted of gravely clayey sand fill to a depth of between 0.8m and 1.0mBGL overlying alluvial sandy clays to at least 7.0mBGL. Below 7m the lithology was coarse sand. No bedrock was encountered. A generalised summary of the subsurface geological profile is presented in Table 1 below.

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**Table 1: Generalised Stratigraphic Log**

Depth (mBGL)	Lithology
0.0-0.7mBGL	Fill – Gravelly Clayey SAND, fine to coarse, grey/brown, gravel fine to medium, low plasticity fines.
0.7-7.0mBGL	ALLUVIAL: Sandy CLAY, dark brown, fine-coarse grained sand, with some fine to coarse grained gravels.
7.0-20.0mBGL(end of hole)	ALLUVIAL: gravelly SAND, fine to coarse grained, orange/brown, fine to coarse grained gravels and low plasticity fines.

Notes: mBGL (metres below ground level)

Detailed borehole logs are attached.

## Drilling Method

A truck mounted drill rig capable of both soil augering and rock drilling was used to dig nine boreholes. All boreholes were logged and then converted into monitoring wells.

## Site Specific Hydrogeology

All of the shallow monitoring wells that were installed to target the perched water within the ash/fill layer did not produce any water. The only well that produced any water was MW01 which was drilled to 20mBGL and into the regional aquifer.

Site specific hydrogeology is summarised in Table 2 below.

**Table 2: Site Specific Hydrology**

Depth to Groundwater	12.75mBGL
Groundwater Occurrence	Possible perched water in all wells except MW01 (Wells MW02-MW09 produced no water). Deeper aquifer in MW01
Gradient and Groundwater Flow Direction	Unknown but possibly south towards Stoney Creek

## Well Development and Purging

### Field parameters

Groundwater field parameters recorded after purging were:

- Dissolved oxygen was 1.02ppm
- pH was 6.62
- redox potential was -11mV
- temperature was 20.8 degrees Celsius



## Laboratory Analysis

Primary samples were analysed by Amdel Laboratories and secondary samples were analysed by ALS Laboratories. Analysis was carried out for TPH, Metals, PAH and VOC.

## Results

The following table indicates analysis above detection limits in MW01 and compares this with the ANZECC trigger values (where available).

**Table 3.1: Groundwater sample results**

Analyte	Concentration in MW01 (µg/L)	ANZECC 2000 Guidelines 95% species Level of Protection, Trigger Values for Freshwater
TPH (C6-C9)	160	n/a
TPH (C10-C14)	100	n/a
TPH (C15-C28)	276	n/a
Total TPH	536	n/a
Cadmium	0.2	0.2
Cobalt	40	90
Chromium	<1	1
Copper	3	1.4
Manganese	1026	1900
Nickel	<b>47</b>	11
Lead	<1	3.4
Strontium	892	n/a
Zinc	<b>32</b>	8
Mercury	<1	0.6
Iron	160	300
Total Nitrogen	<b>1000</b>	500
Total Phosphorus	<b>300</b>	50
Chloroform	6	370
Tetrachloroethene	<b>78</b>	70
Conductivity at 25°C	4300 (µS/cm)	n/a

Notes:

n/a No investigation levels available

Figures in **bold** indicate analysis above trigger value

## Groundwater Impacts

The following summarises the key results of the groundwater monitoring undertaken at the site on 24 August 2005:

- groundwater was encountered at the site at 12.75mBGL;
- Field parameters suggest the groundwater is slightly acidic to neutral, moderately saline, with low dissolved oxygen and a low oxidising potential;
- The shallow monitoring wells (MW02-MW07) that were installed to target a suspected perched groundwater table within the fill/ash layer remained dry after installation. It is possible however that the wells may produce groundwater after a heavy rain event;
- TPH was detected in monitoring wells MW01 at 536µg/L however there are currently no applicable guidelines for TPH in waters;
- Copper and nickel were detected marginally above guideline value in MW01 all other metals were below detection or below guideline level except strontium. There is no guideline level for strontium.
- Chloroform was detected in low levels of 6ug/L and tetrachloroethene was found at 78ug/L. Tetrachloroethene (also known as tetrachloroethylene, perchlorethylene or PCE) and chloroform are used for dry cleaning of fabric and metal degreasing and there is a good chance that they originated from this site considering its previous usage;

### **Tetrachloroethene**

Trichloroethylene (PCE) is a chlorinated ethene used for degreasing, dry cleaning and wool scouring PCE is only slightly soluble in water, biodegrades slowly but does not significantly bio-accumulate. PCE is toxic to aquatic life and a suspected carcinogen.

