

Appendix A References

1. June 1996, "Railway Agreement in Relation to Non-Metropolitan Railways of the State of South Australia, the Commonwealth of Australia and the State of South Australia", 11505602. (to be used as a guide outside the state of South Australia).
2. November 1996, "Investigation Scope Definition Overview and Generic Work Plan for Australian National Projects", Prepared by Rust-PPK, Sinclair Knight Merz & Woodward-Clyde, AN_1_V11.doc.
3. September 2000, "Independent Environmental Audit – Canberra (ACT)", prepared by Indec Consulting, Canberra 04.Doc.
4. March 1998, "Environmental Audit of the Australian National Facilities, Canberra Railway Station Yards and Rail Corridor". 16 March 1998 Document No. 27K009A 98-182.DOC.
5. November 1998, "Phase II Environmental Site Assessment, Canberra Railway Station and Rail Corridor". 12 November 1998, Document No. 27K140A 98-845.DOC.
6. January 1999, "Report on Further Soil and Groundwater Investigations, Canberra Railway Station and Rail Corridor". 14 January 1999, Document No. 7K140B 99-014.DOC.
7. December 1999, "Report on Further Environmental Site Investigation and Site remedial Works, Canberra Railway Station Yards and Corridor". 17 December 1999, Document No. 27K140C 99-0885-00.DOC.

Appendix B
Major Site Review Checklist and
Conformance Report

The Commonwealth of Australia – Procedure for the transfer of former Australian National Land

Major Site Review. This checklist and conformance report has been developed in accordance with Clause 7 of the Railways Agreement signed on 30 June 1997 by the Commonwealth and South Australian Transport Ministers.

The checklist provides guidance for EPA accredited auditors, appointed as reviewers, to check the conformance of available reports for Major Sites as defined by the Commonwealth, pursuant to Clause 7 of the Agreement. In addition to the Reviewers experience the following references shall be taken into account for the purpose of the review:

1. The agreements between the ACT Government and the Commonwealth Government regarding the remediation standards for the Canberra railway site.
2. Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites, ANZECC/NHMRC, January 1992.
3. Protocol for the Health Risk Assessment and Management of Contaminated Sites, Contaminated Sites Monograph Series No. 2, 1993.
4. Identification and Assessment of Contaminated Land, Improving Site History Appraisal, Contaminated Sites Monograph Series No. 3, 1994.
5. Protocol for the Health Risk Assessment and Management of Contaminated Sites, Contaminated Sites Monograph Series No. 5, 1996.
6. Draft Australian Standard - Analysis of Soils, Part 1: The Sampling of Potentially Contaminated Soil, Standards Australia, 1995.
7. The Generic Work Plans for Australian National Projects, 15 November 1996.
8. The covering memorandum to this checklist outlining the methodology to be applied in its use.
9. The specific site scope of works developed for each site.

ASSESSOR (Name & Signature) <div style="background-color: #cccccc; padding: 5px; font-size: 1.2em; font-weight: bold;">Schedule 2.2(a)(ii)</div>	JOB NUMBER: 13017-011-561	JOB TITLE: MAJOR SITE REVIEW - CANBERRA
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f WARREN PUMP

INDEC CONSULTING

MAJOR SITE REVIEW CHECKLIST AND CONFORMANCE REPORT

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Issue 1.0 Revision A

Date: 15 December 2000

LIST OF REPORTS / CORRESPONDENCES	REPORT IDENTIFIER / DATE	INITIAL DOCUMENTS REVIEWED	COMMENTS ON PROVENANCE / CONTENTS / RELATIONSHIP OF DOCUMENTS
"Environmental Audit of the Australian National Facilities, Canberra Railway Station Yards and Rail Corridor".	16 March 1998 Document No. 27K009A 98-182.DOC.	A	Initial environmental audit report which was carried out to identify activities at the site which have the potential to result in contamination of the land.
"Phase II Environmental Site Assessment, Canberra Railway Station and Rail Corridor".	12 November 1998, Document No. 27K140A 98-845.DOC.	B	First phase of soil and groundwater investigations of the main issues identified in the environmental audit report.
"Report on Further Soil and Groundwater Investigations, Canberra Railway Station and Rail Corridor".	14 January 1999, Document No. 7K140B 99-014.DOC.	C	Second phase of soil and groundwater sampling to assist in delineation of the identified contamination issues.
"Report on Further Environmental Site Investigation and Site remedial Works, Canberra Railway Station Yards and Corridor".	17 December 1999, Document No. 27K140C 99-0885-00.DOC.	D	Third phase of soil and groundwater sampling to attempt to assess the significance of the identified contamination issues and to collect additional information on the soil and groundwater quality. Assessment of 'hot spot' areas also included contaminant fate and transport modelling and applying the results of a health risk assessment of undertaken for the Port Pirie Railyard site.

SPECIFICATION	REFERENCE (e.g. 'A' or '3')	COMMENTS	CONFORMANCE STATUS
<p>1. Phase 1</p> <p>Given scope definition, site history, and site activities, has the investigation been in accordance with Ref 5. Specifically, were the following adequately addressed for the potential risks at the site:</p> <ul style="list-style-type: none"> - Site description and definition - Current/Previous owners occupiers & users - Raw materials/products (inc. storages) - Wastes produced/disposal locations - Discharges and spills to land and water - Site geology, hydrogeology & catchment characteristics - Adjacent land uses. 	A, B, C, D, 3, 5	<p>Site description and definition There has been a detailed definition of the site description in Ref A , s2.1. However the site plan provided in Ref A Appendix B does not clearly identify the site boundary. The site boundary is assumed to be as illustrated in Ref B Appendix B, which illustrates a bold outline of the boundary of the site which is being investigated.</p> <p>Current/Previous owners occupiers & users Ref A s2.0 and s3.0 has identified the history of the site adequately to assist in identifying activities which have the potential to result in land contamination of the site.</p> <p>Raw materials/products (inc. storages) Ref A s5.4 has identified areas of the site where raw materials and products have been stored. It is also noted that the site history assessment has been able to identify the areas of the site which stored significant materials storages (such as the old refuelling depot).</p> <p>Wastes produced/disposal locations Ref A s 5.4 attempts to identify the areas which have been highlighted to PPK during the environmental audit. It is assumed that all the areas known to former employees of AN and associated areas have been pointed out to PPK. It is also possible that previously (historic) unidentified areas, containing filling, may exist in minor quantities which have not been identified during the various phases of the assessment. However, it is unlikely that these areas are likely to impact upon continued railway use of the site.</p>	<p>S</p> <p>S</p> <p>S</p> <p>S</p>

SPECIFICATION	REFERENCE (e.g. 'A' or '3')	COMMENTS	CONFORMANCE STATUS
		<p>Discharges and spills to land and water Ref A s5.4 highlights the various areas of the site where discharges and spills have occurred at the site. As indicated above, there maybe other areas not highlighted to PPK during this assessment. These areas (if any) are likely to be minor issues and are unlikely to impact upon continued railway use of the site.</p> <p>Site geology, hydrogeology & catchment characteristics Ref A s5.1, 5.2, 5.3 discuss the environmental setting of the site including the topography, local geography and hydrogeology, local soil types and geology. There is no reference to an assessment of retained records for existing and nearby groundwater bores. It is noted however, in Ref 4 s9.3.3 there is a reference that there are licensed groundwater abstraction wells. Also it is from the investigation phases of the assessment that regional groundwater flow direction from all areas of the site is towards the Jerrabomberra Creek. There is no reference to the likely beneficial use of the groundwater, however, this is further discussed in Ref B, C and D.</p> <p>Adjacent land uses. There is no specific section in Ref A which outlines the surrounding land uses. However, these have been highlighted in various sections throughout the whole report. There is a specific section in Ref B s3.0 and s3.2 which addresses the specific uses surrounding the site.</p> <p>Summary Overall, the issues addressed in the Phase I assessment generally comply with the requirements of Ref 5.</p>	<p>S</p> <p>S</p> <p>S</p>

SPECIFICATION	REFERENCE (e.g. 'A' or '3')	COMMENTS	CONFORMANCE STATUS
<p>2. Phase 2</p> <p>Given the continued use of the site, scope definition, and works from Phase 1, was the Phase 2 program adequate from a risk based perspective. Did the sampling program:</p> <ul style="list-style-type: none"> - Meet the requirements of Ref. 8 - Meet the requirements of Ref. 10 - Adequately define the vertical and lateral extent of identified potential contaminants. 	B, C, D, 8, 10	<p>The scope of work performed and documented in Refs B, C & D generally conformed with the requirements of Ref 8 & 10. However, the Phase 1 has highlighted other areas which have the potential to impact identified receptors at the site. These have not been further investigated as part of the Phase 2 and include:</p> <ul style="list-style-type: none"> • The filling of the former railway turntable. This issue was highlighted in the environmental audit report; • USTs (now removed) were located in the former abattoir site, immediately east of Newcastle Street. It is presumed that the abattoir site is not part of the site; • Potential for fragments of asbestos sheeting to exist in the surface soils was highlighted in the environmental audit and no assessment was performed; • Oily wastes being disposed into the stormwater drain at the ARHS site. This issue was raised in the environmental audit report and no further assessment has been performed; • The environmental audit report identified filling east of the Jerrabomberra Creek north and adjacent to the railway alignment. The filling, as illustrated in the aerial photo was similar to the vacant dump site area; • Significant staining of the soils by petroleum hydrocarbons was noted along-side the fuel depot sidings during the environmental audit of the site. No further assessment of these soils was undertaken. It is assumed that the sidings are located on railway land; and 	MNC

SPECIFICATION	REFERENCE (e.g. 'A' or '3')	COMMENTS	CONFORMANCE STATUS
		<ul style="list-style-type: none"> Black oily waste was observed during the environmental audit in a drainage alignment adjacent to the Shell depot. There was no further assessment of these areas noted in the later environmental site assessment reports. <p>These areas only have the potential to be an issue if significant contamination is present.</p> <p>During assessment of the former refuelling area groundwater monitoring bore GW304 reported a concentration of TPH C6-C9 at 63,000 ug/L. Assessment of the chromatogram indicated that this petroleum hydrocarbon was not derived from the same source as the former refueling area (which was predominantly used for storage and dispensing diesel). The significance of this contamination was also assessed using the fate and transport model, which indicated that there is likely to be no future risks associated with this contamination. However, there has been no further explanation of the presence of this contamination. It is recommended that the results be reviewed to address this anomaly.</p> <p>Ref B s4.0 (first bullet point) makes reference to "heavy metals and PAHs from power station foundry operations and past on-site disposal of foundry wastes". There has been no further reference to this point in any other of the reports and there has been no assessment of this identified in the reports.</p>	<p>MNC</p> <p>MNC</p>
<p>3. Soil Sampling Grid/Pattern</p> <p>On the basis of questions 1 and 2, did the sampling grid or pattern adequately define contaminant issues and therefore provide for a baseline set of data for the site.</p>	<p>B, C, D, 3, 7, 8 & 10</p>	<p>Based on the areas investigated during the Phase 2 assessments (Ref B, C, D) and the requirements of Refs 3 & 7 the sampling programs undertaken were satisfactory to provide a baseline set of data for the issues investigated.</p> <p>As mentioned in Question 2 above, there are number of issues</p>	<p>S</p>

SPECIFICATION	REFERENCE (e.g. 'A' or '3')	COMMENTS	CONFORMANCE STATUS
		<p>identified where there was no further clarification or assessment documented in the Phase 2 reports (Refs B, C, D).</p> <p>Other minor issues to note include:</p> <ul style="list-style-type: none"> Ref D s7.6.1, there were test pit logs provided for the excavations around the USTs adjacent to William Edmunds Plumbers. 	MNC
<p>4. Analytes</p> <p>Given the potential sources/contaminating activities identified in Phase 2, were the range of analytes reported appropriate.</p>	B, C, D, 3, 7, 8 & 10	<p>In most cases investigated the analytes selected were appropriate. However, the analyte list in the following areas is considered to be deficient :</p> <ul style="list-style-type: none"> The main vacant dump site. Although no significant putrescible domestic fill was encountered during the test pitting exercise, there are indications that the groundwater quality has been impacted by leachate generated by the decomposition of putrescible wastes. Traces of cyanide were also detected in GW206 above the guidelines for protection of fresh water ecosystems. It is recommended that groundwater quality be monitored for typical landfill leachate parameters, as well as other parameters identified in previous monitoring. Typical landfill leachate parameters include COD, BOD, Nitrate (N), Ammonia, pH, Kjeldahl nitrogen, sulphate, phosphate, major anions and cations (it is noted that some of these parameters were tested). Ref B, s5.3 review of the COCs indicated that no soil samples were analysed for VOCs or cyanide. Ref B, C & D, there is no evidence in the reports that trip blank samples were collected and placed in sample coolers for primary samples being analysed for VOCs (such as BTEX). 	<p>MNC</p> <p>MNC</p> <p>MNC</p>

SPECIFICATION	REFERENCE (e.g. 'A' or '3')	COMMENTS	CONFORMANCE STATUS
<p>5. Groundwater Investigations</p> <p>Were the identified potential groundwater problems adequately investigated:</p> <ul style="list-style-type: none"> - In terms of procedures used (drilling techniques, well construction etc.) - In terms of definition of lateral and vertical extent of identified contaminant plumes. - Have beneficial use(s) of the groundwater been adequately defined. - Correct well construction used? (taking into account possible presence of LNAPL's & DNAPL's) 	B, C, D, 3, 5, 6, 7, 8 & 10	<p>Identification of beneficial uses Assessment of the groundwater beneficial use has been carried in general accordance with the recognised guidelines.</p> <p>Bore location and construction techniques The location and construction of the bores has been carried in general accordance with the nominated references for the assessment of LNAPLs. There was no evidence during the assessment that DNAPLs exist at the site.</p> <p>Groundwater levels, contours and flow direction Assessment of the interpreted groundwater levels, contours and flow directions has indicated that the standing water level (SWL) reduced levels (RLs) do not correlate with the contours interpreted in the various groundwater maps provided in Refs B & D.</p> <p>The assumed groundwater flow directions are generally correct. However, there are a number of localised variations in the levels and flow directions noted which effect the groundwater flow gradients, and those assumed in the groundwater modelling.</p> <p>There was no information Refs B, C, D to suggest that the groundwater bores were surveyed to AMG coordinates. It is assumed that the bores were surveyed to locate their position.</p>	<p>S</p> <p>S</p> <p>MNC</p>
<p>6. Groundwater Remediation</p> <p>Where groundwater contamination was identified, were the investigations sufficient to enable development of appropriate groundwater remediation strategies, eg.:</p> <ul style="list-style-type: none"> - Were the source identified 	D, 1, 2, 3, 6, 8 & 10	Levels of TPHs in the area of the former refuelling area were identified containing phase separated hydrocarbons (PSHs). It was estimate that approximately 50 litres of PSH was floating on the groundwater table. Removal of the PSH was performed using a 'pig-sock' which extracted approximately 5 litres of PSH. There was no further information presented in Ref D which discussed the status of the remaining PSH (if any).	MNC

SPECIFICATION	REFERENCE (e.g. 'A' or '3')	COMMENTS	CONFORMANCE STATUS
<ul style="list-style-type: none"> - Were the variables of plume geometry clear - Were aquifer characteristics adequately defined - Were pilot studies, if appropriate, conducted. 		<p>Concentrations of dissolved phase TPHs in the former refuelling area were also modelled to assess the likely fate and transport of this remaining contamination. The following comments are provided regarding modelling performed:</p> <ul style="list-style-type: none"> • The reduced groundwater levels shown in Appendix L Ref D are satisfactory. However, four bores GW6, GW8, GW103 and GW104 and GW105 were gauged and sampled on the 1/3/1999 and 18/8/1999 while the remainder were sampled around 15/5/1999. The levels from bores GW6, GW8, GW103, 104 and 105 taken on the 18/8/1999 were used against other bores dated 15/5/1999. The effect on the data are not considered to be too significant but it indicted loose data presentation; • The water levels recorded on the Groundwater Field Parameter sheets (Appendix I, Ref D) are reported as Depth to groundwater from TOC (m). In the table of Ref D Appendix L (Well Gauging Data) some of the measurements are reported as Top of Survey Point and some are reported as Top of Casing – there is no record of which is which on the parameter sheets; • When the reduced water levels are plotted against their corresponding bores and groundwater contours are re-drawn, the groundwater contour maps for both the Figures 8 and 9 (Ref D) are vastly different and the contours shown on these Figures in the report greatly oversimplify the data reported. While this may have no major impact on the final outcome (because the hydraulic conductivity of the aquifer is so low) the figures do not illustrate “actual” groundwater flow lines (direction and length of flow lines) – importantly from areas of contamination where groundwater mounding has an impact; • Hydraulic conductivity testing of five (5) bores across an area as 	MNC

SPECIFICATION	REFERENCE (e.g. 'A' or '3')	COMMENTS	CONFORMANCE STATUS
		<p>large as the site shown in Figure 8 (Ref D) is not considered to be adequate to get a representative range of aquifer parameters – this is not a major problem in this case as the result of the five tested are within one order of magnitude;</p> <ul style="list-style-type: none"> • The use of conservative values for both the hydraulic conductivity, hydraulic gradient and decay constant for the 1-D model is acceptable; • The sensitivity analysis of the 1-D model is only limited to two dispersion coefficient values, it would have been good to see some analysis of effects of different hydraulic conductivities since there were only a relatively small number of hydraulic conductivity test done on the site; • The initial source concentration for the model was set at 10,000 units. Testing reported free product in some bores. It is likely that dissolved phase THP in groundwater below the free phase would have TPH concentrations at saturation, i.e. at least one order of magnitude greater than that modelled. Further sensitivity testing of the model is recommended at the higher TPH concentrations. • Based on the outcome of the above recommendation, the fate of a contamination plume should be assessed in terms of the groundwater flow lines resulting from actual site conditions not a generalised groundwater flow pattern (as shown in Figures 8 & 9), the conclusions should then be made on that basis. <p>Ref B s6.8, Ref C s2.3.1, there is reference to elevated levels of mercury and lead in a number of the groundwater bores, but there is no further explanation of the possible source of these chemicals. It was also noted in some cases at concentrations above the drinking water guidelines and protection of aquatic ecosystem guidelines.</p>	MNC

SPECIFICATION	REFERENCE (e.g. 'A' or '3')	COMMENTS	CONFORMANCE STATUS
<p>7. QA/QC Procedures</p> <p>Were appropriate QA/QC procedures, (inc. work plan reqt's) followed, (see Table A3.1 of Generic work plan), including:</p> <ul style="list-style-type: none"> - Chain of custody forms included - Duplicates , (sufficient & acceptable limits) - Interlaboratory samples accept. Limits 10% - Trip blanks, (acceptable limits (20% mean for background samples or PQL) - NATA accredited methods 	B, C, D, 3, 7, 8 & 10	<p>The results of the assessment of the QA/QC program generally satisfied the requirements outlined in the reference documents. However, the following comments are provided:</p> <ul style="list-style-type: none"> • Ref C, 10% of the samples were checked for analysis within the nominated holding times. It was identified that some samples were analysed outside of the holding times. • Ref C Appendix H, the result for the rinsate blank (report no. 8E02410 page 22 of 24 Lab No, 65606) which is assumed to be a rinsate sample from groundwater sampling equipment had elevated levels of VOCs, and there was no explanation provided in the report. 	<p>MNC</p> <p>MNC</p>
<p>8..Investigation Levels</p> <p>Were the soil and groundwater analytical results compared with appropriate guideline concentrations, eg.:</p> <ul style="list-style-type: none"> - Definition of potential receptor confirmed (industrial workers in most cases) - Appropriate guidelines selected - Comparison of analytical results adequate. - 'Outliers' properly addressed 	B, C, D, 3, 5, 6, & 8.	<p>Comparison of the results of the soil and groundwater samples with the relevant guideline levels were generally within the requirements of the reference documents. However, the following comments are provided:</p> <ul style="list-style-type: none"> • Ref B s6.7. It was assessed that groundwater quality would be suitable for drinking water purposes on the basis of TDS. The guidelines adopted in Ref B are "Australian Drinking Water Standards (Draft 1994/Draft 1995). The current suggested guidelines for drinking water purposes are understood to be the "NHMRC/ARMCANZ 1996 Drinking Water Health & Aesthetic Guidelines". It was later identified that the later criteria were used in Ref D. • Ref B s6.7. It was also assessed that for groundwater discharging to the aquatic environment of the Jerrabomberra Creek, the groundwater quality would also be compared with the ANZECC Australian Water Quality Guidelines for Fresh and Marine Waters (Livestock and Irrigation Standards). The guidelines suggested for groundwater discharging to fresh water ecosystems (which is understood to be the case for the 	<p>MNC</p> <p>MNC</p>

SPECIFICATION	REFERENCE (e.g. 'A' or '3')	COMMENTS	CONFORMANCE STATUS
		<p>Jerrabomberra Creek) are the ANZECC Australian Water Quality Guidelines - Protection of Aquatic Ecosystems (Fresh Water).</p> <ul style="list-style-type: none"> • There was no comparison of the soil results with Environmental B levels for the purpose of assessing the impact on ecological receptors. However, given that the site environment is likely to be significantly modified and that there are unlikely to be any significant ecological receptors, this is not likely to be an issue. • Ref D 7.1.3, an assessment criteria for TPH (C10-C36) in groundwater of 5,000 ug/L has been used. It is referenced in Ref D s6.6.2 that the DIL for groundwater would be used and the actual criteria for TPH C10-C36 is 600 ug/L in groundwater. 	<p>S</p> <p>MNC</p>
<p>9..Phase 3 Remediation Strategies</p> <p>For identified contamination, were/are phase 3 remediation strategies appropriate, eg.:</p> <ul style="list-style-type: none"> - Were target clean-up criteria appropriate - Did the remediation strategies offer reasonable technical solutions to identified contamination. <p>If remediation not yet complete: will the remediation technology being adopted achieve the final remediation goal in the time frame proposed. Factors: time, area, likely residual contamination.</p>	<p>D, 1, 2, 3, 8 & 10.</p>	<p>Refer to Question 6 above.</p>	
<p>10.. Health and Ecological Risk Assessment</p> <p>Given the identified receptors to be protected, (usually on-site rail workers, but being cognisant of possible off-site impacts), were quantitative/ semi-quantitative risk assessment works</p>	<p>D, 1, 2, 3, 4, 6, 8 & 10</p>	<p>Concentrations of metals (lead and zinc) were identified at levels exceeding the adopted criteria for continued railway use. The area was limited in vertical and lateral extent (less than approximately 10 square metres in area and within a depth of 1 metre). The concentrations of zinc were subsequently identified to be within the</p>	<p>S</p>

SPECIFICATION	REFERENCE (e.g. 'A' or '3')	COMMENTS	CONFORMANCE STATUS
<p>appropriate, specifically:</p> <ul style="list-style-type: none"> - Have all COC been considered - Are assessment criteria appropriate - All major exposure and pathways covered - Model inputs appropriate - Toxicological data suitable - Exposure parameters appropriate - Ecological and health receptors considered - Discussion of uncertainty included? - Where appropriate to the scope, have aesthetic issues including odours been adequately addressed. 		<p>NEHF, 1998 assessment criteria for 'hot-spots'. The concentration of lead was compared to the health risk assessment (for lead contamination in soils) performed for the Port Pirie Rail Yards. The parameters (exposure pathways, applicable exposure factors and toxicological factors) of the risk assessment for the Port Pirie site were reviewed. The identified parameters are considered to represent a conservative scenario in terms of the Canberra site. Therefore the identified concentration of lead in soils is likely to be acceptable for continued railway use.</p>	
<p>11.. Validation Programs</p> <p>Following remedial works, have appropriate validation programs been implemented/proposed for the Phase 3 works, specifically:</p> <ul style="list-style-type: none"> - Sampling pattern - Sample frequency soils - Depth of Samples - Groundwater samples - Analytes and levels of detection - QA/QC practices OK 	<p>D, 1, 2, 3, 4, 6, & 10</p>	<p>There are three areas where significant concentration of TPHs were identified and fate and transport modelling was performed to address the significance of the insitu contamination. These include the dissolved phase TPH 'hot spot' in the northern end of the landfill, the dissolved phase TPH area associated with the former refuelling area and the dissolved phase (THP C6-C9) hot spot in north and adjacent to the former refuelling area.</p> <p>Ref D has provided no further comments on the remaining PSH which may remain in the former refuelling area and the significance of this contamination.</p> <p>There has been limited follow-up monitoring in the case where dissolved phase TPHs have been assessed by modelling the likely fate and transport of the remaining contamination.</p>	<p>MNC</p> <p>MNC</p>

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FAX TRANSMISSION



FAX Transmission

Attention: Stuart Glenn



Company: PPK

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From: David Miller

Time:

Date: 20-Nov-00

No of Pages: 8

Topic: Major Site review - Canberra.