### **Chloroform**

Chloroform is chlorinated methane which is commonly used as a solvent and for specialty chemicals and as a cleansing agent in dry cleaning. Chloroform is only slightly soluble in water, biodegrades slowly but does not significantly bio-accumulate. Chloroform is toxic to aquatic life and a suspected carcinogen.

### **Potential source**

Groundwater impacts detected at MW01 consist of C6-C28 fractions, which could indicate fuel and oil impacts. Groundwater impacts of tetrachloroethene and chloroform could originate from the textile manufacturing or ammunition manufacturing processes that were formerly carried out on this site.

### **Fate and Transport**

Fate and transport assessment for the site indicates:

- TPH (C10-C28), tetrachloroethene and chloroform impacts at location MW01 within alluvial sands are likely to associated with the former site use;

- Low level impacts of some heavy metals are likely to be a regional trend;
- Groundwater may provide a pathway allowing TPH and solvents to migrate beneath the site

### **Recommendations**

The presence of PCE and chloroform is of concern. Although below or slightly above trigger levels, one borehole and one sample is not sufficient to evaluate the concentration and distribution of the contaminants beneath the site. PB's initial recommendation is to run a day long pumping test to effectively sample a larger area. Samples will be taken at the beginning, middle and end of the pumping. Further drilling is also recommended to establish the contaminant distribution over the larger area.

If you wish to discuss the results or recommendations of this groundwater monitoring round, please contact myself in Newcastle on 4929 3900 or [dmckay@pb.com.au](mailto:dmckay@pb.com.au).

Yours sincerely

A handwritten signature in black ink, appearing to read 'DMckay'.

**David McKay**  
Principal Hydrogeologist  
Parsons Brinckerhoff Australia Pty Limited



# BOREHOLE ENGINEERING LOG

BOREHOLE NO.

**MW01**

SHEET 2 OF 2

Client: Transpacific Industries Group Pty Ltd  
Project: Installation Groundwater Monitoring Wells and Sampling  
Borehole Location: 233 Kyle St, Rutherford, NSW  
Project Number: 2118506A/001

Date Commenced: 15/8/05  
Date Completed: 15/8/05  
Recorded By: SAM  
Log Checked By:

Drill Model/Mounting:

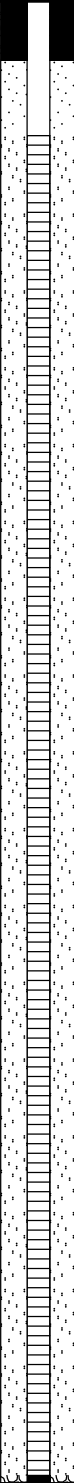

Driller:

Surface RL:

Borehole Diameter:

Driller Lic No:

Co-ords:

Borehole Information							Field Material Description						
1	2	3	4	5	6	7	8	9	10	11	12	13	
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m)	DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY	STRUCTURE AND ADDITIONAL OBSERVATIONS
												VS FB L ST VST H	
WB					11					Gravelly SAND; Fine to coarse grained, orange/brown, fine to coarse grained gravels and low plasticity fines (continued)	M		
				20				END OF BOREHOLE AT 20.00 m					

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

**BOREHOLE ENGINEERING LOG****MW2**

SHEET 1 OF 1

Client: **Transpacific Industries Group Pty Ltd**  
Project: **Installation Groundwater Monitoring Wells and Sampling**  
Borehole Location: **233 Kyle St, Rutherford, NSW**  
Project Number: **2118506A/001**

Date Commenced: **16/8/05**  
Date Completed: **16/8/05**  
Recorded By: **SAM**  
Log Checked By:

Drill Model/Mounting:

Driller:

Surface RL:

Borehole Diameter:

Driller Lic No:

Co-ords:

Borehole Information							Field Material Description					
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m)	DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	STRUCTURE AND ADDITIONAL OBSERVATIONS
											FB VS VL L J MD ST VD H	
TC									SP	FILL; Gravelly Clayey Sand, fine to coarse, grey/brown, gravel fine to coarse, low plasticity fines	M	Fill
					0.70				CL	Sandy CLAY; Medium plasticity, grey mottled orange, sand fine to medium grained	MC>PL	Alluvial
					1							
					2					END OF BOREHOLE AT 2.00 m		

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.