Hello Stuart,

Attached is an edited version of the URS Executive Summary with those issues we discussed highlighted. Would you please liaise with Warren Pump at URS, Melbourne to resolve these issues. I would appreciate your prompt response to this issue so the final report is not delayed, Warren will be on holidays for a week beginning Thursday.

Regards
Schedule 2.2(a)(ii)

David

Ppk065.doc

Please ring (08 8641 2438) if all is not legible

URS

Fax Transmittal

To: David Miller
INDEC Consulting
16 November 2000
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In consultation with the ACT Government
Indec Consulting acting for the Commonwealth
Department of Transport and Regional Development
have engaged Woodward Clyde to conduct

REVIEW OF CANBERRA RAILYARDS

Commonwealth
Govt.

1. Introduction

The ACT Government has requested an independent audit review of the former Australian National (AN) land in Canberra. The review has been carried out by Mr. Warren Pump, a Victorian EPA Accredited Contaminated Land Auditor. The land was Commonwealth property which passed from the Commonwealth Railways to AN when the latter was formed. Since the sale of AN in November 1997 a site assessment and remediation program instigated by AN and now managed by INDEC Consulting (Indec) and funded through the Federal Commonwealth Government has been carried out at the Canberra Site by PPK Environment and Infrastructure (PEI). This audit has been prepared for the Indec Consulting and the ACT Government to provide confidence that the necessary investigation and remedial action required for the continued use of the site for which it was last used prior to the sale date of AN has occurred.

2. Background

At the time of the sale of AN the Federal Government committed funding to remediate for new rail sites and property to a standard suitable for the continuing use for which the property was last used prior to the sale date. The Federal Government undertook this action regardless of whether AN or previous land owners or users caused the environmental contamination.

Indec has been appointed by the Commonwealth to manage all aspects of the remediation program. The remediation process is and has been based on a risk management basis which takes account of the commitment of the Commonwealth to remediate sites to allow land-use consistent with ongoing use for which it was last used.

3. Scope of Work

In respect of providing the ACT Government and the Commonwealth adequate levels of confidence that the environmental risks at the site have been identified and addressed an agreed sign-off process has been adopted. As part of the sign-off process this independent audit has been carried out, which is equivalent to an environmental audit carried out for contaminated land in accordance with the requirements of the Environment Protection Authority of Victoria. However, this audit is not a statutory audit.

In conducting the audit, the Auditor has considered the suitability of the land, based on its environmental condition, for the following range of land uses:

- Light and heavy industrial, especially industrial processes traditionally associated with urban railways and railyards;
- Commercial activities; and
- Solid waste disposal and soil filling.

In addressing such land uses, the Auditor has formed an opinion of the existence, nature and extent of any actual material environmental harm, or threatened material environmental harm,

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Fax Transmittal

To: David Miller
INDEC Consulting
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regarding the site. The term "material environmental harm" has the same meaning as that in the ACT *Environment Protection Act 1997*.

This review is only concerned with impacts to soil and groundwater which may offer a risk to the environment or human health. The review is not concerned with operational issues at the sites, nor is it concerned with the protection of natural flora or fauna (other than those that typically exist in a highly modified form in urban railyards); soil aesthetics; dust; noise; vibration; or ground corrosivity.

4. Summary of Work Conducted and Reviewed

The discussion below provides a brief summary of the reports prepared by PPK and the description of the works performed.

"Environmental Audit of the Australian National Facilities, Canberra Railway Station Yards and Rail Corridor", 16 March 1998 Document No. 27K009A 98-182.DOC.

This report presents the past and current activities at the site which have the potential to cause impact to the identified environmental receptors.

"Phase II Environmental Site Assessment, Canberra Railway Station and Rail Corridor", 12 November 1998, Document No. 27K140A 98-845.DOC.

This report presents the results of the first round of soil and groundwater investigations at the various areas identified during the environmental audit above. It specifically assessed the following areas:

- The fuel depots and former cement works and their impact to the railway corridor;
- The former goods shed (now Robbo's Pet Barn) and surrounding area;
- The old refueling depot;
- The main Canberra station area and surrounds;
- Leased area occupied by William Edmunds Plumbers and the Australian Railway Historical Society (ARHS);
- Vacant dump site (which is understood to have been used for uncontrolled disposal of municipal wastes); and
- Corridor between Jerrabomberra Creek and Ipswich Street.

"Report on Further Soil and Groundwater Investigations, Canberra Railway Station and Rail Corridor", 14 January 1999, Document No. 7K140B 99-014.DOC.

This report presents the results of the second (Phase IIB) round of soil and groundwater investigations at various areas identified upon completion of the initial Phase II investigations. It specifically assessed the following areas:

- Contaminated soil issues associated with the former cement works;

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Fax Transmittal

To: David Miller
INDEC Consulting
16 November 2000
Page 5

5.1 Fuel depots adjacent to the eastern rail corridor

Levels of petroleum hydrocarbon (TPHs) above the adopted criteria for continued railway use were identified adjacent to the Shell and Mobil fuel depots. These levels were at concentrations which represented petroleum hydrocarbons floating on the groundwater table (phase separated hydrocarbons - PSH). It is understood that Indec have communicated these issues to the fuel companies for further consideration.

talk to PPK

In most cases the identified TPHs are not likely to impact upon the continued use of this facility for railway purposes. However, a combination of significant concentration of light fraction TPH compounds (C6-C9 at 46,600 ug/L) and the shallow depth to ground water (approximately 2 metres) may expose workers in the areas to potential soil vapours. An assessment of this issue is required to assess that identified receptors are not exposed to any potential risks associated with the soil vapours.

5.2 Former cement works adjacent to the eastern rail corridor

Concentrations of metals (lead and zinc) were identified at levels exceeding the adopted criteria for continued railway use. The area was limited in vertical and lateral extent (less than 10 square metres in area and within a depth of 1 metre). The concentrations of zinc were subsequently identified to be within the NH&M, 1998 assessment criteria for 'hot-spots'. The concentration of lead was compared to the health risk assessment (for lead contamination in soils) performed for the Port Pirie Rail Yards. The parameters (exposure pathways, applicable exposure factors and toxicological factors) of the risk assessment for the Port Pirie site were reviewed. The identified parameters are considered to represent a conservative scenario in terms of the Canberra site. Therefore the identified concentration of lead in soils is likely to be acceptable for continued railway use.

5.3 Old refueling depot

Levels of TPHs were identified in the vicinity of the former refueling area above the adopted assessment guidelines. Phase separated hydrocarbons were also noted in three of the groundwater monitoring bores. It was estimated that approximately 50 litres of PSH was floating on the groundwater table. Remediation of the PSH was undertaken using a 'pig sock' lowered into the impacted groundwater bores. The pig sock removed PSH by absorption. The last report prepared for the site documented that approximately 5 litres of PSH had been removed.

The significance of the remaining contaminated groundwater was undertaken using fate and transport groundwater modelling techniques. The modelling indicated that there is likely to be minimal risks to the Jerrabomberra Creek. Future monitoring of this area would be required to confirm the predictions of the modelling.

During assessment of this area groundwater monitoring bore GW304 reported a concentration of TPH C6-C9 at 63,000 ug/L. Assessment of the chromatogram indicated that this petroleum hydrocarbon was not derived from the same source as the former refueling area

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Fax Transmittal

To: David Miller
INDEC Consulting
16 November 2000
Page: 6

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(which was predominantly used for storage and dispensing diesel). The significance of this contamination was also assessed using the fate and transport model, which indicated that there is likely to be no future risks associated with this contamination. However, there has been no further explanation of the presence of this contamination. It is recommended that the results be reviewed to address this anomaly.

5.4 Former goods shed

There were no significant issues associated with the operations of the goods shed which had the potential to impact the site. However, the facility was established over filled ground. The filled ground included solid and inert wastes.

5.5 Main Canberra station area

There are no current activities associated with the Canberra station which have the potential to impact continued railway use of the site. In the past ballast contaminated with TPHs was removed and geofabric liner placed to prevent future TPH leakage from the locomotives. There was no documentation provided up to the time of this review which indicated validation of the excavation was performed. However, groundwater was sampled from monitoring bores down-gradient from the area and there were no impacts identified in the groundwater.

Soiled ballast was deposited in various locations south-east of the station area. It is assumed this material was sourced during the removal of the ballast from the main Canberra station area. Assessment of the ballast material, adjacent soils and groundwater down-gradient from the area indicated that there are no significant issues which would limit continued railway use of the site.

5.6 Leased areas (William Edmunds Plumbers and ARHS)

Site facilities are located over filled areas and are assumed to be an extension of the vacant dump area. One significant issue was identified in the area occupied within the William Edmunds site. The review identified, three underground storage tanks located north and adjacent to the main building. Assessment of the soils adjacent to the USTs and groundwater down-hydraulic gradient indicated no adverse impacts.

5.7 Vacant dump site

The results of the investigation of this area indicated the filled area varied from approximately 2m to 6m and contained predominantly domestic (solid / inert wastes) and in the later years of operation, restricted filling to building rubble (soil fill, concrete, bricks, etc.). Levels of TPHs were identified in the northern end of the dump and appeared to be localised in area. Fate and transport modelling indicated that the identified concentration is not likely to impact on the adjacent Jerrabomberra Creek. However, further monitoring of the groundwater should be undertaken to confirm the modelling outcomes.

Although no significant putrescible domestic fill was encountered during the test pitting exercise, there are indications that the groundwater quality has been impacted by leachate

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Fax Transmittal

To David Miller
INDEC Consulting
16 November 2000
Page: 7

generated by the decomposition of putrescible wastes. Traces of cyanide were also detected in FW206 above the guidelines for protection of fresh water ecosystems. It is recommended that groundwater quality be monitored for typical landfill leachate parameters, as well as other parameters identified in previous monitoring.

5.3 Corridor between Jerrabomberra Creek and Ipswich Street

No significant issues were identified in this area which would impact upon continued railway use of the area.

Review of the assessment reports has highlighted that other areas have been identified which have the potential, to impact identified receptors at the site. These areas only have the potential to be an issue if significant contamination is present. These include;

- The filling of the former railway turntable. This issue was highlighted in the environmental audit report;
- USTs (now removed) were located in the former abattoir site, immediately east of Newcastle Street. It is presumed that the abattoir site is not part of the site;
- Potential for fragments of asbestos sheeting to exist in the surface soils was highlighted in the environmental audit and no assessment was performed;
- Oily wastes being disposed into the stormwater drain at the ARHS site. This issue was raised in the environmental audit report and no further assessment has been performed;
- The environmental audit report identified filling east of the Jerrabomberra Creek north and adjacent to the railway alignment. The filling, as illustrated in the aerial photo was similar to the vacant dump site area;
- Significant staining of the soils by petroleum hydrocarbons was noted along-side the fuel depot sidings during the environmental audit of the site. No further assessment of these soils was undertaken. It is assumed that the sidings are located on railway land; and
- Black oily waste was observed during the environmental audit in a drainage alignment adjacent to the Shell depot. There was no further assessment of these areas noted in the later environmental site assessment reports.

oil company representative

talk to PPK

The assessments prepared by PPK have been performed in accordance with the methods and guidelines usually employed for the assessment of potentially contaminated sites, however, there has been no comparison of the local requirements of Environment ACT and supporting legislation for the protection of the environment. The detailed audit report will reference the Environment ACT legislation and any relevant guidelines.

In this review, the Auditor has formed an opinion of the existence, nature and extent of any actual material environmental harm, or threatened material environmental harm, regarding the site. On the basis of the information provided and reviewed, there is no evidence to suggest that the issues assessed present actual material environmental harm to exist.

007/008

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Appendix B

Analytical Results



ENVIRONMENTAL AND INDUSTRIAL SERVICES DIVISION
Amdel Limited ABN 30 008 127 802

Correspondence to: 5 Kelray Place
ASQUITH NSW 2077
P.O. Box 514 Telephone: (02) 9482 1922
HORNSBY NSW 1630 Facsimile: (02) 9482 1734

Tax Invoice

INVOICE NO. 00064984LX

PPK65

PPK Adelaide
101 Pirie St
Adelaide SA 5000

Our Ref. Date
0A01222 25/01/01

Attention : Mr Mike Reynolds
Project
CANBERRA

Your Ref.
27K140D

Account Code : X003000X

Method	Description	Units	Unit Price	Total Amount
E0230	TPH C6-C9 by purge & trap	Schedule 2.2(a)(xi)		
E0221	TPH (C10-C36)			
E0010	Benzene, Toluene, Ethylbenzene & Xylene			
E4870	Dissolved Metals by ICP-MS			
E4810	Dissolved Metals by ICP-AES			
E48501	Mercury low level			
E2450	Total Cyanide			
E0120	Polychlorinated Biphenyls			
E2600	pH			
E2430	Conductivity			
E2690	Total Dissolved Solids			
E2310	Total Alkalinity			
E2720	Sulphate			
E2380	Chloride			
E2530	Total Hardness			
E2630	Dissolved Phosphorous			
E2640	Phosphorus-Total			
E2770	TKN			
E2550	Nitrate-N			
E2560	Nitrite-N			
E2330	Ammonia as N			
E2580	Total Organic Carbon			
E2350	BOD (5)			
E2420	Chemical Oxygen Demand			
E0140	Phenols by GC/MS			
E0080	Organochlorine Pesticide			
E0110	Polycyclic Aromatic Hydrocarbons			
GST	Australian GST			
Net (exclusive of GST)				
GST				
TOTAL				
Terms strictly 30 days nett				

Please send remittances to :-
Amdel Ltd
P.O. Box 338, Torrensville Plaza, S.A. 5031

Accreditation No. 1464

ENVIRONMENTAL AND INDUSTRIAL SERVICES DIVISION

Trading as Australian Analytical Laboratories Pty Ltd

ACN 001 491 667

Correspondence to:

PO BOX 514

HORNSBY NSW 1630

5 Kelray Place

ASQUITH NSW 2077

Telephone: (02) 9482 1922

Facsimile: (02) 9482 1734

CERTIFICATE OF ANALYSIS

Contents :

1. Cover Page
2. Analysis Report Pages
3. QA/QC Appendix

Report No. : 0A01222
Attention : Mr Mike Reynolds
Client : PPK Adelaide
Samples : 19
Reference : 27K140D
Project : CANBERRA
Received Samples : 20/12/00 **Instructions** : 20/12/00
Date Reported : 15/01/01

PLEASE SEE FOLLOWING PAGE FOR METHOD LISTING

RESULTS

All samples were analysed as received. This report relates specifically to the samples received. Results relate to the source material only to the extent that the samples as supplied are truly representative of the sample source. This report replaces any preliminary results issued. Note that for schemes indicated with * NATA accreditation does not cover the performance of this service. Three significant figures (or 2 for <10PQL) are reported for statistical purposes only.

Schedule 2.2(a)(ii)

per D. SPRINGER B.App.Sc.
Manager Environmental Sydney



<u>Method</u>	<u>Description</u>	<u>Extracted</u>	<u>Analysed</u>
E0230	TPH C6-C9 by purge & trap	27/12/00	28/12/00
E0221	TPH (C10-C36)	22/12/00	29/12/00
E0010	Benzene, Toluene, Ethylbenzene & Xylene	27/12/00	28/12/00
E4870	Dissolved Metals by ICP-MS	27/12/00	27/12/00
E4810	Dissolved Metals by ICP-AES	22/12/00	27/12/00
E48501	Mercury low level	02/01/01	03/01/01
E2450	Total Cyanide	03/01/01	03/01/01
E0120	Polychlorinated Biphenyls	27/12/00	03/01/01
E2600	pH	21/12/00	21/12/00
E2430	Conductivity	05/01/01	05/01/01
E2690	Total Dissolved Solids	05/01/01	05/01/01
E2310	Total Alkalinity	21/12/00	21/12/00
E2720	Sulphate	21/12/00	22/12/00
E2380	Chloride	21/12/00	22/12/00
E2530	Total Hardness	22/12/00	27/12/00
E2630	Dissolved Phosphorous	21/12/00	02/01/01
E2640	Phosphorus-Total	21/12/00	12/01/01
E2770	TKN	21/12/00	12/01/01
E2550	Nitrate-N	21/12/00	02/01/01
E2560	Nitrite-N	21/12/00	02/01/01
E2330	Ammonia as N	21/12/00	02/01/01
*E2580	Total Organic Carbon	05/01/01	05/01/01
E2350	BOD (5)	22/12/00	27/12/00
E2420	Chemical Oxygen Demand	03/01/01	04/01/01
E0140	Phenols by GC/MS	04/01/01	04/01/01
E0080	Organochlorine Pesticide	27/12/00	03/01/01
E0110	Polycyclic Aromatic Hydrocarbons	27/12/00	03/01/01

* Performed under NATA accreditation No. 198

Job Number : 0A01222
 Client : PPK Adelaide
 Reference : 27K140D
 Project : CANBERRA

Analyte	Lab No	E91136	E91137	E91138	E91139	E91140
	Sample Id	GW104	GW210	GW310	GW13	GW301
	PQL					
E0230 TPH in Water by P&T/GC-MS (µg/L)						
C6-C9 Fraction	20	nd	nd	nd	nd	nd
E0221 TPH in Water (µg/L)						
C10-C14 Fraction	20	nd	nd	nd	nd	nd
C15-C28 Fraction	100	nd	nd	nd	nd	nd
C29-C36 Fraction	100	nd	nd	nd	nd	nd
E0010 BTEX (P&T) in Water (µg/L)						
Benzene	0.5	nd	nd	nd	nd	nd
Toluene	1	nd	nd	nd	nd	nd
Ethylbenzene	1	nd	nd	nd	nd	nd
Total Xylenes	3	nd	nd	nd	nd	nd
4-Bromofluorobenzene-SURROGATE	1	94%	94%	93%	93%	91%

PQL = Practical Quantitation Limit
 LNR = Samples Listed not Received
 nd = <PQL
 -- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified
 Waters : mg/L (ppm) unless otherwise specified in Method Header
 Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header

Job Number : 0A01222

Client : PPK Adelaide

Reference : 27K140D

Project : CANBERRA

Analyte	Lab No	E91146	E91147	E91148	E91149	E91150
	Sample Id	GW203	GW105	DUP1	GW206	DUP2
	PQL					
E0230 TPH in Water by P&T/GC-MS ($\mu\text{g/L}$)						
C6-C9 Fraction	20	nd	nd	nd	nd	nd
E0221 TPH in Water ($\mu\text{g/L}$)						
C10-C14 Fraction	20	nd	nd	nd	nd	50
C15-C28 Fraction	100	nd	nd	nd	nd	nd
C29-C36 Fraction	100	nd	nd	nd	nd	nd
E0010 BTEX (P&T) in Water ($\mu\text{g/L}$)						
Benzene	0.5	nd	nd	nd	nd	nd
Toluene	1	nd	nd	nd	nd	nd
Ethylbenzene	1	nd	nd	nd	nd	nd
Total Xylenes	3	nd	nd	nd	nd	nd
4-Bromofluorobenzene-SURROGATE	1	91%	92%	89%	92%	90%

PQL = Practical Quantitation Limit

LNR = Samples Listed not Received

nd = < PQL

-- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified

Waters : mg/L (ppm) unless otherwise specified in Method Header

Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header



Job Number : 0A01222

Client : PPK Adelaide

Reference : 27K140D

Project : CANBERRA

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Analyte	Lab No	E91151	E91152	E91153	E91154
	Sample Id	GW114	GW313	GW111	GW109
	PQL				
E0230 TPH in Water by P&T/GC-MS (µg/L)					
C6-C9 Fraction	20	nd	nd	nd	nd
E0221 TPH in Water (µg/L)					
C10-C14 Fraction	20	nd	nd	nd	50
C15-C28 Fraction	100	nd	nd	nd	nd
C29-C36 Fraction	100	nd	nd	nd	nd
E0010 BTEX (P&T) in Water (µg/L)					
Benzene	0.5	nd	nd	nd	nd
Toluene	1	nd	nd	nd	nd
Ethylbenzene	1	nd	nd	nd	nd
Total Xylenes	3	nd	nd	nd	nd
4-Bromofluorobenzene-SURROGATE	1	89%	89%	91%	89%

PQL = Practical Quantitation Limit
 LNR = Samples Listed not Received
 nd = <PQL
 -- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified
 Waters : mg/L (ppm) unless otherwise specified in Method Header
 Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header



Job Number : 0A01222
 Client : PPK Adelaide
 Reference : 27K140D
 Project : CANBERRA

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Analyte	Lab No	E91149	E91150	E91151	E91152	E91153
	Sample Id	GW206	DUP2	GW114	GW313	GW111
	PQL					
E4870 Dissolved Metals in Waters						
Arsenic	0.001	nd	0.001	0.004	0.002	0.003
Beryllium	0.001	nd	nd	nd	nd	nd
Cadmium	0.0001	nd	nd	0.0007	nd	nd
Cobalt	0.001	0.005	nd	0.006	0.008	0.001
Copper	0.001	nd	nd	0.002	nd	0.002
Nickel	0.001	0.005	0.006	0.025	0.005	0.009
Lead	0.001	nd	nd	nd	nd	nd
Zinc	0.002	0.011	0.008	0.342	0.007	0.007
E4810 Dissolved Metals in Waters						
Iron	0.05	0.31	nd	8.60	nd	nd
Calcium	0.1	46	140	260	56	120
Potassium	0.1	3.4	16	50	11	6.2
Magnesium	0.1	29	54	66	28	52
Sodium	0.2	57	59	120	100	290
E48501 Dissolved Mercury in Waters						
Mercury	0.00005	nd	0.00006	nd	nd	0.00005

PQL = Practical Quantitation Limit
 LNR = Samples Listed not Received
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 -- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified
 Waters : mg/L (ppm) unless otherwise specified in Method Header
 Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header

Job Number : 0A01222
 Client : PPK Adelaide
 Reference : 27K140D
 Project : CANBERRA

	Lab No	E91154				
	Sample Id	GW109				
Analyte	PQL					
E4870 Dissolved Metals in Waters						
Arsenic	0.001	0.001				
Beryllium	0.001	nd				
Cadmium	0.0001	nd				
Cobalt	0.001	nd				
Copper	0.001	nd				
Nickel	0.001	0.006				
Lead	0.001	nd				
Zinc	0.002	0.007				
E4810 Dissolved Metals in Waters						
Iron	0.05	nd				
Calcium	0.1	140				
Potassium	0.1	16				
Magnesium	0.1	56				
Sodium	0.2	62				
E48501 Dissolved Mercury in Waters						
Mercury	0.00005	0.00009				

PQL = Practical Quantitation Limit
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 -- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified
 Waters : mg/L (ppm) unless otherwise specified in Method Header
 Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header

Job Number : 0A01222

Client : PPK Adelaide

Reference : 27K140D

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plus Cover Page

	Lab No	E91149	E91150	E91151	E91152	E91153
Analyte	Sample Id	GW206	DUP2	GW114	GW313	GW111
	PQL					
E2450 Total Cyanide in Water						
Total Cyanide	0.005	nd	--	--	--	--
E2600 pH in Water						
pH	0.1	6.9	6.7	6.8	7.0	7.1
E2430 Conductivity (μS/cm at 25.0 C)						
Electrical Conductivity	1	720	1500	2100	930	2000
E2690 Total Dissolved Solids in Water						
TDS (calc.)	1	460	960	1400	590	1300
E2310 Total Alkalinity in Water						
Bicarbonate as CaCO₃	1	340	640	910	350	770
Carbonate as CaCO₃	1	nd	nd	nd	nd	nd
Hydroxide as CaCO₃	1	nd	nd	nd	nd	nd
Alkalinity as CaCO₃	1	340	640	910	350	770
E2720 Sulphate in Water						
Sulphate	1	20	140	210	62	170
E2380 Chloride in Water						
Chloride	1	19	42	54	52	100
E2530 Total Hardness						
Total Hardness as CaCO₃	0.5	230	560	330	260	520
E2630 Dissolved Phosphorus in Water						
Dissolved Phosphorus	0.01	nd	nd	nd	nd	nd

PQL = Practical Quantitation Limit

LNR = Samples Listed not Received

nd = <PQL

-- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified

Waters : mg/L (ppm) unless otherwise specified in Method Header

Leachates : mg/L (ppm) in leachate unless otherwise specified in

Method Header

Job Number : 0A01222
 Client : PPK Adelaide
 Reference : 27K140D
 Project : CANBERRA

Analyte	Lab No	E91154				
	Sample Id	GW109				
	PQL					
E2450 Total Cyanide in Water						
Total Cyanide	0.005	--				
E2600 pH in Water						
pH	0.1	7.0				
E2430 Conductivity ($\mu\text{S}/\text{cm}$ at 25.0 C)						
Electrical Conductivity	1	1500				
E2690 Total Dissolved Solids in Water						
TDS (calc.)	1	970				
E2310 Total Alkalinity in Water						
Bicarbonate as CaCO₃	1	620				
Carbonate as CaCO₃	1	nd				
Hydroxide as CaCO₃	1	nd				
Alkalinity as CaCO₃	1	620				
E2720 Sulphate in Water						
Sulphate	1	140				
E2380 Chloride in Water						
Chloride	1	44				
E2530 Total Hardness						
Total Hardness as CaCO₃	0.5	580				
E2630 Dissolved Phosphorus in Water						
Dissolved Phosphorus	0.01	nd				

PQL = Practical Quantitation Limit
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 -- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified
 Waters : mg/L (ppm) unless otherwise specified in Method Header
 Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header

Job Number : 0A01222
 Client : PPK Adelaide
 Reference : 27K140D
 Project : CANBERRA

Analyte	Lab No	E91149	E91150	E91151	E91152	E91153
	Sample Id	GW206	DUP2	GW114	GW313	GW111
	PQL					
E2640 Total Phosphorus in Water						
Phosphorus	0.01	0.45	0.37	0.16	0.34	0.11
E2770 Kjeldahl Nitrogen in Water						
Kjeldahl Nitrogen	0.1	1.2	nd	32	2.8	0.8
E2550 Nitrate as N in Water						
Nitrate as N	0.01	0.13	8.58	0.05	0.94	0.12
E2560 Nitrite as N in Water						
Nitrite as N	0.01	0.15	0.01	0.12	0.56	0.05
E2330 Ammonia as N in Water						
Ammonia as N	0.01	0.43	nd	24.2	1.02	0.18
E2580 TOC in Water						
TOC	1	11	19	12	7	9
E2350 BOD in Water (5-Day)						
BOD	5	nd	nd	11	nd	nd
E2420 Chemical Oxygen Demand						
COD	50	nd	nd	nd	nd	nd

PQL = Practical Quantitation Limit
 LNR = Samples Listed not Received
 nd = <PQL
 -- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified
 Waters : mg/L (ppm) unless otherwise specified in Method Header
 Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header



Job Number : 0A01222
 Client : PPK Adelaide
 Reference : 27K140D
 Project : CANBERRA

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 plus Cover Page

	Lab No	E91154				
Analyte	Sample Id	GW109				
	PQL					
E2640 Total Phosphorus in Water						
Phosphorus	0.01	0.31				
E2770 Kjeldahl Nitrogen in Water						
Kjeldahl Nitrogen	0.1	0.5				
E2550 Nitrate as N in Water						
Nitrate as N	0.01	9.01				
E2560 Nitrite as N in Water						
Nitrite as N	0.01	nd				
E2330 Ammonia as N in Water						
Ammonia as N	0.01	nd				
E2580 TOC in Water						
TOC	1	12				
E2350 BOD in Water (5-Day)						
BOD	5	nd				
E2420 Chemical Oxygen Demand						
COD	50	nd				

PQL = Practical Quantitation Limit
 LNR = Samples Listed not Received
 nd = <PQL
 -- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified
 Waters : mg/L (ppm) unless otherwise specified in Method Header
 Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header

Job Number : 0A01222
 Client : PPK Adelaide
 Reference : 27K140D
 Project : CANBERRA

Analyte	Lab No	E91149	E91150	E91151	E91152	E91153
	Sample Id	GW206	DUP2	GW114	GW313	GW111
	PQL					
E0140 Phenols By GC/MS In Water (µg/L)						
Phenol	5	nd	nd	nd	nd	nd
2-Chlorophenol	5	nd	nd	nd	nd	nd
2-Methylphenol	5	nd	nd	nd	nd	nd
3-Methylphenol & 4-Methylphenol	5	nd	nd	nd	nd	nd
2-Nitrophenol	5	nd	nd	nd	nd	nd
2.4-Dimethylphenol	5	nd	nd	nd	nd	nd
2.4-Dichlorophenol	5	nd	nd	nd	nd	nd
2.6-Dichlorophenol	5	nd	nd	nd	nd	nd
4-Chloro-3-methylphenol	5	nd	nd	nd	nd	nd
2.4.5-Trichlorophenol	5	nd	nd	nd	nd	nd
2.4.6-Trichlorophenol	5	nd	nd	nd	nd	nd
2.4-Dinitrophenol	20	nd	nd	nd	nd	nd
4-Nitrophenol	10	nd	nd	nd	nd	nd
2.3.4.6-Tetrachlorophenol	10	nd	nd	nd	nd	nd
4.6-Dinitro-2-methylphenol	20	nd	nd	nd	nd	nd
Pentachlorophenol	10	nd	nd	nd	nd	nd
4.6-Dinitro-2-sec-butylphenol	20	nd	nd	nd	nd	nd
2-Fluorophenol-SURROGATE	1	79%	81%	83%	72%	82%
Phenol-D6-SURROGATE	1	69%	67%	67%	60%	68%
2.4.6-Tribromophenol-SURROGATE	1	81%	86%	81%	87%	108%

PQL = Practical Quantitation Limit

LNR = Samples Listed not Received

nd = <PQL

-- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified

Waters : mg/L (ppm) unless otherwise specified in Method Header

Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header

Job Number : 0A01222
 Client : PPK Adelaide
 Reference : 27K140D
 Project : CANBERRA

	Lab No	E91154			
	Sample Id	GW109			
Analyte	PQL				
E0140 Phenols By GC/MS In Water (µg/L)					
Phenol	5	nd			
2-Chlorophenol	5	nd			
2-Methylphenol	5	nd			
3-Methylphenol & 4-Methylphenol	5	nd			
2-Nitrophenol	5	nd			
2,4-Dimethylphenol	5	nd			
2,4-Dichlorophenol	5	nd			
2,6-Dichlorophenol	5	nd			
4-Chloro-3-methylphenol	5	nd			
2,4,5-Trichlorophenol	5	nd			
2,4,6-Trichlorophenol	5	nd			
2,4-Dinitrophenol	20	nd			
4-Nitrophenol	10	nd			
2,3,4,6-Tetrachlorophenol	10	nd			
4,6-Dinitro-2-methylphenol	20	nd			
Pentachlorophenol	10	nd			
4,6-Dinitro-2-sec-butylphenol	20	nd			
2-Fluorophenol-SURROGATE	1	81 %			
Phenol-D6-SURROGATE	1	69 %			
2,4,6-Tribromophenol-SURROGATE	1	106 %			

PQL = Practical Quantitation Limit

LNR = Samples Listed not Received

nd = < PQL

-- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified

Waters : mg/L (ppm) unless otherwise specified in Method Header

Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header

Job Number : 0A01222

Client : PPK Adelaide

Reference : 27K140D

Project : CANBERRA

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Analyte	Lab No	E91149	E91150	E91151	E91152	E91153
	Sample Id	GW206	DUP2	GW114	GW313	GW111
	PQL					
E0080 OC Pesticides in Water ($\mu\text{g/L}$)						
HCB	1	nd	nd	nd	nd	nd
a-BHC	1	nd	nd	nd	nd	nd
g-BHC	1	nd	nd	nd	nd	nd
Heptachlor	1	nd	nd	nd	nd	nd
Aldrin	1	nd	nd	nd	nd	nd
b-BHC	1	nd	nd	nd	nd	nd
d-BHC	1	nd	nd	nd	nd	nd
Oxychlorane	1	nd	nd	nd	nd	nd
Heptachlor epoxide	1	nd	nd	nd	nd	nd
Endosulfan 1	1	nd	nd	nd	nd	nd
Chlordane-Trans	1	nd	nd	nd	nd	nd
Chlordane-Cis	1	nd	nd	nd	nd	nd
trans-Nonachlor	1	nd	nd	nd	nd	nd
DDE	1	nd	nd	nd	nd	nd
Dieldrin	1	nd	nd	nd	nd	nd
Endrin	1	nd	nd	nd	nd	nd
DDD	1	nd	nd	nd	nd	nd
Endosulfan 2	1	nd	nd	nd	nd	nd
DDT	1	nd	nd	nd	nd	nd
Endosulfan sulfate	1	nd	nd	nd	nd	nd
Methoxychlor	1	nd	nd	nd	nd	nd
2,4,5,6-TCMX-SURROGATE	1	105%	121%	106%	101%	105%

PQL = Practical Quantitation Limit

LNR = Samples Listed not Received

nd = <PQL

-- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified

Waters : mg/L (ppm) unless otherwise specified in Method Header

Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header

Job Number : 0A01222

Client : PPK Adelaide

Reference : 27K140D

Project : CANBERRA

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plus Cover Page

Analyte	Lab No	E91154			
	Sample Id	GW109			
	PQL				
E0080 OC Pesticides in Water ($\mu\text{g/L}$)					
HCB	1	nd			
a-BHC	1	nd			
g-BHC	1	nd			
Heptachlor	1	nd			
Aldrin	1	nd			
b-BHC	1	nd			
d-BHC	1	nd			
Oxychlorane	1	nd			
Heptachlor epoxide	1	nd			
Endosulfan 1	1	nd			
Chlordane-Trans	1	nd			
Chlordane-Cis	1	nd			
trans-Nonachlor	1	nd			
DDE	1	nd			
Dieldrin	1	nd			
Endrin	1	nd			
DDD	1	nd			
Endosulfan 2	1	nd			
DDT	1	nd			
Endosulfan sulfate	1	nd			
Methoxychlor	1	nd			
2,4,5,6-TCMX-SURROGATE	1	94%			

PQL = Practical Quantitation Limit

LNR = Samples Listed not Received

nd = <PQL

-- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified

Waters : mg/L (ppm) unless otherwise specified in Method Header

Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header

Job Number : OA01222
 Client : PPK Adelaide
 Reference : 27K140D
 Project : CANBERRA

Analyte	Lab No	E91149	E91150	E91151	E91152	E91153
	Sample Id	GW206	DUP2	GW114	GW313	GW111
	PQL					
E0110 USEPA Priority PAH's in Water (µg/L)						
Naphthalene	1	nd	nd	nd	nd	nd
Acenaphthylene	1	nd	nd	nd	nd	nd
Acenaphthene	1	nd	nd	nd	nd	nd
Fluorene	1	nd	nd	nd	nd	nd
Phenanthrene	1	nd	nd	nd	nd	nd
Anthracene	1	nd	nd	nd	nd	nd
Fluoranthene	1	nd	nd	nd	nd	nd
Pyrene	1	nd	nd	nd	nd	nd
Benz(a)anthracene	1	nd	nd	nd	nd	nd
Chrysene	1	nd	nd	nd	nd	nd
Benzo(b) & (k)fluoranthene	2	nd	nd	nd	nd	nd
Benzo(a)pyrene	1	nd	nd	nd	nd	nd
Indeno(1.2.3-cd)pyrene	1	nd	nd	nd	nd	nd
Dibenz(a,h)anthracene	1	nd	nd	nd	nd	nd
Benzo(g,h,i)perylene	1	nd	nd	nd	nd	nd
Total USEPA Priority PAHs	1	nd	nd	nd	nd	nd
2-Fluorobiphenyl-SURROGATE	1	91%	99%	99%	104%	101%
Anthracene-D10-SURROGATE	1	97%	99%	106%	112%	93%
p-Terphenyl-D14-SURROGATE	1	117%	117%	125%	122%	118%

PQL = Practical Quantitation Limit
 LNR = Samples Listed not Received
 nd = <PQL
 -- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified
 Waters : mg/L (ppm) unless otherwise specified in Method Header
 Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header

Job Number : 0A01222
 Client : PPK Adelaide
 Reference : 27K140D
 Project : CANBERRA

Analyte	Lab No	E91154				
	Sample Id	GW109				
	PQL					
E0110 USEPA Priority PAH's in Water (µg/L)						
Naphthalene	1	nd				
Acenaphthylene	1	nd				
Acenaphthene	1	nd				
Fluorene	1	nd				
Phenanthrene	1	nd				
Anthracene	1	nd				
Fluoranthene	1	nd				
Pyrene	1	nd				
Benz(a)anthracene	1	nd				
Chrysene	1	nd				
Benzo(b) & (k)fluoranthene	2	nd				
Benzo(a)pyrene	1	nd				
Indeno(1.2.3-cd)pyrene	1	nd				
Dibenz(a,h)anthracene	1	nd				
Benzo(g,h,i)perylene	1	nd				
Total USEPA Priority PAHs	1	nd				
2-Fluorobiphenyl-SURROGATE	1	94%				
Anthracene-D10-SURROGATE	1	106%				
p-Terphenyl-D14-SURROGATE	1	122%				

PQL = Practical Quantitation Limit
 LNR = Samples Listed not Received
 nd = <PQL
 -- = Not Applicable

Soils : mg/kg (ppm) dry weight unless otherwise specified
 Waters : mg/L (ppm) unless otherwise specified in Method Header
 Leachates : mg/L (ppm) in leachate unless otherwise specified in Method Header

AMDEL INTERNAL QUALITY ASSURANCE REVIEW.

Job NO. 0A01222

All testing in this report is covered by Amdel NATA accreditation number 1464, unless stated otherwise.

General

1. Laboratory QA/QC including Method Blanks, Duplicates, Matrix Spikes, Laboratory Control Samples or CRM's are included in this QA/QC appendix. (Where applicable)
2. Inter-Laboratory proficiency trial results are available upon request.
3. PQL's are matrix dependent and are increased accordingly where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spike or surrogate recoveries.
5. Where 3 and 2 significant figures are reported for > 10x PQL and < 10x PQL respectively, the last figure is uncertain and is provided for statistical purposes only.
6. Samples duplicated or spiked are from this job and are identified in the following QA/QC report.
7. SVOC analyses on waters are performed on mixed, unfiltered samples(unless noted otherwise).

Maximum Holding Times for Soils, Sediments and Waters

Parameter	Holding Times
<u>Soils</u>	
Volatile and Semi-Volatile Organic Analysis.	Extracted in 14 days, analysed within 40 days.
Metals	Extracted and analysed within 28 days-6 months.
Inorganics*	Extracted and analysed within 7-28 days.
TCLPs*	Extracted and analysed within 14 days, (Zero Headspace-TCLP 7 days).
<u>Waters</u>	
Volatile Organic Analysis	Extracted in 7 days, analysed within 40 days.
Semi-Volatile Organic Analysis	Extracted in 7 days, analysed within 40 days.
Inorganics*	Analysed within 24 hrs-28 days.
Metals (dissolved metals should be supplied field filtered)	Prepared and analysed within 28 days.

* Please refer to 'Preservation Information Chart for Soils, Sediments & Waters' for further information. (ISFORM.098). Holding times may be extended with the use of preservation bottles and/or freezing samples. Reference: USEPA SW846 and AMDEL SPM-01 (incorporating NEPM Guidelines).

Chain of Custody and Sample Integrity

	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Chain of Custody received with samples	√		
Custody seals were received intact, if used			√
Samples were received chilled and in good condition	√		
Samples received appropriately preserved for all tests	√		
VOC/SVOC samples were received in teflon lined containers	√		
Volatiles samples received with Zero Headspace	√		
Samples analysed within recommended holding times	√		
Chain of Custody completed by Amdel and attached	√		

Chromatography Calibration/Acceptance Criteria

Retention time window meets acceptance criteria (±2%)	√
Reference standard meets acceptance criteria (±10%)	√
Recalibration standard meets acceptance criteria (±15%)	√
Internal standard recovery acceptable.	√

AMDEL INTERNAL QUALITY ASSURANCE REVIEW Cont..

Amdel QA/QC Compliance Assessment

	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Surrogates performed on all appropriate GC analyses and meet acceptance limits (70% - 130% recovery*).	✓		
Matrix Spikes performed once per process batch and at least 1 in 20 samples (Results meet acceptance limits - 70% - 130% recovery* or 80% - 120% recovery* for inorganics in water.)	✓		
Laboratory Control samples performed once per process batch and at least 1 in 20 samples (Results meet acceptance limits - 70% - 130% recovery* in soil or 80%-120%/90-110% recovery* for waters.)	✓		
Laboratory Duplicate samples performed once per process batch and at least 1 in 10 samples (Results meet acceptance limits). < 4 PQL - +/- 2 PQL 4-10 PQL - 0-25 or 50% RPD > 10 PQL - 0-10 or 30% RPD	✓		
Method Blanks performed once per process batch and at least 1 in 20 samples (Results not detected at the PQL).	✓		
N/A=Not Applicable.			
			* Phenols 50% - 130% recovery
			* SVOCs 60% - 130% recovery
			* Phenoxy Acid Herbicides 60% - 140% recovery

QA/QC Appendix

Please refer to the following pages for the QA/QC data.

Comments specific to sample analyses from this job.

Schedule 2.2(a)(ii)

per D. SPRINGER B.App.Sc.
Manager Environmental Sydn

QAQC : Method Blank(s)

ANALYTE	Sample ID PQL	Blank1	Blank2	Blank3	Blank4	Blank5
E0230 TPH in Water by P&T/GC-MS ($\mu\text{g/L}$)						
C6-C9 Fraction	20	nd				
E0221 TPH in Water ($\mu\text{g/L}$)						
C10-C14 Fraction	20	nd				
C15-C28 Fraction	100	nd				
C29-C36 Fraction	100	nd				
E0010 BTEX (P&T) in Water ($\mu\text{g/L}$)						
Benzene	0.5	nd				
Toluene	1	nd				
Ethylbenzene	1	nd				
Total Xylenes	3	nd				

PQL = Practical Quantitation Limit
 nd = <PQL
 -- = Not Applicable

(S) Soils : mg/kg (ppm) dry weight
 (W) Waters : mg/l (ppm) unless otherwise specified



QAQC : Laboratory Control Sample(s)

Analyte	Level (ppm)	Level Detected			Recovery Details		
		Result1 (ppm)	Result2 (ppm)	Result3 (ppm)	Rec 1 (%)	Rec 2 (%)	Rec 3 (%)
E4870 Dissolved Metals in Waters							
Arsenic	0.100	0.099			99%		
Beryllium	0.100	0.101			101%		
Cadmium	0.1000	0.097			97%		
Cobalt	0.100	0.092			92%		
Copper	0.100	0.094			94%		
Nickel	0.100	0.093			93%		
Lead	0.100	0.094			94%		
Zinc	0.100	0.097			97%		
E4810 Dissolved Metals in Waters							
Iron	1.0	1.00			100%		
Calcium	10.0	10			100%		
Potassium	10.0	10			105%		
Magnesium	10.0	9.8			99%		
Sodium	10.0	10			101%		
E48501 Dissolved Mercury in Waters							
Mercury	0.001	0.001			105%		

PQL = Practical Quantitation Limit
 -- = Not Applicable
 nd = < PQL

(S) Soils : mg/kg (ppm) dry weight
 (W) Waters : mg/l (ppm) unless otherwise specified

QAQC : Method Blank(s)

ANALYTE	Sample ID PQL	Blank1	Blank2	Blank3	Blank4	Blank5
E4870 Dissolved Metals in Waters						
Arsenic	0.001	nd				
Beryllium	0.001	nd				
Cadmium	0.0001	nd				
Cobalt	0.001	nd				
Copper	0.001	nd				
Nickel	0.001	nd				
Lead	0.001	nd				
Zinc	0.002	nd				
E4810 Dissolved Metals in Waters						
Iron	0.05	nd				
Calcium	0.1	nd				
Potassium	0.1	nd				
Magnesium	0.1	nd				
Sodium	0.2	nd				
E48501 Dissolved Mercury in Waters						
Mercury	0.00005	nd				

PQL = Practical Quantitation Limit
 nd = < PQL
 -- = Not Applicable

(S) Soils : mg/kg (ppm) dry weight
 (W) Waters : mg/l (ppm) unless otherwise specified

QAQC : Laboratory Control Sample(s)

Analyte	Level (ppm)	Level Detected			Recovery Details		
		Result1 (ppm)	Result2 (ppm)	Result3 (ppm)	Rec 1 (%)	Rec 2 (%)	Rec 3 (%)
E2450 Total Cyanide in Water							
Total Cyanide	0.460	0.500			109%		
E2600 pH in Water							
pH	7.4	7.4	7.4	100%	100%	100%	0%
E2430 Conductivity (μS/cm at 25.0 C)							
Electrical Conductivity	303	310			103%		
E2690 Total Dissolved Solids in Water							
TDS (calc.)	194	199			103%		
E2310 Total Alkalinity in Water							
Bicarbonate as CaCO3	59.5	58			98%		
Alkalinity as CaCO3	59.5	58			98%		
E2720 Sulphate in Water							
Sulphate	20	21	20	103%	99%	101%	3%
E2380 Chloride in Water							
Chloride	50	51			102%		
E2530 Total Hardness							
Total Hardness as CaCO3	66.2	66			99%		
E2630 Dissolved Phosphorus in Water							
Dissolved Phosphorus	1.0	1.03			103%		

PQL = Practical Quantitation Limit
 -- = Not Applicable
 nd = <PQL

(S) Soils : mg/kg (ppm) dry weight
 (W) Waters : mg/l (ppm) unless otherwise specified



QAQC : Method Blank(s)

ANALYTE	Sample ID PQL	Blank1	Blank2	Blank3	Blank4	Blank5
E2450 Total Cyanide in Water						
Total Cyanide	0.005	nd				
E2600 pH in Water						
pH	0.1	5.5				
E2430 Conductivity (μS/cm at 25.0 C)						
Electrical Conductivity	1	nd				
E2310 Total Alkalinity in Water						
Bicarbonate as CaCO₃	1	nd				
Alkalinity as CaCO₃	1	nd				
E2720 Sulphate in Water						
Sulphate	1	nd				
E2380 Chloride in Water						
Chloride	1	nd				
E2530 Total Hardness						
Total Hardness as CaCO₃	0.5	nd				
E2630 Dissolved Phosphorus in Water						
Dissolved Phosphorus	0.01	nd				

PQL = Practical Quantitation Limit
 nd = < PQL
 -- = Not Applicable

(S) Soils : mg/kg (ppm) dry weight
 (W) Waters : mg/l (ppm) unless otherwise specified

QAQC : Laboratory Control Sample(s)