**BOREHOLE ENGINEERING LOG****MW3**

SHEET 1 OF 1

Client: **Transpacific Industries Group Pty Ltd**  
Project: **Installation Groundwater Monitoring Wells and Sampling**  
Borehole Location: **233 Kyle St, Rutherford, NSW**  
Project Number: **2118506A/001**

Date Commenced: **16/8/05**  
Date Completed: **16/8/05**  
Recorded By: **SAM**  
Log Checked By:

Drill Model/Mounting:

Driller:

Surface RL:

Borehole Diameter:

Driller Lic No:

Co-ords:

Borehole Information							Field Material Description					
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m)	DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	STRUCTURE AND ADDITIONAL OBSERVATIONS
											RELATIVE DENSITY /CONSISTENCY	
											FB VL L MD VD	
											VS SL ST VST H	
TC										FILL; Gravelly Clayey Sand, fine to coarse grained, brown/grey, gravel fine to coarse grained, with low plasticity fines	D	Fill
					0.50						M	
					1					Sandy CLAY; Medium plasticity, grey, sand fine to medium grained	MC>PL	Alluvial
					2					END OF BOREHOLE AT 1.80 m		

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.





BOREHOLE NO.

**BOREHOLE ENGINEERING LOG****MW6**

SHEET 1 OF 1

Client: **Transpacific Industries Group Pty Ltd**  
Project: **Installation Groundwater Monitoring Wells and Sampling**  
Borehole Location: **233 Kyle St, Rutherford, NSW**  
Project Number: **2118506A/001**

Date Commenced: **16/8/05**  
Date Completed: **16/8/05**  
Recorded By: **SAM**  
Log Checked By:

Drill Model/Mounting:

Driller:

Surface RL:

Borehole Diameter:

Driller Lic No:

Co-ords:

Borehole Information							Field Material Description					
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m)	DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	STRUCTURE AND ADDITIONAL OBSERVATIONS
											RELATIVE DENSITY /CONSISTENCY	
											FB VL L MD VS FL ST VST D H	
TC					0.20					FILL; Sandy Gravel (Ash), fine to coarse grained, grey, sand fine to coarse grained  Sandy CLAY; Medium plasticity, grey, sand fine to coarse grained	M	Ash Fill  Alluvial
										END OF BOREHOLE AT 1.50 m		

# BOREHOLE ENGINEERING LOG

BOREHOLE NO.

**MW7**

SHEET 1 OF 1

Client: **Transpacific Industries Group Pty Ltd**  
 Project: **Installation Groundwater Monitoring Wells and Sampling**  
 Borehole Location: **233 Kyle St, Rutherford, NSW**  
 Project Number: **2118506A/001**

Date Commenced: **16/8/05**  
 Date Completed: **16/8/05**  
 Recorded By: **SAM**  
 Log Checked By:

Drill Model/Mounting:

Driller:

Surface RL:

Borehole Diameter:

Driller Lic No:

Co-ords:

Borehole Information							Field Material Description					
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m)	DEPTH(m)	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY /CONSISTENCY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VS	FB	VL	LD	ST	MD	VS	VS	VS	VS	VS	VS	VS
TC								MC	TOPSOIL; Sandy Silty, pale brown, sand fine to medium grained	D		Topsoil
					0.20				Sandy CLAY; Medium plasticity, orange, fine to medium grained	MC>PL		Alluvial
					1							
					2				END OF BOREHOLE AT 2.00 m			

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.



BOREHOLE NO.