Analyte	Level (ppm)	Level Detected			Recovery Details		
		Result1 (ppm)	Result2 (ppm)	Result3 (ppm)	Rec 1 (%)	Rec 2 (%)	Rec 3 (%)
E2640 Total Phosphorus in Water							
Phosphorus	1.00	0.95			95%		
E2770 Kjeldahl Nitrogen in Water							
Kjeldahl Nitrogen	5.0	4.6			90%		
E2550 Nitrate as N in Water							
Nitrate as N	1.0	0.90			90%		
E2560 Nitrite as N in Water							
Nitrite as N	1.0	0.92			92%		
E2330 Ammonia as N in Water							
Ammonia as N	1.0	1.00			100%		
E2580 TOC in Water							
TOC	100	98			98%		
E2350 BOD in Water (5-Day)							
BOD	200	200			100%		
E2420 Chemical Oxygen Demand							
COD	500	480			95%		

PQL = Practical Quantitation Limit
 -- = Not Applicable
 nd = <PQL

(S) Soils : mg/kg (ppm) dry weight
 (W) Waters : mg/l (ppm) unless otherwise specified

QAQC : Method Blank(s)

ANALYTE	Sample ID PQL	Blank1	Blank2	Blank3	Blank4	Blank5
E2640 Total Phosphorus in Water						
Phosphorus	0.01	nd				
E2770 Kjeldahl Nitrogen in Water						
Kjeldahl Nitrogen	0.1	nd				
E2550 Nitrate as N in Water						
Nitrate as N	0.01	nd				
E2560 Nitrite as N in Water						
Nitrite as N	0.01	nd				
E2330 Ammonia as N in Water						
Ammonia as N	0.01	nd				
E2580 TOC in Water						
TOC	1	nd				
E2350 BOD in Water (5-Day)						
BOD	5	nd				
E2420 Chemical Oxygen Demand						
COD	50	nd				

PQL = Practical Quantitation Limit
 nd = < PQL
 -- = Not Applicable

(S) Soils : mg/kg (ppm) dry weight
 (W) Waters : mg/l (ppm) unless otherwise specified

QAQC : Method Blank(s)

ANALYTE	Sample ID PQL	Blank1	Blank2	Blank3	Blank4	Blank5
E0140 Phenols By GC/MS In Water (µg/L)						
Phenol	5	nd				
2-Chlorophenol	5	nd				
2-Methylphenol	5	nd				
3-Methylphenol & 4-Methylpheno	5	nd				
2-Nitrophenol	5	nd				
2,4-Dimethylphenol	5	nd				
2,4-Dichlorophenol	5	nd				
2,6-Dichlorophenol	5	nd				
4-Chloro-3-methylphenol	5	nd				
2,4,5-Trichlorophenol	5	nd				
2,4,6-Trichlorophenol	5	nd				
2,4-Dinitrophenol	20	nd				
4-Nitrophenol	10	nd				
2,3,4,6-Tetrachlorophenol	10	nd				
4,6-Dinitro-2-methylphenol	20	nd				
Pentachlorophenol	10	nd				
4,6-Dinitro-2-sec-butylphenol	20	nd				

PQL = Practical Quantitation Limit
 nd = < PQL
 -- = Not Applicable

(S) Soils : mg/kg (ppm) dry weight
 (W) Waters : mg/l (ppm) unless otherwise specified



QAQC : Laboratory Control Sample(s)

Analyte	Level (ppm)	Level Detected			Recovery Details		
		Result1 (ppm)	Result2 (ppm)	Result3 (ppm)	Rec 1 (%)	Rec 2 (%)	Rec 3 (%)
E0080 OC Pesticides in Water (µg/L)							
HCB	10	9			86%		
a-BHC	10	8			84%		
g-BHC	10	9			92%		
Heptachlor	10	9			93%		
Aldrin	10	9			89%		
b-BHC	10	10			99%		
d-BHC	10	10			99%		
Oxychlorane	10	10			101%		
Heptachlor epoxide	10	10			98%		
Endosulfan 1	10	10			101%		
Chlordane-Trans	10	10			100%		
Chlordane-Cis	10	11			105%		
trans-Nonachlor	10	10			104%		
DDE	20	20			102%		
Dieldrin	10	10			103%		
Endrin	10	10			104%		
DDD	20	21			104%		
Endosulfan 2	10	11			107%		
DDT	20	22			108%		
Endosulfan sulfate	10	11			109%		
Methoxychlor	10	11			109%		

PQL = Practical Quantitation Limit
 -- = Not Applicable
 nd = <PQL

(S) Soils : mg/kg (ppm) dry weight
 (W) Waters : mg/l (ppm) unless otherwise specified

QAQC : Laboratory Duplicate(s)

Analyte	Dupl A	Dupl B	Average	RPD (%)	Dupl A	Dupl B	Average	RPD (%)
E0080 OC Pesticides in Water (µg/L)								
HCB	nd	nd						
a-BHC	nd	nd						
g-BHC	nd	nd						
Heptachlor	nd	nd						
Aldrin	nd	nd						
b-BHC	nd	nd						
d-BHC	nd	nd						
Oxychlorane	nd	nd						
Heptachlor epoxide	nd	nd						
Endosulfan 1	nd	nd						
Chlordane-Trans	nd	nd						
Chlordane-Cis	nd	nd						
trans-Nonachlor	nd	nd						
DDE	nd	nd						
Dieldrin	nd	nd						
Endrin	nd	nd						
DDD	nd	nd						
Endosulfan 2	nd	nd						
DDT	nd	nd						
Endosulfan sulfate	nd	nd						
Methoxychlor	nd	nd						

PQL = Practical Quantitation Limit
 nd = < PQL
 -- = Not Applicable

(S) Soils : mg/kg (ppm) dry weight
 (W) Waters : mg/L (ppm) unless otherwise specified

The number in brackets after the method header identifies the sample tested.

QAQC : Method Blank(s)

ANALYTE	Sample ID PQL	Blank1	Blank2	Blank3	Blank4	Blank5
E0080 OC Pesticides in Water (µg/L)						
HCB	1	nd				
a-BHC	1	nd				
g-BHC	1	nd				
Heptachlor	1	nd				
Aldrin	1	nd				
b-BHC	1	nd				
d-BHC	1	nd				
Oxychlorane	1	nd				
Heptachlor epoxide	1	nd				
Endosulfan 1	1	nd				
Chlordane-Trans	1	nd				
Chlordane-Cis	1	nd				
trans-Nonachlor	1	nd				
DDE	1	nd				
Dieldrin	1	nd				
Endrin	1	nd				
DDD	1	nd				
Endosulfan 2	1	nd				
DDT	1	nd				
Endosulfan sulfate	1	nd				
Methoxychlor	1	nd				

PQL = Practical Quantitation Limit
 nd = <PQL
 -- = Not Applicable

(S) Soils : mg/kg (ppm) dry weight
 (W) Waters : mg/l (ppm) unless otherwise specified



QAQC : Laboratory Control Sample(s)

Analyte	Level (ppm)	Level Detected			Recovery Details		
		Result1 (ppm)	Result2 (ppm)	Result3 (ppm)	Rec 1 (%)	Rec 2 (%)	Rec 3 (%)
E0110 USEPA Priority PAH's in Water (µg/L)							
Naphthalene	10	9			90%		
Acenaphthylene	10	9			87%		
Acenaphthene	10	10			96%		
Fluorene	10	9			93%		
Phenanthrene	10	10			98%		
Anthracene	10	9			94%		
Fluoranthene	10	9			94%		
Pyrene	10	9			93%		
Benz(a)anthracene	10	8			80%		
Chrysene	10	10			103%		
Benzo(b) & (k)fluoranthene	20	15			75%		
Benzo(a)pyrene	10	7			72%		
Indeno(1.2.3-cd)pyrene	10	8			79%		
Dibenz(a,h)anthracene	10	7			73%		
Benzo(g,h,i)perylene	10	8			76%		

PQL = Practical Quantitation Limit
 -- = Not Applicable
 nd = <PQL

(S) Soils : mg/kg (ppm) dry weight
 (W) Waters : mg/l (ppm) unless otherwise specified



QAQC : Method Blank(s)

ANALYTE	Sample ID PQL	Blank1	Blank2	Blank3	Blank4	Blank5
E0110 USEPA Priority PAH's in Water (µg/L)						
Naphthalene	1	nd				
Acenaphthylene	1	nd				
Acenaphthene	1	nd				
Fluorene	1	nd				
Phenanthrene	1	nd				
Anthracene	1	nd				
Fluoranthene	1	nd				
Pyrene	1	nd				
Benz(a)anthracene	1	nd				
Chrysene	1	nd				
Benzo(b) & (k)fluoranthene	2	nd				
Benzo(a)pyrene	1	nd				
Indeno(1.2.3-cd)pyrene	1	nd				
Dibenz(a,h)anthracene	1	nd				
Benzo(g,h,i)perylene	1	nd				

PQL = Practical Quantitation Limit
nd = <PQL
-- = Not Applicable

(S) Soils : mg/kg (ppm) dry weight
(W) Waters : mg/l (ppm) unless otherwise specified



INDUSTRIAL AND ENVIRONMENTAL SERVICES DIVISION

Trading as Australian Analytical Laboratories Pty Ltd
ACN 001 491 667

Correspondence to:
PO BOX 514
HORNSBY NSW 1630

5 Kelray Place
ASQUITH NSW 2077
Telephone: (02) 9482 1922
Facsimile: (02) 9482 1734

Client: PPK Adelaide	Our Ref: 0A01222
Your Ref: 27K140D	Date: 23/01/01

SAMPLE DISPOSAL ADVICE

All samples remain the client's property after analysis. These will be either returned or disposed of (at the client's cost where applicable) following analysis.

Please indicate your requirements below.

- 1. RETURN SAMPLES TO CLIENT
- 2. DISCARD AFTER * 6 Weeks - Soils
* 4 Weeks - Waters
- 3. DISCARD IMMEDIATELY

** Storage times commence from date of issue of the final report.*

ADDITIONAL HOLDING REQUIREMENTS

- 4. HOLD SAMPLES UNTIL ___ / ___ / ___ (DATE)
- 5. HOLD SAMPLES FOR EXTRA _____ (WEEKS)

PLEASE NOTE: A charge of \$2.50 per sample per month or part thereof applies

RETURN TO FOLLOWING ADDRESS _____

TRANSPORT COMPANY _____

PLEASE NOTE: *If this advice slip is not returned within 15 days, it will be assumed that the samples referenced above can be discarded after indicated storage times (*)*

Authorised Signature _____

Please return to

Kattubava Sahul
AMDEL Ltd
P.O. Box 514
HORNSBY N.S.W. 2077
or fax to (02) 9482 1734

Adelaide
101 Pirie Street Adelaide SA 5000
Tel: (08) 8405 4300 Fax: (08) 8405 4301

Brisbane
348 Edward Street, Brisbane QLD 4000
Tel: (07) 3218 2222 Fax: (07) 3831 4223

Melbourne
163 Eastern Road, South Melbourne VIC 3205
Tel: (03) 9686 1166 Fax: (03) 9686 1110

Perth
97 Broadway, Nedlands WA 6009
Tel: (08) 9389 8668 Fax: (08) 9389 8447

Sydney
9 Blaxland Road, Rhodes NSW 2138
Tel: (02) 9743 0333 Fax: (02) 9736 1568

Chain of Custody

Order No: 0771

Job Title: Canberra Rail Yards

Laboratory Name: Amdel

Address:

Fax Number:

Phone Number:

Contact Name:

Delivery Method:

Quote Number:

PPK Job Number: 27K140D

Job Location: Canberra

Project Manager: M. Reynolds / S. Glenn

Results Expected by/on:

Fax Results to: AIA

Fax Number:

Phone Number:

Spreadsheet of Results Required: Y / N

Format:

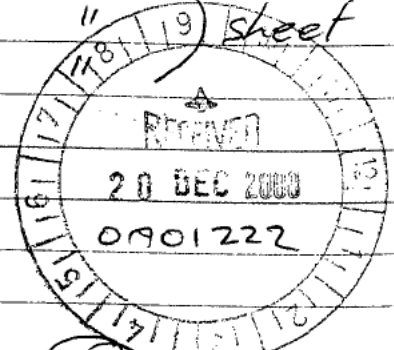
Turnaround Time Required: 5 days

Invoice to: AIA

Comments:

Date Sampled	Time	Sample I.D.	Container Size	Sample Location	Medium*	Preservative Type	Filtered (X)	TPH	BTEX	PAH's	OC/OP/PCB's	Metals**	Cyanide Total
	E91148	DUP1						X	X				
	49	GW206										X	X
	50	DUP2										X	V
	51	GW114										X	V
	52	GW313										X	V
	55	GW111										X	V
	54	GW109										X	V

Initials	Comments/Additional Information and/or Analysis Required
	land fill analysis + Total Cyanide
	Land fill analysis
	" " See attached sheet
	" " " "
	" " " "
	" " " "



Relinquished by: M. Reynolds

Date & Time: 19-12-2000

Company: PPK

Signature: Schedule 2.2(a)(ii)

Received in Good Order & Condition by (Name): R Schacht

Date & Time: 20/12/00

Company: Amdel

Signature: Schedule 2.2(a)(ii)

Relinquished by:

Date & Time:

Company:

Signature:

Received in Good Order & Condition by (Name):

Date & Time:

Company:

Signature:

Relinquished by:

Date & Time:

Company:

Signature:

Received in Good Order & Condition by (Name):

Date & Time:

Company:

Signature:

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

PPK

Environment & Infrastructure
ACN 078 004 798

White Page - Laboratory Copy

Yellow Page - Project File Copy

Green Page - Remains in Book

Please deliver the goods and/or services to the office indicated:

Adelaide

101 Pirie Street Adelaide SA 5000
Tel: (08) 8405 4300 Fax: (08) 8405 4301

Brisbane

348 Edward Street, Brisbane QLD 4000
Tel: (07) 3218 2222 Fax: (07) 3831 4223

Melbourne

163 Eastern Road, South Melbourne VIC 3205
Tel: (03) 9686 1166 Fax: (03) 9686 1110

Perth

97 Broadway, Nedlands WA 6009
Tel: (08) 9389 8668 Fax: (08) 9389 8447

Sydney

9 Blaxland Road, Rhodes NSW 2138
Tel: (02) 9743 0333 Fax: (02) 9736 1568

Chain of Custody

Order No: 0770

Job Title: **CANBERRA RAIL YARDS**

Laboratory Name: **AMDEL**

Address:

Fax Number:

Phone Number:

Contact Name:

Delivery Method:

Quote Number:

PPK Job Number:

27K140D

Job Location:

Canberra

Project Manager: **M. Reynolds S. Glenn**

Results Expected by/on:

Fax Results to: **AIA**

Fax Number:

Phone Number: **84054300**

Spreadsheet of Results Required: **Y / N**

Format:

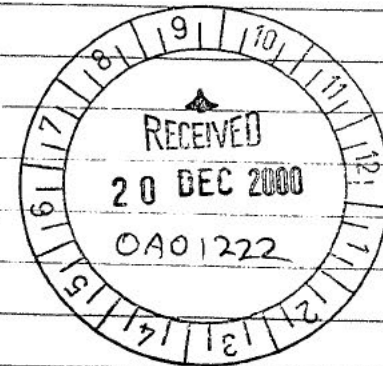
Turnaround Time Required: **5 day**

Invoice to: **AIA**

Comments:

Date Sampled	Time	Sample I.D.	Container Size	Sample Location	Medium*	Preservative Type	Filtered (X)	TPH	BTEX	PAH's	OC/OP/PCBs	Metals**							
18/12/00	091136	GW104	1 X 500 2 X 50					X	X										
"	37	GW210	"					X	X										
"	38	GW310	"					X	X										
"	39	GW13	"					X	X										
"	40	GW301	"					X	X										
"	41	GW307	"					X	X										
"	42	GW305	"					X	X										
"	43	GW303	"					X	X										
"	44	GW204	"					X	X										
"	45	GW311	"					X	X										
"	46	GW203	"					X	X										
"	47	GW105	"					X	X										

Initials	Comments/Additional Information and/or Analysis Required



Relinquished by: **M. Reynolds**

Date & Time: **19/12/2000**

Company: **PPK**

Signature: **Schedule 2.2(a)(ii)**

Received in Good Order & Condition by (Name): **Schacht**

Date & Time: **20/12/00**

Company: **Amdel**

Signature: **Schedule 2.2(a)(ii)**

Relinquished by:

Date & Time:

Company:

Signature:

Received in Good Order & Condition by (Name):

Date & Time:

Company:

Signature:

Relinquished by:

Date & Time:

Company:

Signature:

Received in Good Order & Condition by (Name):

Date & Time:

Company:

Signature:

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

2/...
27K140D

- ▶ Selected metals (As, Be, Cd, Co, Cu, Fe, Pb, Hg, Ni, Zn)
- ▶ PCB's
- ▶ CN (GW206 only)
- ▶ TPH

Parameters to be analysed will be:

- ▶ PH, EC, TDS by EC
- ▶ Cations Ca, Mg, Na, K
- ▶ Anions CO₃, HCO₃, SO₄, OH, Cl
- ▶ Alkalinity (as CO₃), hardness (carbonate, non carbonate, total)
- ▶ Nutrients phosphate, phosphorus, TKN, nitrate, nitrite, ammonia, ammonium
- ▶ TOC, BOD, COD
- ▶ Phenols (speciated)
- ▶ Pesticides (OCP's)
- ▶ PAH's

Appendix C

Photographs



Photo 1: No evidence of asbestos sheeting on surface soils or slabs.



Photo 2: Stormwater drain – no evidence of oil or oil staining.



Photo 3: Stormwater drain – no evidence of oil or oil staining.



Photo 4: Revegetated areas adjacent to fuel depot sidings. No visual evidence of staining.



Photo 5: Revegetated areas adjacent to fuel depot sidings. No visual evidence of staining.



Photo 6: Shell Depot – no evidence of staining.



Photo 7: Shell Depot – no evidence of staining.

Appendix D

Canberra Rail Station and Former
Municipal Landfill Area,
Groundwater Monitoring Well
Locations

Canberra Rail Station &
Former Municipal Dump Area,
Groundwater Monitoring Wells



Report on Further Soil and Groundwater Investigations Canberra Railway Station and Rail Corridor

Indec Consulting

**PPK Environment &
Infrastructure Pty Ltd**

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101 Pirie Street
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PO Box 398
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Australia

14 January 1999
27K140B 99-014.DOC

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ACN 078 004 798

A NATA Certified Quality Company

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A NATA Certified Quality Company

Our Reference 27K140B/SPTAY/lhh

14 January 1999

Mr Colin Denton
Indec Consulting
300 Flinders Street
ADELAIDE SA 5000

Dear **Colin**

Report on Further Soil and Groundwater Investigations: Australian National Canberra Railyards, Canberra

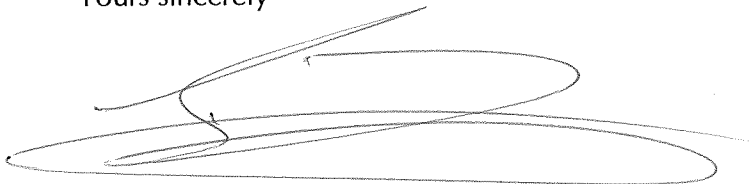
PPK is pleased to provide three copies of the above report for your consideration.

The results and findings of the combined Phase II Assessment program and Further Soil and Groundwater Investigations, have identified requirements for the implementation of minor site remediation and management actions, which are detailed in this report. It is further recommended that these issues are discussed with the ACT Environment Authorities (Department of Urban Services), to ensure compliance with any Territory based legislation or requirements.

In accordance with standard PPK protocols, detailed work scopes and cost estimates for the nominated site remediation and monitoring works will be provided to INDEC in a separate submission to this report.

I trust that I have interpreted your requirements correctly. If you have any queries or questions relating to the above report or the remediation and validation program, please do not hesitate to call me on the above number.

Yours sincerely



Stuart Taylor
Team Leader Environmental Assessment and Remediation
PPK Environment & Infrastructure Pty Ltd

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Executive Summary

PPK Environment & Infrastructure Pty Ltd (PPK) was commissioned by INDEC Consulting (INDEC) to undertake further soil and groundwater investigations at the Canberra Railway Station yards and rail corridor, located in the south east of Canberra in the suburbs of Kingston and Fyshwick.

The scope of additional soil and groundwater works completed during December 1998, were based on the results and findings of a targeted Phase II Environmental Site Assessment (ESA), undertaken by PPK and reported in November 1998 (PPK, Document Number 98-845) which identified both localised on site soil and groundwater impacts, considered to be the result of both on site and off site sources of contamination. The objectives of the further soil and groundwater investigations were to assess and report on the identified soil and groundwater contamination and to provide recommendations for any remediation and rehabilitation works in order to reduce potential environmental liabilities and/or human health risks posed by the identified site conditions for the continued use of the site as a railway station and rail corridor.

The purpose of this report is to present the results and findings of the combined site assessment works completed to date and to provide recommendations for subsequent site remediation or management based on the continued industrial (rail) use of the site.

The combined site works undertaken during the Phase II ESA program and subsequent further soil and groundwater investigations comprised targeted soil sampling and analysis at thirty seven locations and targeted groundwater sampling and analysis at forty five locations. All sampling locations were sited to target the areas of known and suspected contamination identified in the Phase I Audit report and/or subsequent Phase II site inspections

The results and findings of the combined site works undertaken during July and December 1998, respectively, has identified and confirmed the presence of localised on site soil and groundwater impacts, considered to be the result of both on site and off site sources of contamination.

On Site Sources of Contamination

Localised impacted areas considered to be the result of either current or former on site sources of contamination were identified and delineated within the former locomotive refuelling area and the adjacent former municipal waste dump, and the former cement works, adjacent to Newcastle Street.

Former Locomotive Refuelling Area

Observations and intrusive sampling and analysis works have identified the presence of surface and subsurface hydrocarbon (diesel) impacted soils surrounding the former locomotive refuelling area and associated interceptor. Analysis of the groundwater samples recovered from the eight monitoring wells surrounding the former refuelling area reported the presence of elevated concentrations of dissolved phase petroleum hydrocarbons (in excess of the nominated assessment criteria), in four of the wells, with a free phase hydrocarbon product with an apparent thickness of 4mm identified within the monitoring well closest to the former refuelling tank.

On the basis of the results of the two sampling and monitoring rounds completed it is apparent that the zone of absorbed phase soil impacts and dissolved/free phase groundwater impacts are localised within the immediate vicinity (25m radius) of the former refuelling tank. Based on the easterly direction of localised groundwater flow the nearest groundwater receptor to the former refuelling area is likely to be the Jerrabomberra Creek, located in excess of 800m, east of the impacted area. From the two monitoring rounds completed, no evidence of any petroleum hydrocarbon impacts have been reported in the monitoring wells, located hydraulically down gradient of the former refuelling area.

Based on the dissolved phase concentrations reported to date in conjunction with the direction of localised groundwater flow and the distance to the nearest receptor, it is considered that the impacted groundwaters identified are unlikely to pose a significant risk to the Jerrabomberra Creek system and adjoining wetlands, however future groundwater monitoring on a regular basis will be required as a proactive site management strategy. Further site management issues incorporating the recovery of the available free phase product using passive recovery socks are recommended where free phase hydrocarbons were present. It is further recommended that these issues are discussed with the ACT Environment authorities (Department of Urban Services), to ensure compliance with any territory based legislation or requirements.

In terms of potential health risks to on site workers, it is considered that due to the depth of the impacted soils and groundwater within the vicinity of the refuelling area, the observed site contaminant conditions are not likely to pose potential health risks to on site workers under normal site activities and operations. Potential health risks may be present if future maintenance works or works involving either deep excavations within these areas or extraction and use of the groundwater occurs. On site personnel should be made aware of site conditions such that appropriate safety procedures can be adopted prior to the commencement of any such works.

Municipal Waste Disposal Area

Visual assessment of the fill materials within the main portion of the former dump area located to the north and north east of the main railyards identified waste materials including ash, cinders, slag, asbestos containing materials, coal, metal objects and an abandoned heating oil tank to depths in excess of 3.9m bgl. Laboratory analysis of selected soil/fill samples recovered within the main waste/fill area reported no extensive or gross chemical contamination of the soils, with only an elevated concentration of Benzo(a)pyrene identified in a test pit containing extensive ash, cinder and slag materials.

Based on the north- north easterly direction of localised groundwater flow in this portion of site and the close proximity of the adjacent Jerrabomberra Creek and associated wetlands, all groundwater investigations were targeted surrounding the hydraulically downgradient perimeter of the waste fill areas and adjacent to the boundary of the waste fill area and the adjacent creek and wetlands. Analysis of the groundwater recovered from these wells reported no significant organic constituents, with the exception of a single sample recovered from the north western site boundary, where concentrations of dissolved phase TPH constituents were reported, however no obvious source zone or surrounding impacts were identified during the drilling and construction of the well. Trace concentrations of Di-n-butyl phthalate, a known "plasticiser agent" and common constituent of plastic materials were further reported in two of the groundwater samples recovered from the wells within the centre of the peripheral site boundary. Concentrations of heavy metals whilst in some instances in excess of the Australian Drinking Water Standards, were generally consistent with the concentrations reported across the whole site, indicating no significant

contribution from any waste materials and subsequent leachate products (if any) from the known waste fill areas.

In terms of potential risks or impacts to the receiving creek and wetland systems, the concentration of heavy metal constituents reported during both rounds of groundwater sampling have all been below the Australian Water Quality Guidelines for Fresh Waters (1992) - Summary Guidelines for the protection of aquatic ecosystems and are therefore considered to represent negligible risks under current site conditions, however future groundwater monitoring on a regular basis will be required as a proactive site management strategy. It is further recommended that these issues are discussed with the ACT Environment Authorities (Department of Urban Services), to ensure compliance with any territory based legislation or requirements.

Eastern Rail Corridor (adjacent former Cement Works)

Previous audit and intrusive assessment works undertaken with the rail corridor and northern access areas adjacent to the Newcastle Street bridge, identified the presence of shallow fill materials comprising ash and cinder wastes. Laboratory analysis of these waste materials, which were generally confined to the upper 150mm soil profile reported lead and zinc concentrations in excess of the nominated industrial (rail) assessment criteria. Additional soil investigations undertaken during the further soil and groundwater works, confirmed the presence of high concentrations of lead and zinc constituents within these fill materials in a localised area immediately east of the original groundwater monitoring well, where surficial outcropping of these fill materials was identified.

Based on the localised area of the identified impacted fill materials it is considered that the observed site contaminant conditions are not likely to pose potential health risks to on site workers under normal site activities and operations, however potential health risks may be present if future maintenance works or works involving either longer exposure periods within the localised area are undertaken. Similarly, based on the localised nature of the chemical impacts within the upper 150mm soil profile it is considered that the potential for subsequent leachate generation and impact upon underlying soil profiles and groundwater are negligible.

Due to the small area in concern and the potential for future health risks to site workers (albeit low to negligible) it is recommended that remedial actions are implemented to either provide a surficial covering layer over these fill materials or to excavate and remove these materials to an appropriate off site waste repository. It is further recommended that these issues are discussed with the ACT Environment Authorities (Department of Urban Services), to ensure compliance with any territory based legislation or requirements.

Impacts from suspected off site activities

The predominant soil and groundwater impacts identified within the eastern portion of the rail corridor during the Phase II ESA works and subsequent further investigation works are considered to be the result of on site migration of petroleum hydrocarbon products from the Shell, Mobil and Caltex/Ampol Fuel Depots.

Results of the Phase II ESA works undertaken in June 1998 identified the presence of adsorbed phase soil and dissolved phase groundwater impacts, characteristic of degraded distillate/motor spirit mix were identified within the rail corridor subsurface soils adjacent to the northern boundary of the Shell depot, located adjacent to the Monaro Highway. Further on site soil and groundwater impacts were identified adjacent to the Caltex/Ampol and Mobil Fuel Depots, with

minor subsurface soil impacts identified adjacent to the Southern boundary of the BP Fuel Depot. Evidence of previous environmental investigations in the form of three groundwater monitoring wells were observed within the rail corridor adjacent to the Mobil depot.

Due to the presence of rail infrastructure (predominantly operational rail lines) further drilling and construction of monitoring wells to delineate the extent of the observed absorbed and dissolved plumes was not possible, however an additional round of groundwater sampling was undertaken to provide confirmation that the impacts were most likely sourced from off site operations or activities. The results and findings of the additional round of groundwater sampling have confirmed the presence of on site groundwater impacts adjacent to both the Shell and Mobil Fuel Depots, however the concentration of dissolved phase impacts were observed to have decreased in the wells adjacent to the Shell depot and have increased in the wells adjacent to the Mobil depot. No obvious groundwater impacts were observed adjacent to the BP and Caltex/Ampol depot's.

Based on the results of the two sampling and monitoring rounds completed (July and December 1998) localised groundwater flow within the eastern rail corridor was confirmed to be in a general westerly direction, with the nearest groundwater receptor likely to be the Jerrabomberra Creek, located in excess of 1200m, west of the impacted areas. No information relating to the presence any additional groundwater monitoring wells or abstraction wells within the vicinity of the impacted areas was available during the preparation of this report.

From the two monitoring rounds completed, no evidence of any petroleum hydrocarbon impacts have been reported in the monitoring wells, hydraulically down gradient of the depot and rail corridor area. Based on the dissolved phase concentrations reported to date in conjunction with the direction of localised groundwater flow and the distance to the nearest receptor, it is considered that the impacted groundwaters identified are unlikely to pose a significant risk to the Jerrabomberra Creek system and adjoining wetlands, however future groundwater monitoring on a regular basis will be required as a proactive site management issue. As the source of the on site impacts as considered to potentially arise from the Shell and Mobil operations, it is recommended that both of these companies are advised of the findings of the environmental investigations to date and asked to either assess the situation and impacts to the AN site on their own or to contribute to the continuation of assessment and monitoring works relevant to their properties. It is further recommended that these issues are discussed with the ACT Environment authorities (Department of Urban Services), to ensure compliance with any territory based legislation or requirements.

With respect to potential risks to on site AN workers, it is considered that due to the depth of the impacted soils and groundwater within the rail corridor the observed site contaminant conditions are not likely to pose potential health risks to on site workers under normal site activities and operations, however potential health risks may be present if future maintenance works or works involving either deep excavations within these areas or if extraction and/or use of the groundwater within these areas occurs. On site personnel should be made aware of site conditions such that appropriate safety procedures can be adopted prior to the commencement of any such works.

In accordance with standard PPK protocols, detailed work scopes and cost estimates for the nominated site remediation and monitoring works will be provided to INDEC in a separate submission to this report.

1. Introduction

PPK Environment & Infrastructure Pty Ltd (PPK) was commissioned by INDEC Consulting Pty Ltd (INDEC) to undertake further soil and groundwater investigations at the Canberra Railway Station and rail corridor, located in the south east of Canberra, in the suburbs of Kingston and Fyshwick.

The scope of additional soil and groundwater works completed during December 1998, were based on the results and findings of a targeted Phase II Environmental Site Assessment (ESA), undertaken by PPK and reported in November 1998 (PPK, Document Number 98-845) which identified both localised soil and groundwater impacts, considered to be the result of both on site and off site sources of contamination. PPK was subsequently engaged to undertake the additional soil and groundwater investigations in accordance with the proposed scope of works documented in the PPK submission of 16 November 1998 (PPK, Reference Number 27K140A/SPT).

The principal objectives of the further soil and groundwater investigations were to:

- determine the nature and extent of soil and groundwater impacts present on site;
- assess any potential environmental liabilities or potential risks to human health posed by the identified contaminants; and to
- provide recommendations for any remediation and rehabilitation works in order to reduce potential environmental liabilities and/or human health risks posed by the identified site conditions for the continued use of the site as a railway station and rail corridor.

To achieve these objectives, the further assessment included the following activities:

- review of existing site information contained in the Phase I Environmental Audit and Phase II ESA report;
- site walk-over survey, to confirm the reported conditions and identify any additional items for investigation;
- regauging and sampling of the existing 32 groundwater monitoring wells (29 of which were installed by PPK in June 1998);
- drilling, construction, gauging and sampling of an additional 16 groundwater monitoring wells;
- assessment of investigation findings and preparation of this report.

This report presents the findings of the combined site assessment works completed to date and contains recommendations for further investigations and remedial actions where required.

2. Background Information

2.1 Site Identification and Location

The Canberra Railway Station and associated rail corridor are described in cadastral maps as:

- 10/47F 11/47
- Kingston
- 11/11
- (1) Fyshwick District, Section 47, Block 2.
 - (2) Fyshwick District, Section 30, Blocks 3,12,13,17,19 and 21. (Block 3 originally Volume 889, Folio 6 and Block 19 Volume 1513, Folio 34).
 - (3) ~~Fyshwick~~ District, Section 39, Blocks 2 and 3.
 - (4) Fyshwick District, Section 11, Block 1 (originally Volume 1249, Folio 75).

The subject site is defined in the original Seat of Government Railway Act 1928, as well as subsequent Commonwealth Government Gazettes which have both added and removed areas of land as required.

The address of the subject railway station property is Wentworth Avenue, Kingston, ACT, with the railway corridor extending to the east through Queanbeyan in New South Wales. A map reference showing the location of the Canberra Railway Station and railway corridor is included in Appendix A, and site plans are included in Appendix B.

2.2 Overview of Phase 1 Audit Report

The site was the subject of a Phase I Environmental Audit, undertaken by PPK and reported in the PPK Phase 1 Environmental Audit of the Australian National Facilities Canberra Railway Station Yards and Rail Corridor Report (PPK document number 98-182) in March 1998. The scope of works addressed during the Phase 1 Environmental Audit program included detailed historical site investigations and a walk-over survey of the entire railway facility, undertaken by an experienced PPK Environmental Auditor.

2.2.1 Site History

In 1909, Canberra was selected as the new national capital. Railway usage at the site commenced in 1913, when work started on the construction of an 8.5 kilometre section of railway line linking Queanbeyan in NSW with the power station and Commonwealth stores depot in Wentworth Avenue, Kingston. The first goods train arrived in Canberra in 1914. Development at the site including construction of goods storage buildings, passenger buildings, rail sidings and shunting yards has continued off and on until the present day. The site has also been enlarged on more than one occasion by way of transfer of land to the Commonwealth for the purposes of the railway.

A number of industrial rail sidings were constructed in the Fyshwick area adjacent to the rail corridor, starting from around the mid 1950s. Leased sidings included the Shell Company of Australia since 1955, Caltex Oil since 1962, Esso Australia since 1963 and BP Australia since 1964. It is suspected that the ESSO lease has been transferred to Mobil Oil Australia as part of former asset exchanges between the two companies. A siding for the Australian Cement Company was also constructed, however the cement works are no longer in existence.

The owner of the property is Australian National and the site has been under the control of the Commonwealth Government since 1928 when the Seat of Government Railway Act came into force. The property has been leased by the State Rail Authority of NSW in accordance with the operating agreement with the Australian National Railways Commission since 8 May 1985.

The current railway station site comprises several leased areas. Lease holders include Robbo's Pet Barn (in the former goods shed), the Australian Railways Historical Society (ARHS) and William Edmund Plumbers and Gasfitters (both in the north eastern area of the site, and the Austin Siddely Car Club (in two garage buildings).

Based on the findings of the site history investigations, the following current and former site operations and activities were identified as potential sources of on site contamination:

- the storage and handling of petroleum hydrocarbon products;
- the on-site disposal of ash, cinders and coal;
- the construction and possible demolition of buildings containing asbestos;
- the storage and use of coal on site;
- the storage and use of paints, poisons, solvents, insecticides and battery acid;
- substantial filling of the northern part of the site with materials of an uncertain nature.

Based on the findings of the site walk through inspection and the findings of the site history investigation, the following site areas were identified and selected for further investigation during the subsequent Phase II ESA program:

- surface and subsurface soil and groundwater contamination by hydrocarbon products adjacent to the fuel terminals, along the rail corridor in Fyshwick;
- hydrocarbon contamination around the former locomotive refuelling facility;
- potential contamination from fill materials consisting of ash and cinders in western part of the site;
- potential contamination from fill materials of an unknown nature in the northern part of the site;
- oily wastes disposed to earthen stormwater drains adjacent to the Shell depot and in the ARHS site;
- coal stockpiles and localised hydrocarbon surface staining.

2.3 Overview of Phase II ESA Report

Based on the issues identified during the Phase 1 Environmental Audit, PPK designed and implemented a targeted Phase II Environmental Site Assessment Program to determine the nature and extent of any soil and groundwater contamination. The Phase II ESA program comprised the targeted soil boring, test-pitting and sampling at 37 locations across the site based on areas of potential contamination identified in the Phase 1 Audit and from observations made during a subsequent site inspection. The Phase II ESA program further incorporated the drilling, construction and sampling of 29 on site groundwater monitoring wells and the sampling of three existing wells located adjacent to the Mobil Fuel Depot and rail siding.

The results and findings of the Phase II ESA program identified localised on site soil and groundwater impacts, considered to be the result of both on site and off site sources of contamination.

Localised impacted areas considered to be the result of either current or former on site sources of contamination were identified within the main station complex and the adjacent former municipal waste dump, and the former cement works, adjacent to Newcastle Street.

Localised impacted areas considered to be the result of potential off site sources of contamination were identified within the eastern rail corridor, adjacent to the Shell, Caltex/Ampol and Mobil Fuel Depots.

2.3.1 Impacts From On Site Activities

Main Station Area

The predominant soil and groundwater impacts identified within the main station area, incorporate the presence of surficial hydrocarbon staining and volatile hydrocarbon impacts within the soils surrounding the former refuelling area. Analysis of the groundwater sample recovered from the well closest to the refuelling area reported elevated concentrations of dissolved phase petroleum hydrocarbons (in excess of the nominated assessment criteria), characteristic of a degraded distillate product. No hydrocarbon impacts were reported in the adjacent monitoring wells located to the immediate east and north, of the refuelling area, potentially indicating that the observed impacts may be localised around the southern portion of the refuelling area.

Municipal Waste Disposal Area

The extensive filling of the northern and eastern portions of the main railyards was considered to represent the significant potential environmental impacts for the site due to suspected nature of the materials reported to have buried within this area and the proximity to the adjacent Jerrabomberra Creek and wetlands. Anecdotal information provided by site personnel suggests that this area of site has been used for the disposal of municipal wastes from the early 1950's through to the late 1970's/early 1980's. The test pit excavations undertaken during the investigation program identified waste materials buried beyond a depth of 3.9m below ground level (bgl). Visual assessment

of the fill materials did not identify any obvious gross visually contaminated materials, however ash, cinders, slag, asbestos containing materials, coal, metal objects and an abandoned heating oil tank were identified. Olfactory assessment of the fill materials identified the presence of strong odours emanating from the within the waste mass, however no readily identifiable source zone was encountered. Laboratory analysis of selected samples reported a single exceedance of the nominated assessment criteria, with an elevated concentration of Benzo(a)pyrene identified in a test pit containing extensive ash, cinder and slag materials. Laboratory analysis of the single monitoring well, located on the north eastern side of the main fill area, reported a lead concentration, slightly in excess of the nominated drinking water criteria, but below the Australian Water Quality Guidelines for Fresh Waters (1992) - Summary Guidelines for the protection of aquatic ecosystems.

Eastern Rail Corridor (adjacent former Cement Works)

High concentrations of heavy metals, particularly lead and zinc were reported within the upper soil profile, located to the south of the former cement works, adjacent to Newcastle Street. Visual assessment of the upper soil profile reported the presence of a gravelly fill material which contained ballast, ash and cinders. No evidence of these fill materials were reported below a depth of 0.15m, however the lateral extent of fill impacts were not determined.

Site Wide Groundwater Issues

Analysis of groundwater samples recovered from the main station and adjacent waste fill area reported a general exceedance of the drinking water standards for lead, mercury and in one well, arsenic. In all cases the exceedances were no more than an order of magnitude in excess of the drinking water with all samples reporting concentrations below the ANZECC Australian Water Quality Guidelines for the protection of fresh water aquatic ecosystems. Similar concentrations of dissolved phase lead and mercury were identified within groundwater samples recovered from the eastern rail corridor indicating possible widespread occurrences of these analytes, which may not be directly associated with rail activities.

2.3.2 Impacts From Suspected Off Site Activities

The predominant soil and groundwater impacts suspected to be the result of on site migration of petroleum hydrocarbon products were identified within the eastern portion of the rail corridor, adjacent to the Shell, Caltex/Ampol and Mobil Fuel Depots.

Adsorbed phase soil and dissolved phase groundwater impacts, characteristic of a degraded distillate/motor spirit mix were identified within the subsurface soils adjacent to the northern boundary of the Shell depot, located adjacent to the Monaro Highway. Based on the apparent direction of localised groundwater flow and physical obstructions surrounding the northern portion of the Shell depot, delineation of the identified dissolved phase groundwater impacts was not achieved during the Phase II ESA works.

Olfactory evidence of petroleum hydrocarbon impacts within the subsurface soil profile was further reported in six of the twelve soil and groundwater sampling locations

targeted adjacent to the southern boundaries of the Mobil, Ampol/Caltex and BP Fuel Depots. Laboratory analysis of groundwater samples recovered from three of the monitoring wells located adjacent to the Mobil depot and from a single well located adjacent to the Caltex/Ampol depot, reported high concentrations of dissolved phase petroleum hydrocarbons, including TPH, benzene and PAH compounds. Two of the three impacted samples recovered from wells adjacent to the Mobil depot, were recovered from the existing monitoring wells. Based on the apparent direction of localised groundwater flow and physical obstructions surrounding the southern portions of the Mobil and Caltex/Ampol depots, delineation of the identified dissolved phase groundwater impacts was not achieved during the Phase II ESA works.

3. Site Description

3.1 Topography

The main railway station area and adjacent shunting yards have undergone substantial filling in the eastern part of the site and some cutting to the south west of the rail lines to render the area reasonably flat between elevations of approximately 560 m and 564 m above the Australian Height Datum (AHD). Along the north eastern boundary of the site (adjacent to the Jerrabomberra Creek silt trap), an embankment several metres high, created by the placement of fill in this area, is present. The residential development to the north is several metres higher than the rail yards area, and the site slopes away from the residential area towards both the south and east.

From where the rail lines cross the Jerrabomberra Creek, the ground level along the rail corridor rises steadily towards the south east from an elevation of approximately 560 m AHD adjacent the creek to approximately 580 m AHD at the Newcastle Street bridge.

3.2 Site and Surrounding Land Usage

Advice from Environment ACT has identified that the railyards and corridor has been associated with light industry.

To the north and west of the main railway station area, the site is bounded by Cunningham Street and Wentworth Avenue. A mixture of residential and commercial premises are located opposite the site along these boundaries. The Jerrabomberra Creek borders the site to the north east, and commercial and light industrial properties borders the site to the south.

The Jerrabomberra Creek crosses the site to the south east of the main railway station yards and flows north and north west into Lake Burley Griffin. Adjacent to the rail lines at the location of the creek crossing, the site is bordered by undeveloped land vegetated with tall grass and trees. Further south east Monaro Highway and Ipswich Street both cross the rail corridor via bridges over the rail lines. South east of Ipswich Street the rail corridor is bordered on both sides by industrial land usage.

3.3 Local Soil Profile

Reference to Published information (Bureau of Mineral Resources, Geology and Geophysics - Geology of Canberra, Queanbeyan and Environs, 1980) shows that the near surface geological conditions vary along the length of the railway easement between Kingston and Queanbeyan. At the north western (Kingston) end, north west of Robbo's Pet Barn, and in the Fyshwick area, south east of the Ipswich Street Bridge, the surficial geology is likely to comprise Canberra Formation sedimentary rock which includes calcareous shale, limestone, sandstone and tuff, that in some areas is overlain by Tertiary Age quartz pebble gravel and coarse sand.

In between these two areas, Quaternary Age alluvial soils including gravel, sand, silt and clays associated with Jerrambomberra Creek are present at the natural ground surface. From around the Newcastle Street Bridge and South east of this bridge, the near surface geology alters to Ainslie Volcanic Rock comprising volcanic andesite. As the railway easement then approaches the Molongolo River, the Tertiary and Quaternary materials noted above are likely to overlie the volcanic rock.

Further east towards Queanbeyan the near surface geology is likely to alter once more, to Pittman Formation sedimentary rocks, principally sandstone, siltstone and shale.

3.4 Regional and Local Groundwater

ACT Electricity and Water (Ecowise) advised that local groundwater depth varies seasonally from 2 m below ground level (bgl) to 10 m bgl, and generally lies between 4 m and 6 m bgl.

Three existing groundwater monitoring wells were identified on the AN rail corridor adjacent to the Mobil depot during the Phase 1 Audit Program. The standing water level within these wells reports groundwater within 0.5 - 1.5m of the ground surface. As Environment ACT has no formal records of any groundwater monitoring or extraction wells, it is unknown as to when and why these wells were constructed. It is further unknown as to who requested the construction of the wells and which parties undertook the construction program.

4. Summary of Potential Contamination Issues - Further Soil and Groundwater Investigation Objectives

Based on historical information, in conjunction with the results and findings of the Phase I Audit and subsequent Phase II ESA works, the following contaminants were considered to represent potential environmental and/or human health risks and as such were targeted for further investigation:

- heavy metals (particularly lead and zinc) present within surficial ballast, ash and cinder wastes, adjacent to the former cement works;
- petroleum hydrocarbons resulting from product losses and spillages associated with the former locomotive refuelling facility, located within the centre of the main railyards;
- petroleum hydrocarbons, heavy metals and monoaromatic hydrocarbons (MAHs) associated with the bulk storage of hydrocarbon products in the Shell, Caltex/Ampol, Mobil and BP Fuel Depots located adjacent to the eastern portion of the rail corridor; and
- heavy metals, organic and inorganic contaminants associated with the extensive municipal wastes buried in the northern and eastern portions of the railyards site.

Based on these issues and target areas, the principal objectives of the further soil and groundwater investigations were to:

- determine the nature and extent of soil and groundwater impacts present on site;
- assess any potential environmental liabilities or potential risks to human health posed by the identified contaminants; and to
- provide recommendations for any remediation and rehabilitation works in order to reduce potential environmental liabilities and/or human health risks posed by the identified site conditions for the continued use of the site as a railway station and rail corridor.

5. Further Soil and Groundwater Investigations - Sampling and Assessment Rationale

5.1 Soil and Groundwater Sampling Rationale

The further soil and groundwater sampling program was based on the scope of works nominated within the project proposal document "Proposal for Additional Soil and Groundwater Investigations - Canberra Railway" (PPK reference 27K140A/SPT dated 16 November 1998).

In order to facilitate a methodical and targeted sampling program, PPK segregated the Canberra site into distinct sub areas based on current and former site activities and previously identified environmental impacts. The rationale behind this approach allowed for the implementation of a specific sampling program for localised contamination as well as a more general sampling program for dispersed contaminants.

The sub areas targeted for localised soil and groundwater sampling comprised of the:

- former locomotive refuelling facility,
- former municipal waste dump site, and;
- eastern rail corridor and adjacent fuel depots, fuel sidings and former cement works.

The general location of the aforementioned sub areas are depicted on Figures 1, 2 and 3, Appendix C.

5.2 Soil and Groundwater Sampling Procedures

Soil samples were recovered during the drilling and construction of the groundwater monitoring wells where visual or olfactory evidence of any impacts or contamination was observed. All groundwater monitoring wells were drilled using a truck mounted drilling rig using push tube rods and rotary air. All wells were constructed from Class 18 uPVC materials with machine slotted uPVC screens placed from the base of each well to within approximately 1 m of the ground level to allow the inflow of phase separated products, if present. Environmental borelogs and well construction logs are presented in Appendix D.