**BOREHOLE ENGINEERING LOG****MW8**

SHEET 1 OF 1

Client: **Transpacific Industries Group Pty Ltd**  
Project: **Installation Groundwater Monitoring Wells and Sampling**  
Borehole Location: **233 Kyle St, Rutherford, NSW**  
Project Number: **2118506A/001**

Date Commenced: **16/8/05**  
Date Completed: **16/8/05**  
Recorded By: **SAM**  
Log Checked By:

Drill Model/Mounting:

Driller:

Surface RL:

Borehole Diameter:

Driller Lic No:

Co-ords:

Borehole Information							Field Material Description					
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m)	DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	STRUCTURE AND ADDITIONAL OBSERVATIONS
											RELATIVE DENSITY /CONSISTENCY	
											FB VL L MD VD	
											VS SL ST VST H	
TC										FILL; Silty Gravelly Sand, fine to coarse grained, dark brown, gravel fine to coarse grained, low plasticity fines	D	Fill
					1.00					Sandy CLAY; Medium plasticity, orange/red, sand fine to medium grained		Alluvial
					2					END OF BOREHOLE AT 2.20 m		

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.

**BOREHOLE ENGINEERING LOG****MW9**

SHEET 1 OF 1

Client: **Transpacific Industries Group Pty Ltd**  
Project: **Installation Groundwater Monitoring Wells and Sampling**  
Borehole Location: **233 Kyle St, Rutherford, NSW**  
Project Number: **2118506A/001**

Date Commenced: **16/8/05**  
Date Completed: **16/8/05**  
Recorded By: **SAM**  
Log Checked By:

Drill Model/Mounting:

Driller:

Surface RL:

Borehole Diameter:

Driller Lic No:

Co-ords:

Borehole Information							Field Material Description					
1	2	3	4	5	6	7	8	9	10	11	12	13
METHOD	SUPPORT	WATER	WELL CONSTRUCTION	RL(m)	DEPTH(m)	FIELD TEST	SAMPLE	GRAPHIC LOG	USC SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	STRUCTURE AND ADDITIONAL OBSERVATIONS
											RELATIVE DENSITY /CONSISTENCY	
											FB VL L MD VD	
											VS SL ST VST H	
TC										FILL; Gravelly Sandy Clay, medium plasticity, brown, sand fine to coarse grained, gravel fine to coarse grained	MC>PL	Fill
					0.70					Sandy CLAY; medium plasticity, orange/brown, sand fine to medium grained		Alluvial
					1							
					2					END OF BOREHOLE AT 2.00 m		

This borehole log should be read in conjunction with Parsons Brinckerhoff's accompanying standard notes.



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**ABN 84 797 323 433**  
NCSI Certified Quality System ISO 9001

Our reference: 2118506A\_PR\_1295

Your reference:

21 November 2005

Tibor de Jong  
Transpacific Industries Pty Ltd  
PO Box 1824  
Milton  
Queensland 4064

Dear Tibor

## Re Further Groundwater investigation

### Background

In August 2005 a borehole was drilled to a depth of 20 metres below ground level (mBGL) in the alluvium underlying the Kyle Street site. This borehole was converted to a monitoring well (MW10<sup>1</sup>) for monitoring groundwater (for details see PB Report 2118506A\_PR\_1119 dated 20 September 2005)

Analysis of groundwater sampled from MW10 on 24 August 2005 identified low levels of contamination in the groundwater for Total Petroleum Hydrocarbons (TPH) and Volatile Organic Compounds (VOCs). **Table 1** summarises the results of groundwater analysis of a sample taken from MW10<sup>1</sup>.

**Table 1 Groundwater sample results (24/8/05)**

Analyte	Concentration in MW10 (µg/L)	ANZECC 2000 Guidelines 95% species Level of Protection, Trigger Values for Freshwater
TPH (C <sub>6</sub> -C <sub>9</sub> )	160	n/a
TPH (C <sub>10</sub> -C <sub>14</sub> )	100	n/a
TPH (C <sub>15</sub> -C <sub>28</sub> )	276	n/a
Total TPH	536	n/a
Chloroform	6	370
Tetrachloroethene (TeCE)	<b>78</b>	70

Notes:

n/a No investigation levels available

Figures in **bold** indicate analysis above trigger value

<sup>1</sup> Monitoring Well **MW01** has been renamed **MW10** in this report as this was the number that was entered on the Laboratory Chain of Custody and therefore the Laboratory Certificate of Analysis (included as an attachment to this report). Any reference to **MW10** or to **MW01** is a reference to the same well.