Soil logging, well development, well purging, sample collection and transfer of samples to the environmental laboratory were undertaken in general accordance with the guidelines and procedures specified within the *Investigation Scope Definition Overview and Generic Workplan for Australian National Projects* prepared by the Australian National Project Consultancy Panel in November 1996. Groundwater wells were purged with a whaler pump and PVC tubing and/or a stainless steel bailer. All groundwater samples were collected using a stainless steel bailer in conjunction with subjective analysis (eg odour and appearance) and field parameters (ie electrical

conductivity, dissolved oxygen, redox potential, pH and temperature) and observations were recorded on field sheets. Field parameter sheets, completed at the time of sample are included in Appendix E.

Sampling equipment was decontaminated between each sample collection using Decon 90 cleaning solution and potable water, the equipment was then rinsed with potable water, followed by a final rinse with deionised water prior to use.

Interpolated groundwater flow contours are depicted in Figures 4,5 and 6, Appendix F.

5.3 Soil and Groundwater Analytes

Selected soil and groundwater samples were submitted for a range of chemical analyses incorporating general screen parameters characteristic of the entire site and sub area specific parameters based on the nature of the current and former site activities and previously identified impacts.

The rationale for selection of the various parameter suites for sample testing is detailed below.

Heavy Metals (soils and groundwaters)

The nominated heavy metal screen incorporated arsenic, chromium, copper, cadmium, mercury, nickel, lead and zinc. The nominated suite of heavy metals was considered to be appropriate given the nature of the operations conducted across the site, the existence of widespread surficial fill materials and the presence of identified impacts.

pH and Total Dissolved Salts (groundwaters)

pH is a measure of the relative acidity and/or alkalinity of the groundwater. pH has a major effect upon the fate and mobility of particular heavy metals and other chemical constituents within the environment. Total Dissolved Salts (TDS) measures the concentration of dissolved phased ions present within the groundwater. TDS and pH measurements are the principal measurements of groundwater quality.

Total Petroleum Hydrocarbons (TPH) and MonoAromatic Hydrocarbons (BTEX) (soils and groundwaters)

Based on the widespread storage and use of fuels and lubricating oil products on and adjacent to the site, TPH and BTEX analyses were undertaken where evidence of hydrocarbon contamination was known or suspected.

Polynuclear Aromatic Hydrocarbons (soil and groundwaters)

Polynuclear Aromatic Hydrocarbons (PAHs) are a common constituent of diesel fuels, oil tars and tarry residues. Some PAHs are suspected and known carcinogens, particularly benzo(a)pyrene. PAHs are also produced from the incomplete combustion of fuels and therefore may be present in waste oil products, slag and foundry wastes.

Semi Volatile Organic Compounds (groundwaters)

The Semi volatile organic compound (SVOC) screen incorporates a extensive range of semi volatile organic compounds including, PAHs, OCPs, TPHs, Organophosphate pesticides, Fumigants, Chlorinated hydrocarbons and Phenolics. The SVOC screen provides a general screen of the organic constituents within the groundwater, and is useful for identifying particularly where current and/or former site usage is varied (ie. storage of various chemicals/fuels and solvents) or unknown.

Volatile Organic Compounds (groundwaters)

The Volatile Organic Compound (VOC) screen incorporates a extensive range of volatile organic compounds including, BTEX compounds, halogenated aliphatic and aromatic compounds, aromatic and aliphatic hydrocarbon compounds and a range of volatile solvents. The VOC screen provides a general screen of the volatile organic constituents within the groundwater, particularly where current and/or former site usage is varied (ie. storage of various fuels and solvents) or unknown.

5.4 Laboratory Used

All soil samples recovered as part of the field investigation program were submitted to AMDEL Limited for the nominated analytical program.

AMDEL Limited
5 Kelray Place
ASQUITH NSW 2077

AMDEL has NATA accreditation for operating a quality management system (ISO 9001), together with NATA registration for all of the nominated chemical analyses.

For quality assurances and quality control purposes PPK also submitted check samples and duplicate analyses to Australian Environmental Laboratories (AEL) in Melbourne. AEL are similarly NATA accredited for all of the nominated analytical testing procedures.

Chain Of Custody documents and analytical request documents are presented in Appendix G. Original certified laboratory results including QA/QC data reports are presented in Appendix H.

5.5 Assessment Criteria

In order to assess the level and significance of any potential contaminants detected through analytical laboratory testing it is usual to reference established environmental investigation levels and/or human health threshold exposure levels.

5.5.1 Soil Assessment Criteria

For the purpose of assessing potential long term human health risks, the South Australian Health Commission (SAHC) Investigation Levels as specified within the publication "A Practical Guide to the Health Risk Assessment and Management of Contaminated Land in SA"-SAHC January 1993, are referenced as the adopted initial investigation levels.

For the purpose of assessing potential environmental risks, the Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC/ NH&MRC 1992) Environmental Investigation Levels are referenced as the adopted initial investigation levels. The ANZECC Environmental investigation guidelines are primarily based on threshold levels for phytotoxicity and surface water receptors and are derived to protect the most sensitive receptor likely to be placed at risk and to reflect a level at which there is no observed effect on that receptor. Where ANZECC guidelines are deficient for certain analytes use of the Dutch Criteria are recommended.

The SAHC (health) and the ANZECC (environmental) Investigation Levels represent contaminant levels which if exceeded during the course of the initial investigation, does not necessarily represent an immediate action level, but does need to be assessed further through risk analysis to determine the relative level and significance of the contaminant concentrations on a site specific basis.

As a preliminary aid in the evaluation of site specific health based risk analysis, the Proposed Health Based Soil Guidelines (Langley et al 1996) as presented in the Health Risk Assessment and Management of Contaminated Sites - Contaminated Sites Monograph Series No. 5, 1996 are used as reference criteria. The Langley Criteria incorporate health based soil guidelines for a range of potential exposure settings including:

- Exposure setting **A** - 'standard' residential;
- Exposure setting **B** - 'restricted' residential with substantial vegetable garden (limits on poultry meat intake);
- Exposure setting **C** - 'restricted' residential with substantial vegetable garden (exclusions on poultry meat intake);
- Exposure setting **D** - residential with restricted soil access (includes medium to high density residential);
- Exposure setting **E** - parks, recreational open space and playing fields: includes secondary schools;
- Exposure setting **F** - commercial/industrial sites.

As part of the AN Assessment and Remediation Program, a technical panel comprising members of the three consultancies undertaking the works have agreed to adopt the proposed Health Based Soil Investigation Levels (exposure setting F) as the initial contaminant investigation levels based on the current and continued industrial/rail use of the site.

In the case of analytes not covered by the nominated guidelines the Dutch Investigation and Intervention values will be referenced. Following discussions between the AN consultancy panel and the South Australian EPA and the SAHC, the following threshold concentrations for C10 - C36 petroleum hydrocarbon fractions were agreed, providing that it can be demonstrated that the residual hydrocarbon compounds are sufficiently immobile that they do not pose a significant environmental risk to surface receptors and groundwater:

- 1000 mg/kg - threshold criteria for sites which may be rezoned to a more sensitive land use;
- 5000 mg/kg - threshold criteria for sites which will remain for commercial / industrial use.

5.5.2 Groundwater Assessment Criteria

For the purpose of assessing the groundwater contaminant levels it is usual to take account of the potential beneficial uses of the groundwater and the potential for the groundwater to discharge to sensitive receiving water bodies (marine or freshwater).

Based on the measured salinity range of the groundwater beneath the site, it is apparent that the groundwater quality is within plausible potable limits (TDS below 1,000 mg/L) and therefore potential beneficial uses of the groundwater must include human consumption. Although groundwater beneath the site or immediate surrounds does not appear to be used for human consumption, assessment of the groundwater will be conservatively made to the lower of the health-based and aesthetic-based values contained within the Australian Drinking Water Guidelines (ADWG, 1996).

When assessing the potential impacts to the Jerrabombera Creek and adjoining Wetlands, reference has also been made to the Australian Water Quality Guidelines for Fresh and Marine Receiving Waters (ANZECC, 1992).

In the case of analytes not covered by the above (ie. TPH's) reference has been drawn from the Dutch Intervention Levels for groundwater, however it must be recognised that these guidelines have no legal standing in Australia and are used here solely for comparison purposes.

6. Further Soil and Groundwater Investigations - Contamination Assessment

In this section of the report, the results and findings of the investigation program are reviewed and discussed in relation to the contaminants present and their significance. In the following discussion, judgement has been applied in the assessment and interpretation of the available information in order to develop a conceptual model of the contamination that is present and its extent and significance.

6.1 Former Locomotive Refuelling Facility

Located in the main station rail yards, south west of the former goods shed (currently Robbo's Pet Barn), this area of site was targeted during the earlier Phase II ESA works as an area formerly used for the storage and distribution of locomotive fuel. Observations of hydrocarbon spillage in and around the former pump shed and the identification of a faint hydrocarbon odours within the surficial soils were noted during the Phase I Audit.

The Phase II ESA program comprised the drilling and construction of 3 groundwater monitoring wells and a single soil bore surrounding the former refuelling tank, interceptor trap and raised platform and dispensing pumps. Visual and olfactory evidence of hydrocarbon impacted soils were noted at the surface and also at depths between 3m and 4m bgl within two monitoring wells (GW5 & GW6), located immediately south of the above ground tank. Laboratory analysis of the impacted soils reported petroleum hydrocarbon concentrations below the proposed assessment criteria for continued rail (industrial) use, however laboratory analysis of the groundwater sample recovered from the closest monitoring well (GW5) reported TPH concentrations of 122,000 ug/L and a benzene concentration of 20ug/L. Assessment of the resulting TPH chromatogram identified the hydrocarbon contaminant as a degraded distillate product.

6.1.1 Additional soil and groundwater sampling points

In an attempt to delineate the extent of vapour phase soil and dissolved phase groundwater impacts identified during the Phase II ESA, an additional 5 groundwater monitoring wells (GW101 - GW105) were drilled and constructed surrounding the former refuelling tank and existing wells. The approximate location of the original and additional wells are shown in Figure 1, Appendix C.

All groundwater samples recovered from both the additional and existing wells were submitted to Amdel and analysed for TPH, BTEX, lead and mercury.

6.1.2 Field Observations and Contamination Assessment

The soil profile encountered during the drilling of the additional monitoring wells was consistent with the general soil profile encountered across the majority of the main railyards. Fill depths varied from 0.1m bgl to 0.4 m bgl and comprised predominantly of clayey silty sands with occasional cinder and slag/ballast fragments. The fill materials were underlain by natural clays with some inclusions of quartzitic gravels and ironstone gravels.

Olfactory evidence of hydrocarbon impacts were noted within the subsurface soils recovered from depths between 3m bgl and 7m bgl within wells GW 101 and GW 103, located to the north west and north east of the former refuelling tank. Laboratory analysis of selected soils where olfactory impacts were identified, reported trace concentrations of petroleum hydrocarbons (below the proposed assessment criteria for continued rail (industrial) use), characteristic of a degraded diesel product.

Laboratory analysis of the groundwater samples recovered from the additional wells reported the presence of dissolved phase hydrocarbons (also characteristic of a degraded distillate product) in monitoring wells GW101, GW102 and GW103. Laboratory analysis of the original wells installed during the Phase II ESA reported no dissolved impacts in monitoring wells GW6 or GW8, however a free phase distillate product with an apparent thickness of 4 mm was encountered in well GW5.

Based on the results of the two sampling and monitoring rounds completed (July and December 1998) it is apparent that the impacted groundwaters are localised within an approximate 25m radius surrounding the former refuelling. Further delineation of the dissolved phase impacts to the immediate north or east of the refuelling tank was not possible due to drilling restrictions imposed by the adjacent rail lines which surround the refuelling tank area on all sides.

Based on the easterly direction of localised groundwater flow (confirmed during both the July and December gauging events) the nearest groundwater receptor to the former refuelling area is likely to be the Jerrabomberra Creek, located in excess of 800m, east of the impacted area. From the two monitoring rounds completed, no evidence of any petroleum hydrocarbon impacts have been reported in the monitoring wells, hydraulically down gradient of the former refuelling area. Based on the dissolved phase contaminant concentrations reported to date in conjunction with the direction of localised groundwater flow and the distance to the nearest receptor, it is considered that the impacted groundwaters identified are unlikely to pose a significant risk to the Jerrabomberra Creek system and adjoining wetlands. Similarly, it is considered that due to the depth of the impacted soils and groundwater within the rail corridor, the observed site contaminant conditions are not likely to pose potential health risks to on site workers under normal site activities and operations. Potential health risks may be present if future maintenance works or works involving either deep excavations within these areas or extraction and use of the groundwater occurs.

6.2 Former Municipal Waste Dump

Located in the far northern and eastern portions of the main rail yards, this area of site was used extensively from the early 1950's through to the late 1970's/early 1980's as a dumping ground for municipal wastes.

Test pit excavations combined with the drilling and construction of a groundwater monitoring well during the Phase II ESA identified the presence of buried waste materials extending beyond 3.9m bgl within the centre and perimeter of the dump site. Visual assessment of the fill materials did not identify any obvious gross visually contaminated materials, however ash, cinders, slag, asbestos containing materials, coal, metal objects and an abandoned heating oil tank were identified. Olfactory assessment of the fill materials identified the presence of strong odours emanating from the within the waste mass, however no readily identifiable source zone was encountered. Laboratory analysis of selected samples reported a single exceedance of the nominated assessment criteria, with an elevated concentration of Benzo(a)pyrene identified in a test pit containing extensive ash, cinder and slag materials. Laboratory analysis of the single monitoring well, located on the north eastern side of the main fill area, reported a lead concentration, slightly in excess of the nominated drinking water criteria.

Based on the extensive area of known and suspected waste fill materials and the close proximity to the adjacent Jerrbomberra Creek and Wetlands (less than 50m) it was considered that further, more extensive investigations were required to allow for the assessment of potential impacts to the creek and wetland systems.

6.2.1 Additional soil and groundwater sampling points

In an attempt to assess potential discharges or impacts to the adjacent Jerrbomberra Creek and wetlands, an additional 11 groundwater monitoring wells (GW106 - GW113) were drilled and constructed within the access track surrounding the majority of the former dumping area and the adjacent ARHS/William Edmunds property. The approximate location of the original and additional wells are shown in Figure 1, Appendix C.

All groundwater samples recovered from both the additional and existing wells were submitted to Amdel for TPH, SVOC's, VOC's, pH, TDS and heavy metals analysis.

6.2.2 Field Observations and Contamination Assessment

The soil profile encountered during the drilling of the additional monitoring wells surrounding the known fill areas was characterised by extensive silty clay and gravel fill materials to depths in excess of 5m bgl. The fill materials were underlain by natural sandy silts to depths in excess of 8m bgl.

No visual or olfactory evidence of any significant impacts were identified within the soil profiles encountered. Furthermore no evidence of any extensive waste materials were identified within the soil profiles encountered. Due to the compacted nature of the silty clay and gravel fill materials and the subsequent requirement for the use of air

hammer drilling, no soil samples were recovered from the eight additional monitoring wells constructed.

Laboratory analysis of the groundwater samples recovered from the additional wells reported the no significant volatile or semi volatile constituents, with the exception of the groundwater sample recovered from monitoring well GW109, located at the north western site boundary, where dissolved phase concentrations of TPH in excess of 37000ug/L were reported. Chromatographic analysis of the sample identified the hydrocarbon contaminant as a highly degraded kerosene or distillate product. No obvious source zone or surrounding impacts were identified during the drilling and construction of the well. Trace concentrations of Di-n-butyl phthalate, a known "plasticiser agent" and common constituent of plastic materials were reported in the groundwater samples recovered from monitoring wells GW112 and GW116.

Concentrations of heavy metals whilst in some instances in excess of the Australian Drinking Water Standards, were generally consistent with the concentrations reported across the whole site, indicating no significant contribution from any waste materials and subsequent leachate products (if any) from the known waste fill areas. In terms of potential risks or impacts to the receiving creek and wetland systems, the concentration of heavy metal constituents reported during both rounds of groundwater sampling have all been below the Australian Water Quality Guidelines for Fresh Waters (1992) - Summary Guidelines for the protection of aquatic ecosystems and are therefore considered to represent negligible risks under current site conditions.

6.3 Eastern Rail Corridor Adjacent Former Off Site Cement Works

Located to the east of the main railyards, within the Fyshwick industrial area, this area comprises the rail corridor and northern access areas adjacent to the Newcastle Street bridge. This area previously adjoined the southern boundary of a former cement works where visually discoloured and potentially impacted surface soils were identified during the initial Phase 1 Environmental Audit.

The Phase II ESA program comprised the drilling and construction of a single groundwater monitoring well within the northern portion of the AN rail corridor and access area to the former cement works (now industrial/commercial premises). Results and findings of the drilling and sampling works identified the presence of an extensive shallow band of ballast, ash and cinders, in which concentrations of lead and zinc (4,733 mg/kg & 53,264 mg/kg respectively) were both identified in excess of the nominated assessment criteria for industrial (rail) land use.

6.4 Eastern Rail Corridor and Adjacent Fuel depots

Located to the east of the main railyards, within the Fyshwick industrial area, this area comprises the rail corridor between the Ipswich and Newcastle Street bridges. This area of the rail corridor provides sidings and access to numerous industrial premises, including the operational Shell, Mobil, Caltex/Ampol and BP Fuel Depots.

Adsorbed phase soil and dissolved phase groundwater impacts, characteristic of a degraded distillate/motor spirit mix were identified within the subsurface soils adjacent to the northern boundary of the Shell depot, located adjacent to the Monaro Highway.

Olfactory evidence of petroleum hydrocarbon impacts within the subsurface soil profile were further reported in six of the twelve soil and groundwater sampling locations targeted adjacent to the southern boundaries of the Mobil, Ampol/Caltex and BP Fuel Depots. Laboratory analysis of groundwater samples recovered from three of the monitoring wells located adjacent to the Mobil depot and from a single well located adjacent to the Caltex/Ampol depot, reported high concentrations of dissolved phase petroleum hydrocarbons, including TPH, benzene and PAH compounds. Two of the three impacted samples recovered from wells adjacent to the Mobil depot, were recovered from existing monitoring wells, however it is unknown as to who commissioned or constructed the monitoring wells.

The approximate location of the existing groundwater monitoring wells are shown on Figures 2 and 3, Appendix C.

6.4.1 Additional groundwater sampling

Based on the presence of rail infrastructure (predominantly operational rail lines) further drilling and construction of monitoring wells to delineate the extent of the observed absorbed and dissolved plumes was not possible. In order to gain sufficient information relating to the nature and extent of the observed impacts and to provide confirmation that the impacts were most likely sourced from off site operations or activities, PPK undertook a second round of groundwater well gauging and sampling.

All groundwater samples recovered from the existing wells were submitted to Amdel and analysed for TPH, PAH, BTEX and heavy metals.

6.4.2 Field Observations and Contamination Assessment

Well gauging of the existing groundwater monitoring wells reported no free phase or phase separated hydrocarbons, however distinct hydrocarbon sheens were observed on the surface of the groundwater in monitoring wells, GW4 and GW35 (located adjacent to the Shell depot), and GW 22, GW24, PMW1 and PMW2 (all located adjacent to the Mobil depot).

Laboratory analysis of groundwater samples recovered from the existing wells constructed by PPK adjacent to the Shell depot confirmed the presence of hydrocarbon impacts with TPH concentrations of 50,100 ug/L and 8140 ug/L reported within wells GW4 and GW2 respectively with corresponding benzene concentrations of 10407 ug/L and 3644 ug/L respectively reported. Naphthalene concentrations of 139 ug/L and 9 ug/L were further reported within wells GW4 and GW2 respectively. Minor TPH impacts were identified within monitoring well GW 35, where TPH concentrations of 90 ug/L were reported. Overall, the second round of groundwater data confirms the presence of hydrocarbon impacts and also indicates a general reduction in the concentrations reported when compared to the initial analytical results.

Laboratory analysis of groundwater samples recovered from the existing wells adjacent to the Mobil depot similarly confirmed the presence of hydrocarbon impacts with TPH concentrations of 108,500 ug/L, 50,700 ug/L and 307 ug/L reported within wells PMW1, PMW2 and GW24 respectively with corresponding benzene concentrations of 18ug/L, 1 ug/L and 12 ug/L respectively reported. Naphthalene concentrations of 43 ug/L and 2 ug/L were further reported within wells PMW1 and GW24 respectively. Overall, the second round of groundwater data confirms the presence of hydrocarbon impacts and also indicates a general increase in the concentration of hydrocarbon components present within monitoring wells PMW1 and PMW2, whilst a reduction in hydrocarbon components was observed in monitoring well GW24 when compared to the initial analytical results.

No evidence of impacted groundwaters were identified in the existing groundwater monitoring wells adjacent to the Caltex/Ampol and BP Fuel Depots.

Based on the results of the two sampling and monitoring rounds completed (July and December 1998) localised groundwater flow within the eastern rail corridor was confirmed to be in a general westerly direction, with the nearest groundwater receptor likely to be the Jerrabomberra Creek, located in excess of 1200m, west of the impacted areas. No information relating to the presence any additional groundwater monitoring wells or abstraction wells within the vicinity of the impacted areas was available during the preparation of this report.

From the two monitoring rounds completed, no evidence of any petroleum hydrocarbon impacts have been reported in the monitoring wells, hydraulically down gradient of the depot and rail corridor area. Based on the dissolved phase concentrations reported to date in conjunction with the direction of localised groundwater flow and the distance to the nearest receptor, it is considered that the impacted groundwaters identified are unlikely to pose a significant risk to the Jerrabomberra Creek system and adjoining wetlands. Similarly, it is considered that due to the depth of the impacted soils and groundwater within the rail corridor, the observed site contaminant conditions are not likely to pose potential health risks to on site workers under normal site activities and operations. Potential health risks may be present if future maintenance works or works involving either deep excavations within these areas or if extraction and/or use of the groundwater within these areas occurs.

6.4.3 Additional Surface Soil Sampling

In order to gain sufficient information relating to the nature and extent of the observed fill materials and heavy metal impacted materials, PPK drilled and recovered soil and fill samples from an additional 6 shallow soil bores surrounding the existing groundwater monitoring well. The approximate location of the original monitoring well and additional soil bores are shown in Figure 3, Appendix C.

Selected surface and subsurface soil samples recovered from the additional soil bores were submitted to Amdel for pH and heavy metals analysis.

6.4.4 Field Observations and Contamination Assessment

The soil profile encountered during the drilling and sampling of the additional soil bores surrounding the original groundwater monitoring well was characterised by silty clay and gravel fill materials with inclusions of ash, cinders, plastic wastes and minor roots to a maximum depth of 0.3m bgl. The fill materials were underlain by natural clays and silty clays to depths in excess of 0.5m bgl. Auger refusal was encountered within all boreholes at varying depths between 0.3 m and 0.5m bgl. The suspected cause of the refusal was believe to be rock materials forming part of the shoulder of the rail corridor and access areas.

No visual or olfactory evidence of any significant impacts were identified within the soil profiles encountered, other than the presence of ash and cinders, which were predominantly restricted to the upper 150mm soil profile.

Laboratory analysis of the surface soil/fill materials recovered from the additional soil bores reported lead and zinc concentrations (5420 mg/kg and 49531 mg/kg respectively) in excess of the nominated industrial (rail) assessment criteria in only one of the six additional bores drilled. These elevated concentrations corresponded to an area of extensive ash and cinder fill materials. No exceedances of the nominated assessment criteria were reported within the underlying soil/fill profile (0.15 m - 0.30m bgl).

Based on the results of the two sampling rounds completed (July and December 1998) an approximate boundary of the surficial impacted soils can be assigned to the area immediately east of the original groundwater monitoring well with an approximate radius of 10m.

Based on the localised area of the identified impacted fill materials it is considered that the observed site contaminant conditions are not likely to pose potential health risks to on site workers under normal site activities and operations, however potential health risks may be present if future maintenance works or works involving either longer exposure periods within the impacted area are undertaken. Based on the localised nature of the chemical impacts within the upper 150mm soil profile it is considered that the potential for subsequent leachate generation and impact upon underlying soil profiles and groundwater are negligible.

7. Conclusions and Recommendations

The results and findings of the combined Phase II ESA works and the additional soil and groundwater investigations undertaken during July and December 1998, respectively, has identified and confirmed the presence of localised on site soil and groundwater impacts, considered to be the result of both on site and off site sources of contamination.

Impacts from on site activities

Localised impacted areas considered to be the result of either current or former on site sources of contamination were identified and delineated within the former locomotive refuelling area and the adjacent former municipal waste dump, and the former cement works, adjacent to Newcastle Street.

Former Locomotive Refuelling Area

Observations and intrusive sampling and analysis works have identified the presence of surface and subsurface hydrocarbon impacted soils surrounding the former locomotive refuelling area and associated interceptor. Field assessment of soil samples recovered during the investigation program reported the presence of surficial hydrocarbon staining of the soils and hydrocarbon odours between depths of 3m and 4m within five of the groundwater monitoring wells surrounding the former refuelling area and interceptor trap. All soil samples selected for analysis reported residual concentrations of petroleum hydrocarbons (characteristic of a degraded distillate product) below the nominated assessment criteria for industrial (rail) land use. Analysis of the groundwater samples recovered from the eight monitoring wells surrounding the former refuelling area reported the presence of elevated concentrations of dissolved phase petroleum hydrocarbons (in excess of the nominated assessment criteria), in four of the wells, with a free phase hydrocarbon product with an apparent thickness of 4mm identified within the monitoring well closest to the former refuelling tank.

Based on the results of the two sampling and monitoring rounds completed (July and December 1998) it is apparent that the zone of absorbed phase soil impacts and dissolved/free phase groundwater impacts are localised within the immediate vicinity (25m radius) of the former refuelling tank, however precise delineation of the dissolved phase impacts to the immediate north or east of the refuelling tank was not possible due to drilling restrictions imposed by the adjacent rail lines which surround the refuelling tank area on all sides. Based on the easterly direction of localised groundwater flow (confirmed during both the July and December gauging events) the nearest groundwater receptor to the former refuelling area is likely to be the Jerrabomberra Creek, located in excess of 800m, east of the impacted area. From the two monitoring rounds completed, no evidence of any petroleum hydrocarbon impacts have been reported in the monitoring wells, hydraulically down gradient of the former refuelling area. Based on the dissolved phase concentrations reported to date in conjunction with the direction of localised groundwater flow and the distance to the nearest receptor, it is considered that the impacted groundwaters identified are unlikely to pose a significant risk to the Jerrabomberra Creek system and adjoining wetlands,

however future groundwater monitoring on a regular basis will be required as a proactive site management issue. Further site management issues incorporating the recovery of the available free phase product using passive recovery socks are recommended within monitoring well GW5. It is further recommended that these issues are discussed with the ACT Environment authorities (Department of Urban Services), to ensure compliance with any territory based legislation or requirements.

In terms of potential health risks to on site workers, it is considered that due to the depth of the impacted soils and groundwater within the vicinity of the refuelling area, the observed site contaminant conditions are not likely to pose potential health risks to on site workers under normal site activities and operations. Potential health risks may be present if future maintenance works or works involving either deep excavations within these areas or extraction and use of the groundwater occurs. On site personnel should be made aware of site conditions such that appropriate safety procedures can be adopted prior to the commencement of any such works.

No remedial works, other than the minor actions already nominated are deemed necessary for the continued use of the site as an operational railway station and railyard.

Municipal Waste Disposal Area

The extensive filling of the northern and eastern portions of the main railyards is considered to represent the potential environmental and structural limitations for the future use or development of these portions of site, other than for the continued use.

Visual assessment of the fill materials within the main portion of the former dump area identified waste materials including ash, cinders, slag, asbestos containing materials, coal, metal objects and an abandoned heating oil tank to a depth in excess of 3.9m bgl. Laboratory analysis of selected soil/fill samples reported a single exceedance of the nominated assessment criteria, with an elevated concentration of Benzo(a)pyrene identified in a test pit containing extensive ash, cinder and slag materials. Laboratory analysis of the groundwater samples recovered from the monitoring wells surrounding the hydraulically downgradient perimeter of the waste fill areas reported the no significant organic constituents, with the exception of a single sample recovered from the north western site boundary, where concentrations of dissolved phase TPH constituents were reported. Chromatographic analysis of the sample identified the hydrocarbon contaminant as a highly degraded kerosene or distillate product. No obvious source zone or surrounding impacts were identified during the drilling and construction of the well. Trace concentrations of Di-n-butyl phthalate, a known "plasticiser agent" and common constituent of plastic materials were further reported in two of the groundwater samples recovered from the wells within the centre of the peripheral site boundary. Concentrations of heavy metals whilst in some instances in excess of the Australian Drinking Water Standards, were generally consistent with the concentrations reported across the whole site, indicating no significant contribution from any waste materials and subsequent leachate products (if any) from the known waste fill areas. In terms of potential risks or impacts to the receiving creek and wetland systems, the concentration of heavy metal constituents reported during both rounds of groundwater sampling have all been below the Australian Water Quality Guidelines for Fresh Waters (1992) - Summary Guidelines for the protection of aquatic

ecosystems and are therefore considered to represent negligible risks under current site conditions, however future groundwater monitoring on a regular basis will be required as a proactive site management issue. It is further recommended that these issues are discussed with the ACT Environment Authorities (Department of Urban Services), to ensure compliance with any territory based legislation or requirements.

Eastern Rail Corridor (adjacent former Cement Works)

Previous audit and intrusive assessment works undertaken with the rail corridor and northern access areas adjacent to the Newcastle Street bridge, identified the presence of shallow fill materials comprising ash and cinder wastes. Laboratory analysis of these waste materials, which were generally confined to the upper 150mm soil profile reported lead and zinc concentrations in excess of the nominated industrial (rail) assessment criteria.

Additional soil investigations undertaken during the further soil and groundwater works undertaken in December 1998, confirmed the presence of high concentrations of lead and zinc constituents within these fill materials in a localised area immediately east of the original groundwater monitoring well, where surficial outcropping of these fill materials was identified.

Based on the localised area of the identified impacted fill materials it is considered that the observed site contaminant conditions are not likely to pose potential health risks to on site workers under normal site activities and operations, however potential health risks may be present if future maintenance works or works involving either longer exposure periods within the localised area are undertaken. Similarly, based on the localised nature of the chemical impacts within the upper 150mm soil profile it is considered that the potential for subsequent leachate generation and impact upon underlying soil profiles and groundwater are negligible.

Due to the small area in concern and the potential for future health risks to site workers (albeit low to negligible) it is recommended that remedial actions are implemented to either provide a surficial covering layer over these fill materials or to excavate and remove these materials to an appropriate off site waste repository. It is further recommended that these issues are discussed with the ACT Environment Authorities (Department of Urban Services), to ensure compliance with any territory based legislation or requirements.

No remedial works, other than the minor actions already nominated are deemed necessary for the continued use of the site as an operational railway station and railyard.

Impacts from suspected off site activities

The predominant soil and groundwater impacts identified within the eastern portion of the rail corridor during the Phase II ESA works and subsequent further investigation works are considered to be the result of on site migration of petroleum hydrocarbon products from the Shell, Mobil and Caltex/Ampol Fuel Depots.

Results of the Phase II ESA works undertaken in June 1998 identified the presence of adsorbed phase soil and dissolved phase groundwater impacts, characteristic of degraded distillate/motor spirit mix were identified within the rail corridor subsurface soils adjacent to the northern boundary of the Shell depot, located adjacent to the Monaro Highway. Further on site soil and groundwater impacts were identified adjacent to the Caltex/Ampol and Mobil Fuel Depots, with minor subsurface soil impacts identified adjacent to the Southern boundary of the BP Fuel Depot. Evidence of previous environmental investigations in the form of three groundwater monitoring wells were observed within the rail corridor adjacent to the Mobil depot.

Due to the presence of rail infrastructure (predominantly operational rail lines) further drilling and construction of monitoring wells to delineate the extent of the observed absorbed and dissolved plumes was not possible, however an additional round of groundwater sampling was undertaken to provide confirmation that the impacts were most likely sourced from off site operations or activities. The results and findings of the additional round of groundwater sampling have confirmed the presence of on site groundwater impacts adjacent to both the Shell and Mobil Fuel Depots, however the concentration of dissolved phase impacts were observed to have decreased in the wells adjacent to the Shell depot and have increased in the wells adjacent to the Mobil depot. No obvious groundwater impacts were observed adjacent to the BP and Caltex/Ampol depot's.

Based on the results of the two sampling and monitoring rounds completed (July and December 1998) localised groundwater flow within the eastern rail corridor was confirmed to be in a general westerly direction, with the nearest groundwater receptor likely to be the Jerrabomberra Creek, located in excess of 1200m, west of the impacted areas. No information relating to the presence any additional groundwater monitoring wells or abstraction wells within the vicinity of the impacted areas was available during the preparation of this report.

From the two monitoring rounds completed, no evidence of any petroleum hydrocarbon impacts have been reported in the monitoring wells, hydraulically down gradient of the depot and rail corridor area. Based on the dissolved phase concentrations reported to date in conjunction with the direction of localised groundwater flow and the distance to the nearest receptor, it is considered that the impacted groundwaters identified are unlikely to pose a significant risk to the Jerrabomberra Creek system and adjoining wetlands, however future groundwater monitoring on a regular basis will be required as a proactive site management issue. As the source of the on site impacts as considered to potentially arise from the Shell and Mobil operations, it is recommended that both of these companies are advised of the findings of the environmental investigations to date and asked to either assess the situation and impacts to the AN site on their own or to contribute to the continuation of assessment and monitoring works relevant to there properties. It is further recommended that these issues are discussed with the ACT Environment authorities (Department of Urban Services), to ensure compliance with any territory based legislation or requirements.

With respect to potential risks to on site AN workers, it is considered that due to the depth of the impacted soils and groundwater within the rail corridor the observed site contaminant conditions are not likely to pose potential health risks to on site workers

under normal site activities and operations, however potential health risks may be present if future maintenance works or works involving either deep excavations within these areas or if extraction and/or use of the groundwater within these areas occurs. On site personnel should be made aware of site conditions such that appropriate safety procedures can be adopted prior to the commencement of any such works.

In accordance with standard PPK protocols, detailed work scopes and cost estimates for the nominated site remediation and monitoring works will be provided to INDEC in a separate submission to this report.

8. 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 PPK ("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.

Reliance on Data

In preparing the report, PPK 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, PPK 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. PPK 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 PPK.

Environmental Conclusions

In accordance with the scope of services, PPK 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.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and no other party. PPK assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of PPK or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report).

Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

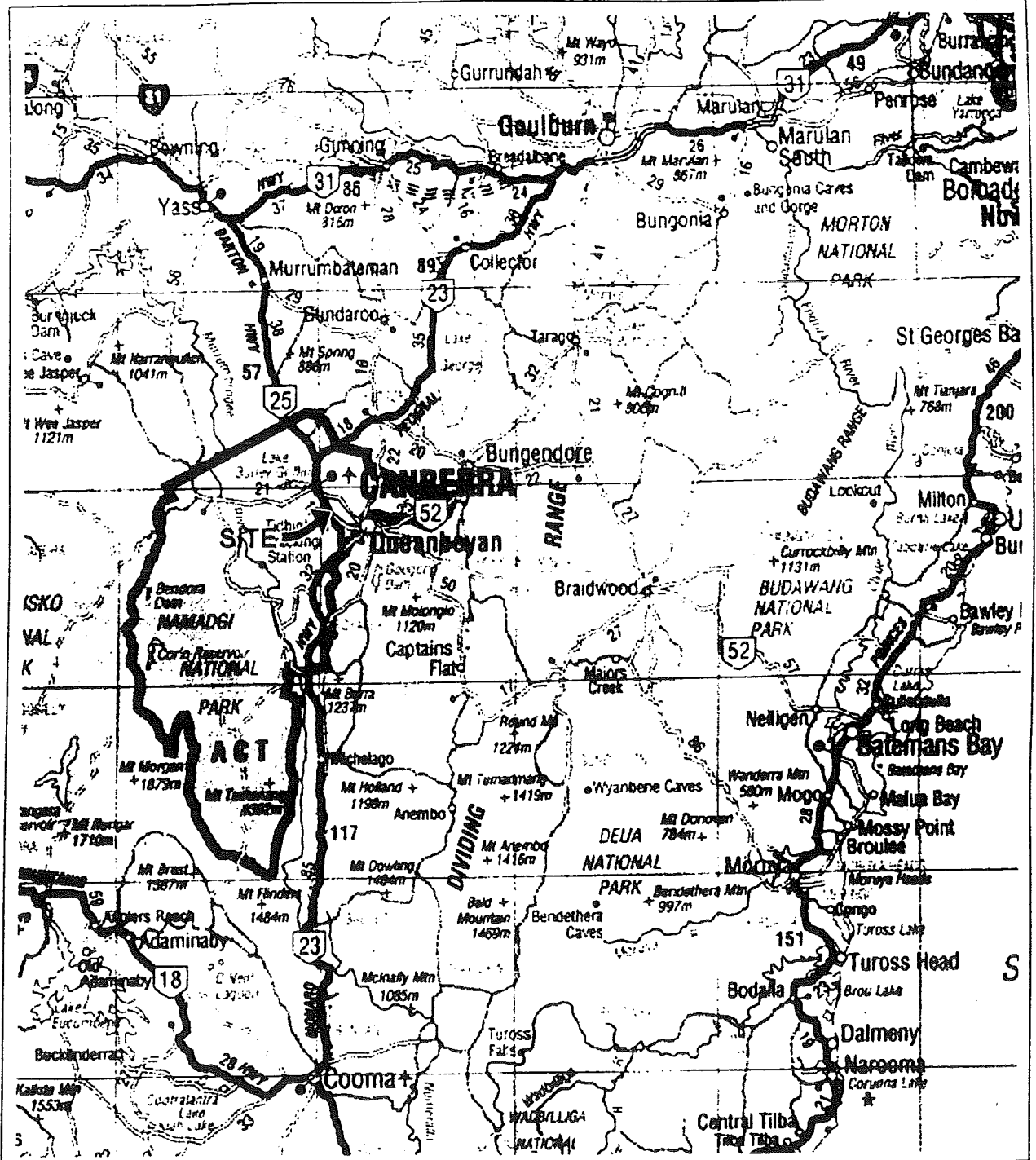
Other Limitations

PPK will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

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

Site Location Plan



Map Courtesy of Penguin Books Australia



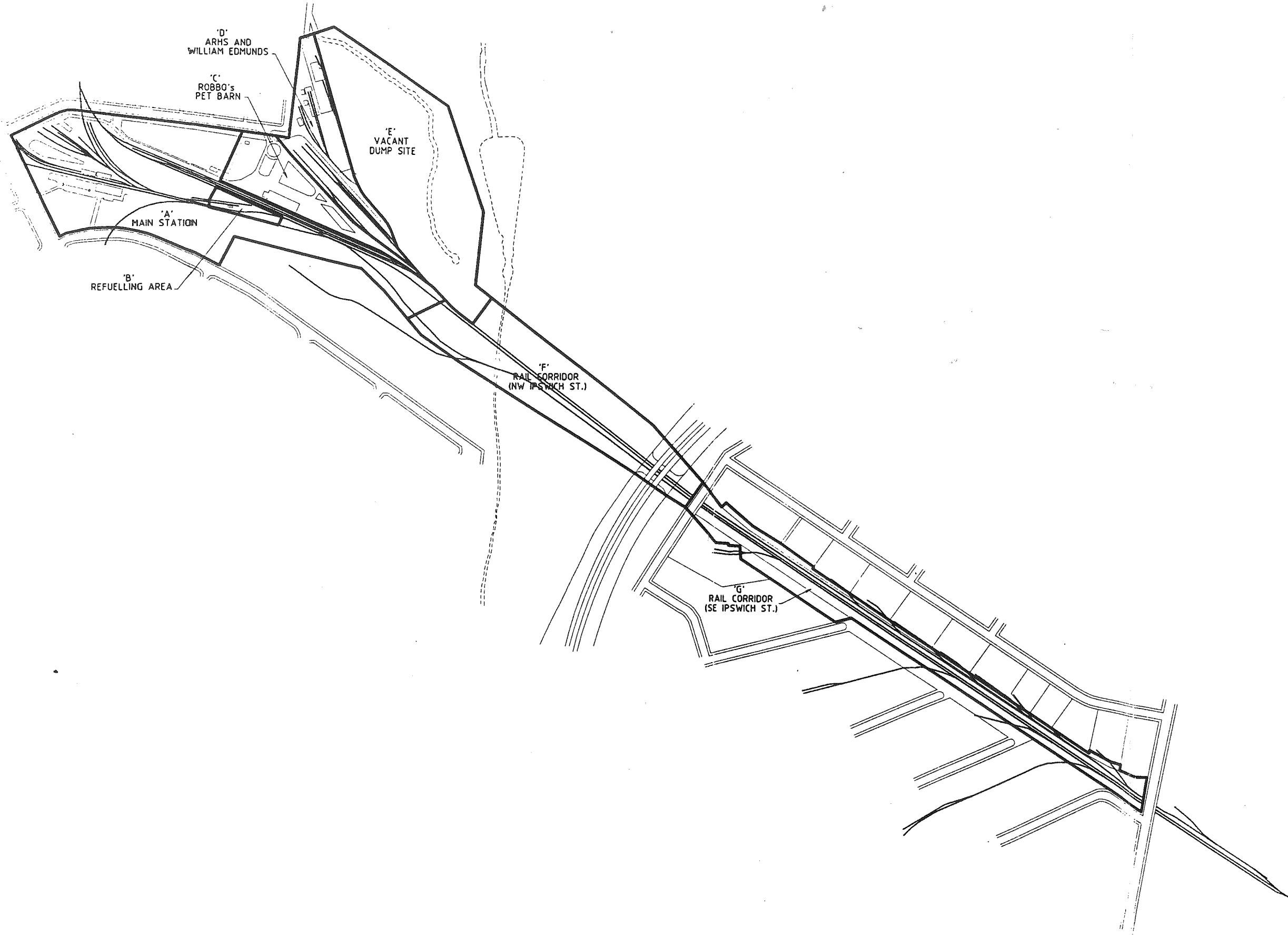
Australian National Phase II Environmental Site Assessments

Site Location Map

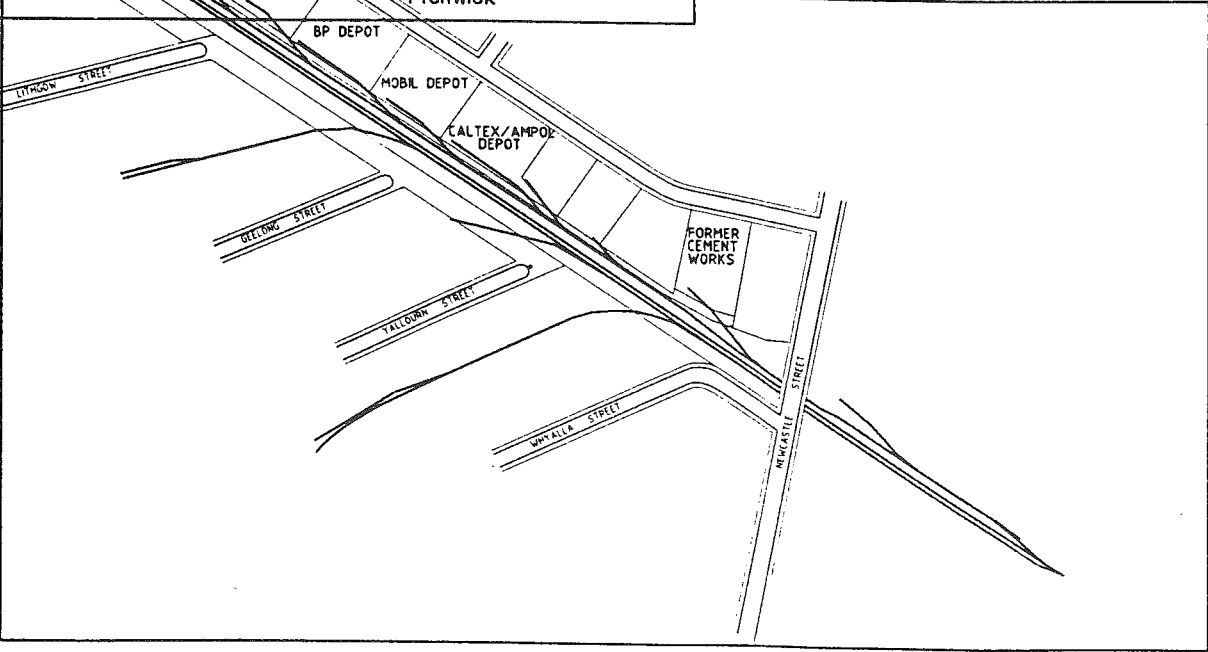
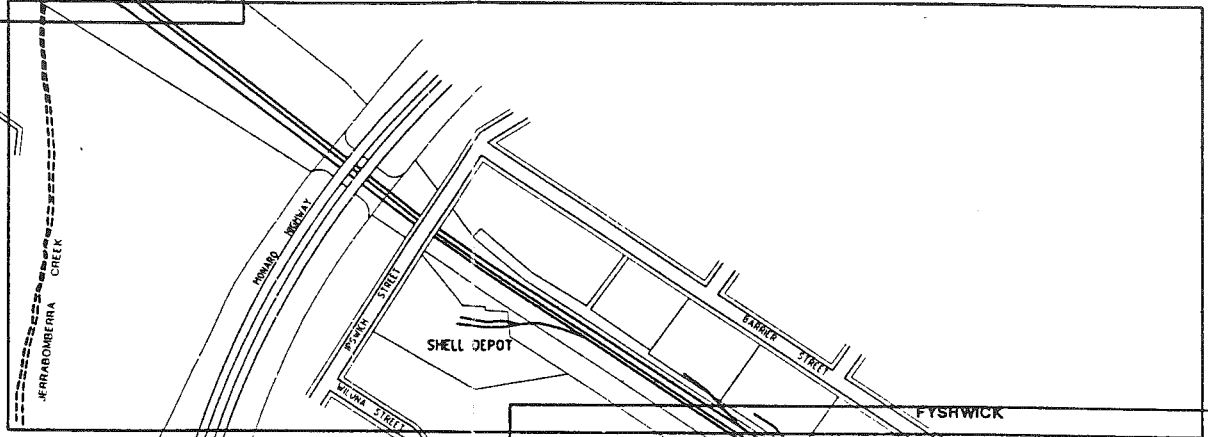
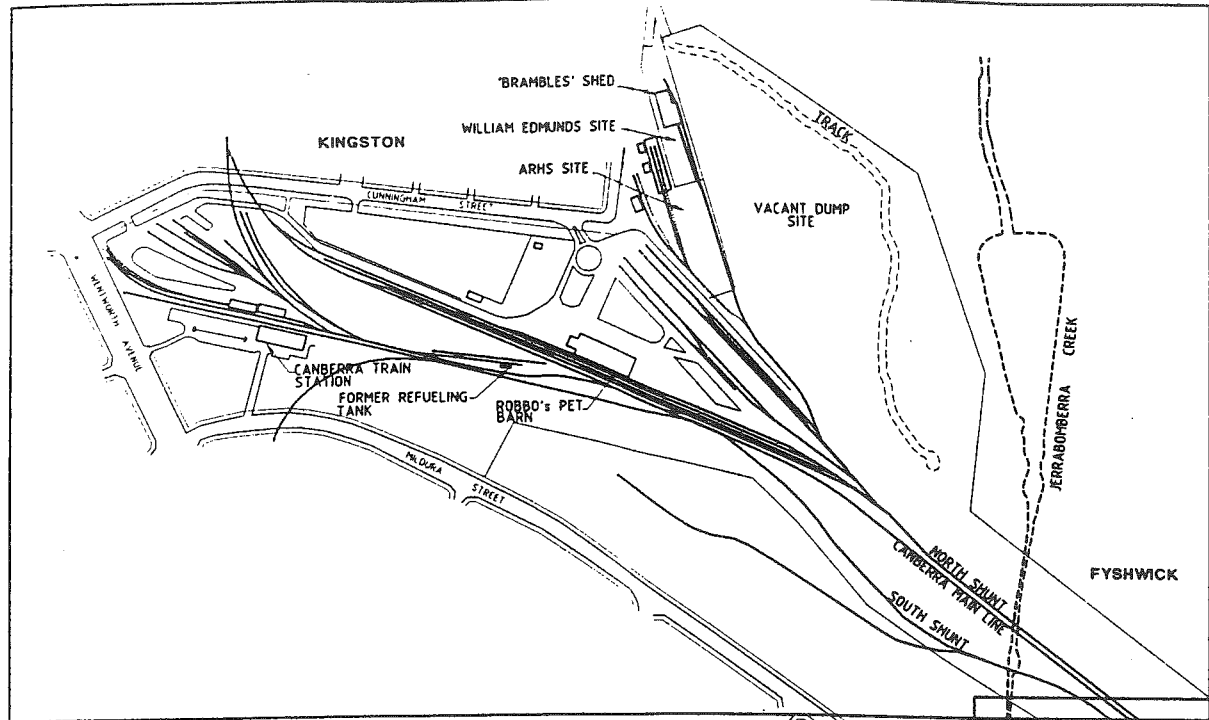
Canberra Railway Yards