## Scope

Given the site was previously used for textile manufacture for nearly 50 years and Tetrachloroethene is used in this process for dry cleaning then the presence of TeCE in groundwater may well have derived from this site or the adjacent site, which was also part of the textile manufacturing works.

PB was commissioned by Transpacific Industries Pty Ltd in September 2005 to construct two additional on-site wells into the alluvium to establish the groundwater gradient and to further sample groundwater in the alluvium.

Two additional groundwater monitoring wells were installed in November 2005. These wells were subsequently developed and all three monitoring wells were sampled on the 11 November 2005

## Site Specific Geology

The geology of the two new wells is summarised in Table 2:

**Table 2 Generalised Stratigraphic Log**

Depth (mBGL)	Lithology
0.0-0.9 mBGL	Fill – Gravely Clayey SAND, fine to coarse, grey/brown, gravel fine to medium, low plasticity fines.
0.9-7.0 mBGL	ALLUVIAL: Sandy CLAY, dark brown, fine-coarse grained sand, with some fine to coarse grained gravels.
7.0-15.0 mBGL	ALLUVIAL: gravely SAND, fine to coarse grained, orange/brown, fine to coarse grained gravels and low plasticity fines.

Notes: mBGL (metres below ground level)

## Drilling Method

The wells were constructed using direct flush rotary drilling with a guar gum additive to prevent collapse. Well screen (50mm ID) was installed between 12 and 15 mBGL with plain (unslotted) casing above. Groundwater was encountered between 12 and 13 mBGL. The wells were subsequently developed by pumping with a Grundfos MP1 electric submersible pump.

## Laboratory Analysis

All three wells (MW10, MW11 and MW12) were purged using the Grundfos MP1 pump for approximately 30 minutes or until pH and electrical conductivity (EC<sub>25</sub>) stabilised. Samples (MW10A, MW11 and MW12) were then taken using a dedicated disposable bailer. Analysis was carried out for TPH and VOC only. One additional sample (MW10B) was taken from MW10 after an additional period of 30 minutes pumping to gauge whether the concentrations of contaminants varied with time. A sample was also taken of the water that was supplied by the drillers and used as a drilling fluid.



## Results

The following table indicates analysis above detection limits in MW10 and compares this with the ANZECC trigger values (where available).

**Table 3 Groundwater sample results**

Analyte	Concentration (µg/L)						Drill Fluid	ANZECC (2000 )
	MW10	MW10 'A'	MW10 'B'	MW11	MW12			
Date	24/8/05			11/11/05				
TPH (C <sub>6</sub> -C <sub>9</sub> )	160	130	57	<	<	25		n/a
TPH (C <sub>10</sub> -C <sub>14</sub> )	100	<	<	<	<	<		n/a
TPH (C <sub>15</sub> -C <sub>28</sub> )	276	<	<	<	<	<		n/a
Total TPH	536	<	<	<	<	<		n/a
Chloroform	6	<	<	26	29	68		370
Tetrachloroethene (TeCE)	<b>78</b>	<b>110</b>	42	<	<	<		70
Trichloroethene (TCE)	<	<	5	<	<	<		330

Notes:

n/a No investigation levels available

Figures in **bold** indicate analysis above trigger value

Guidelines 95% species Level of Protection, Trigger Values for Freshwater

< below detection level

## Groundwater Impacts

The following summarises the key results of the groundwater monitoring undertaken at the site on 11 September 2005:

### Tetrachloroethene (TeCE)

Tetrachloroethene (TeCE - also known as perchloroethene – PeCE or “Perc”) is a dense chlorinated organic solvent used for degreasing, dry cleaning and wool scouring. TeCE is only slightly soluble in water, biodegrades slowly but does not significantly bio-accumulate. TeCE is toxic to aquatic life and a suspected carcinogen.

The levels of TeCE are low and TeCE was only detected in MW10 (from 24/8/05 and samples 'A' and 'B'). Samples taken from MW10 indicate the presence of TeCE and in two out of three samples were marginally above the ANZECC Guideline Levels (for comparison the drinking water guideline for TeCE is 50µg/L).

## **Trichloroethene (TCE)**

Trichloroethene (TCE – also known as Trichloroethylene or 1,1,2 Trichloroethylene) is a degradational product of TeCE and is also a dense chlorinated organic solvent. Trichloroethene is only slightly soluble in water, biodegrades slowly but does not significantly bio-accumulate. Trichloroethene is toxic to aquatic life and a suspected carcinogen.

In only one sample analysed (MW10B) was TCE detected and only at a level significantly below guideline levels.

## **Chloroform**

Chloroform (also known as trichloromethane) is chlorinated methane which is commonly used as a solvent and for specialty chemicals and as a cleansing agent in dry cleaning. Chloroform is only slightly soluble in water, biodegrades slowly but does not significantly bio-accumulate. Chloroform is toxic to aquatic life and a suspected carcinogen.

Chloroform was detected in the water used for drilling and in wells MW11, MW12 and the original sample taken from MW10 (24/8/05). However it was absent from subsequent samples taken from MW10. It is therefore possible that the source of the chloroform was the drilling water. The analysis indicated only very low levels of chloroform which were significantly below the ANZECC guideline levels (and at a level significantly below the drinking water standard of 250µg/L)

## **TPH**

The TPH (C<sub>10</sub>-C<sub>28</sub>) observed in MW10 in August was not observed in any of the samples taken in September. The reason for this is unknown. The TPH (C<sub>6</sub>-C<sub>9</sub>) fraction observed in MW10 (Samples A and B) was reported by the lab to be primarily composed of TeCE and in the drilling water to be primarily chloroform. Consequently, apart from the low levels of TeCE, TCE and chloroform there appear to be no other organic contaminants detected in the groundwater.

## **Fate and Transport**

### **Groundwater flow**

The datum levels of all three wells were surveyed to a reduced level (RL) in meters above Australian Height datum (m.A.H.D.). The relative heights of the groundwater table at the three locations were then able to be compared (see **Figure 1**).

The levels were found to be nearly identical with only 2cm difference over a distance of approximately 150m. This suggests a groundwater gradient of 10<sup>-4</sup> which, assuming a hydraulic conductivity of 10m/d, suggests a groundwater flow velocity of just 10<sup>-3</sup> m/d (1mm/d). The flow direction is not possible to determine (or contour) from the available data because of the little or no difference between the levels. However, from the limited data available a groundwater flow direction towards the south seems possible.

## **Recommendations**

The presence of chlorinated solvents in the groundwater is undesirable, the measured levels are very low, hydraulic movement appears minimal and the risks to health and the environment are extremely low. The following recommendations are provided to increase the level of knowledge about the groundwater flow direction and the concentration of contaminants:

- To carry out further quarterly monitoring of all wells with sampling and analysis for VOCs;
- To carry out a longer term pumping test of MW10 to further investigate the variation of contaminant concentration with time. This method enables a greater volume of groundwater to be sampled;
- Monthly measurement of groundwater levels to see if there is any season variation in the water table and determine the groundwater flow direction

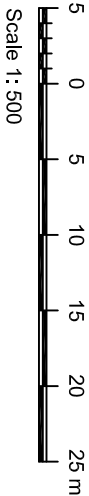
If you wish to discuss the results or recommendations of this groundwater monitoring round, please contact myself in Newcastle on 4929 3900 or [dmckay@pb.com.au](mailto:dmckay@pb.com.au).

Yours sincerely

### **David McKay**

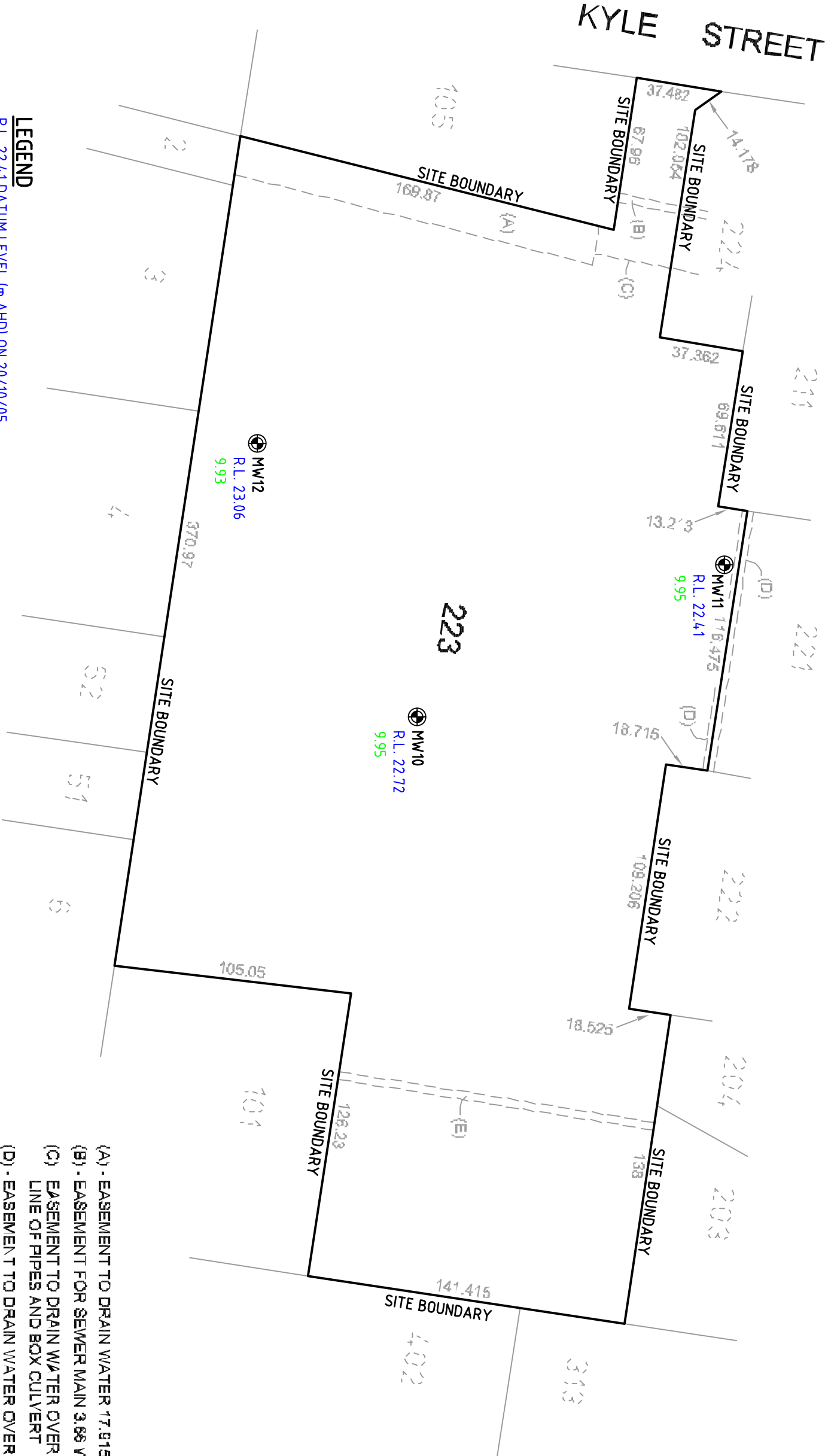
Principal Hydrogeologist  
Parsons Brinckerhoff Australia Pty Limited

Client: Transpacific Industries  
Project: Groundwater Investigation  
Location: Lot 223 Kyle Street, Rutherford



**LEGEND**  
R.L. 22.41 DATUM LEVEL (m AHD) ON 20/10/05  
⊕ MW10 - MONITORING WELL LOCATION AND IDENTIFICATION  
RECORDED LEVEL ON 20/10/05

- (A) - EASEMENT TO DRAIN WATER 17.815 WIDE
- (B) - EASEMENT FOR SEWER MAIN 3.66 WIDE
- (C) EASEMENT TO DRAIN WATER OVER EXISTING LINE OF PIPES AND BOX CULVERT
- (D) - EASEMENT TO DRAIN WATER OVER EXISTING LINE OF PIPES AND BOX CULVERT
- (E) - EASEMENT FOR SEWER MAIN 3.66 WIDE



Site Plan  
Figure 1