Appendix B

Site Plans



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DRAWN BJB 10.7.98		CHECKED BJH 10.7.98		PROJECT NO. 27K140A		DATE 10.7.98	



NO.	DATE	DESCRIPTION	BY	APP'D	SCALE	DATE	DESCRIPTION	BY	APP'D

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PROJECT
CANBERRA RAIL YARDS

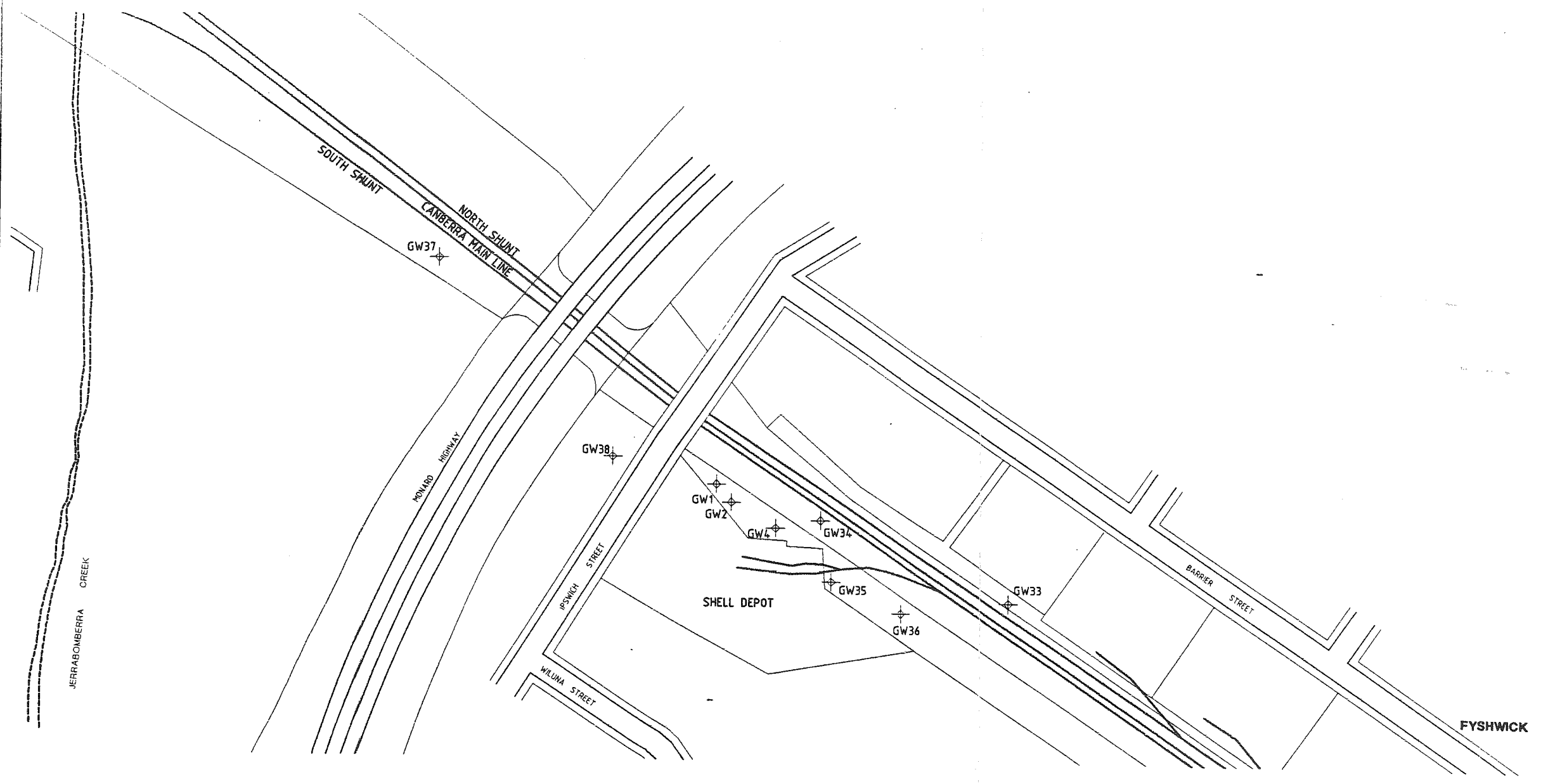
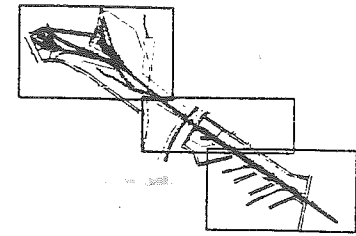
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PHASE 2 INVESTIGATION
SHEET 2 OF 11**

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DRAWN	BJB 10.7.98
CHECKED	BJH 10.7.98
DATE	27K140A/02

Appendix C

Sampling Location Plans (Soil)

Figures 1, 2 & 3



LEGEND

GW2 DENOTES GROUNDWATER WELL LOCATION 'JUNE 98'

NO	DATE	DESCRIPTION	BY	APPD	DATE	DESCRIPTION	BY	APPD
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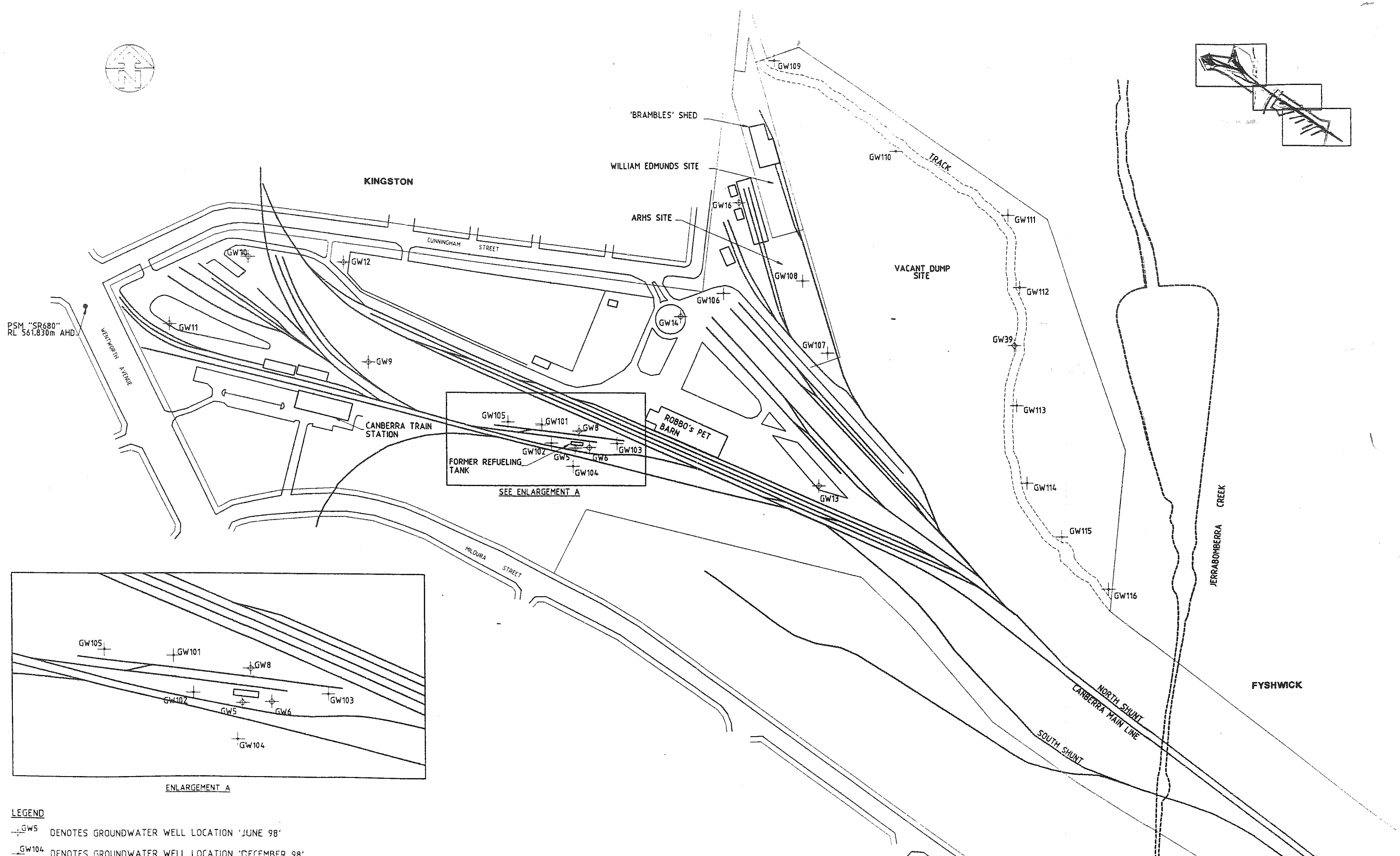
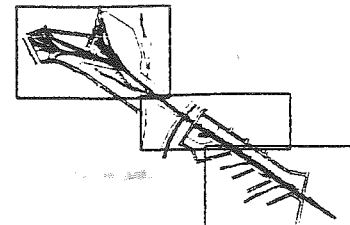
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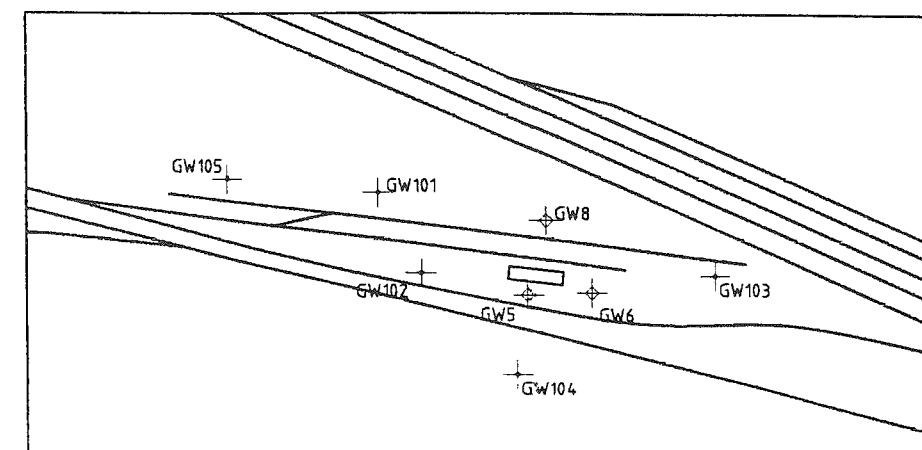
PROJECT
CANBERRA RAIL YARDS

TITLE
**PHASE 2B INVESTIGATION
GROUNDWATER WELL LOCATIONS
SHEET 2 OF 6**

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DRAWING	18.12.98	PROJECT APPROVAL
DRAWING	18.12.98	CLIENT APPROVAL
27K140B/02		



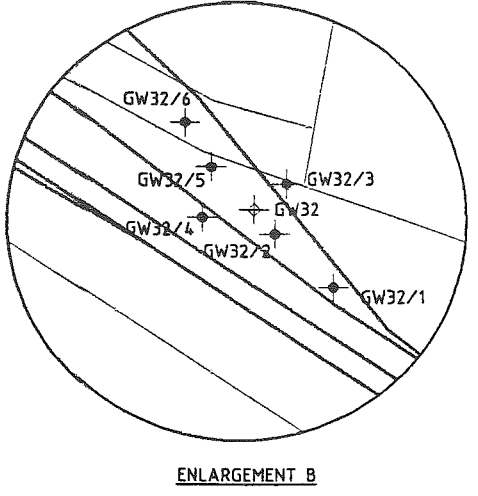
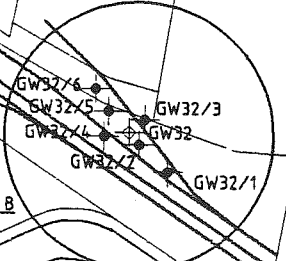
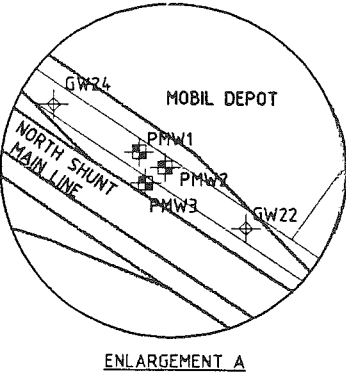
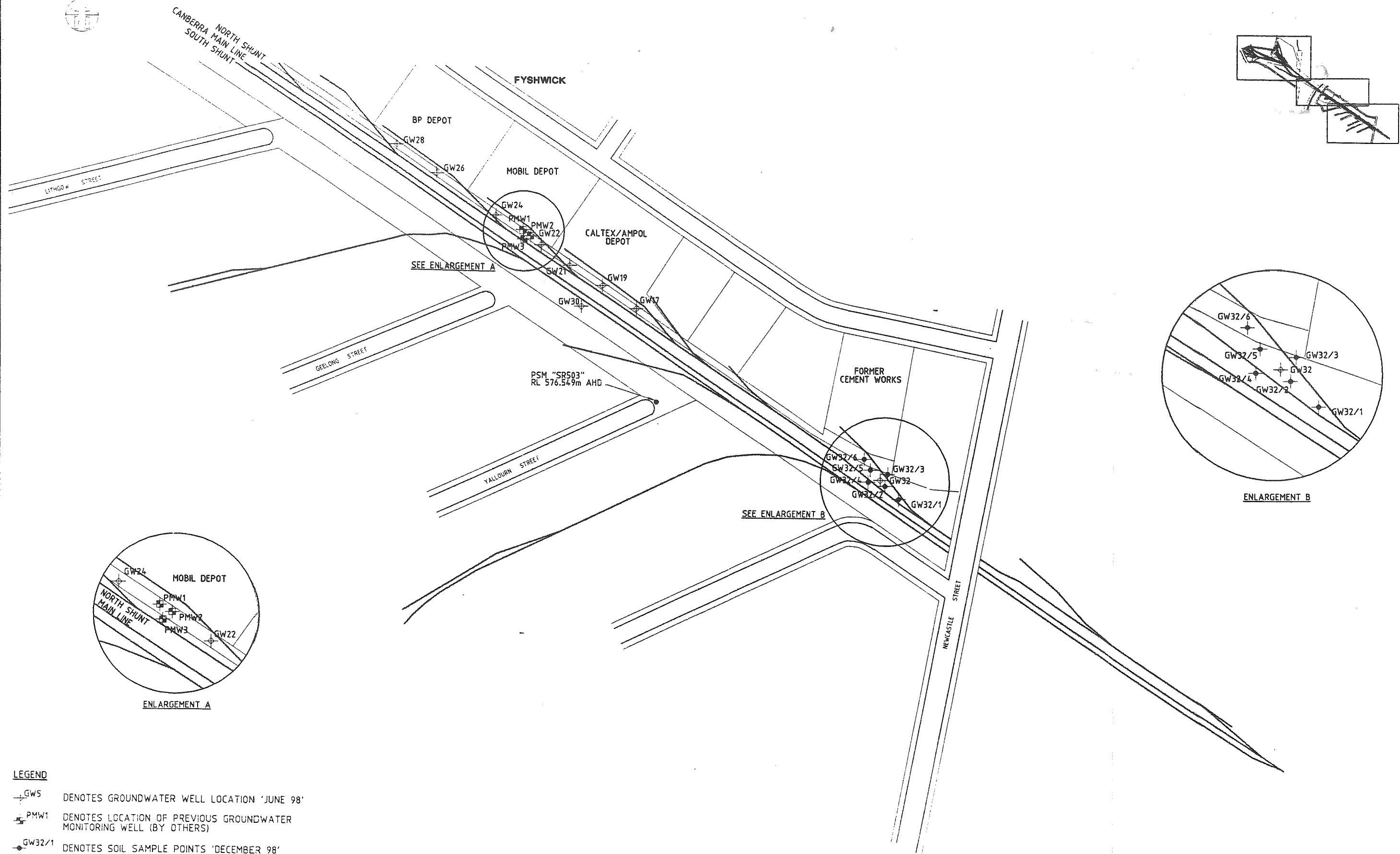
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RL 561.830m AHD



ENLARGEMENT A

LEGEND
 + GW5 DENOTES GROUNDWATER WELL LOCATION 'JUNE 98'
 - GW104 DENOTES GROUNDWATER WELL LOCATION 'DECEMBER 98'

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- LEGEND**
- GW5 DENOTES GROUNDWATER WELL LOCATION 'JUNE 98'
 - PMW1 DENOTES LOCATION OF PREVIOUS GROUNDWATER MONITORING WELL (BY OTHERS)
 - GW32/1 DENOTES SOIL SAMPLE POINTS 'DECEMBER 98'

CLIENT INDEC CONSULTING		PROJECT CANBERRA RAIL YARDS	
PPK Environment & Infrastructure PPK HOUSE 51 PINE STREET ADELAIDE SOUTH AUSTRALIA 5000 TELEPHONE: 081 2405 200 FAX: 081 2405 293 Email: pproad@ppk.com.au		TITLE PHASE 2B INVESTIGATION GROUNDWATER WELL LOCATIONS AND SOIL SAMPLING LOCATIONS SHEET 3 OF 6	
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REVISIONS AND APPROVALS NO. DATE DESCRIPTION BY APPR. CODE DATE DESCRIPTION BY APPR. CODE	REVISIONS AND APPROVALS		

Appendix D

Environmental Borelogs and Well
Construction Logs

Project	CANBERRA RAIL YARDS			Job Number	27K140B
Date	1/12/98	Time		Location No	GW 101
Coordinates (AMG)		N	E	Réduced Level (mAHD)	

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.1		FILL. Clayey silty sand, dark brown, occasional fine cinders/slag fragments.	1	0	
0.1-0.4		Sandy Clayey SILT. Brown, yellow brown, fine to medium sand, some fine roots.	0	0	
0.4-1.2		Silty Sandy CLAY. Mottled orange brown and yellow, shale/siltstone fragments towards base, thin powdery white seam at 0.65 m.	0	0	
1.2-1.8		Gravelly Silty CLAY. Mottled brown, yellow, red, siltstone fragments fine to coarse, very silty (waxy).	0	0	
1.8-2.5		Clayey Silty GRAVEL. yellow, light brown, siltstone fragments, considerable clay.	0	12	
2.5-7.5	3.0	Silty CLAY. yellowBrown, some gravel.	2	116	
	5.0	hydrocarbon odour from 3.0 metres to 7.0 metres	2	320	
	7.0		1	56	
		End of Borehole 7.5 m			

Logged by	MBR	Sampled by	MBR
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Field Classification 0 ... No obvious contamination 1 ... Slight visual contamination and/or slight odour 2 ... Visual contamination and/or odour 3 ... Gross visual contamination and/or strong odour	Comments
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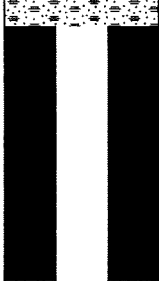
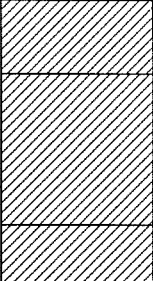
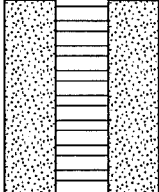
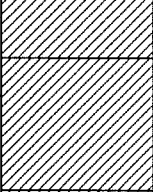
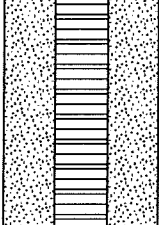
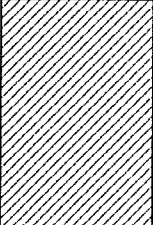
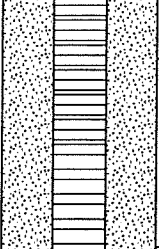
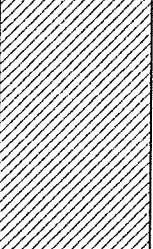
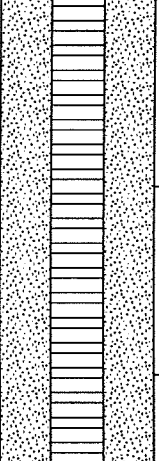
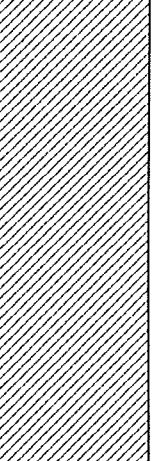
PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301



Drilling Co.: UNDERDALES	Permit No.:	GW101
Drill Method: AIR	TOC Elevation: 564.191 AHD	
Boring Dia: 0.15 Meters	Water Struck At: 6 Meters	Logged By:
Date Drilled: 1/12/98	SWL: 6.41 Meters	M.REYNOLDS

16/12/98 10:57:49 AM

C:\PROGRA-2\GBATEC-1\WELLO-127K140B.WL2

Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
	0		1		FILL. Clayey silty sand, dark brown, occasional fine cinders/slag fragments. Sandy Clayey SILT. Brown, yellow brown, fine to medium sand, some fine roots. Silty Sandy CLAY. Mottled orange brown and yellow, shale/siltstone fragments towards base, thin powdery white seam at 0.65 m.
	12		2		Gravelly Silty CLAY. Mottled brown, yellow, red, siltstone fragments fine to coarse, very silty (waxy).
	116		3		Clayey Silty GRAVEL. yellow, light brown, siltstone fragments, considerable clay.
	320		5		Silty CLAY, yellowBrown, some gravel, hydrocarbon odour from 3.0 metres to 7.0 metres
	56		7		

Completion Notes:

Well completed with standpipe and lock

Site:

CANBERRA RAILYARDS

Site Address:

Canberra Railyards

Project No.: **27K140B**

Page 1

Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	1/12/98	Time	Location No	GW 102
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.4		FILL. Clayey silty sand, dark brown, occasional fine cinders/slag fragments.	1	0	
0.4-1.2		Sandy Clayey SILT. Brown, yellow brown, fine to medium sand, some fine roots.	0	0	
1.2-3.0		Silty Sandy CLAY. Mottled orange brown and yellow, shale/siltstone fragments towards base.	0	<10	
3.0-4.5		Gravelly Silty CLAY. Mottled brown, yellow, red, siltstone fragments fine to coarse, very silty (waxy). hydrocarbon odour from 3.0 metres.	2	235	
4.5-7.5		Clayey Silty GRAVEL. yellow, light brown, siltstone fragments, considerable clay. Hydrocarbon odour slight at 7.0 metres	1	45	
		End of Borehole 7.5 m			

Logged by	MBR	Sampled by	MBR
Field Classification		Comments	
0 ... No obvious contamination 1 ... Slight visual contamination and/or slight odour 2 ... Visual contamination and/or odour 3 ... Gross visual contamination and/or strong odour			

PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301



Drilling Co.: UNDERDALES	Permit No.:	GW102
Drill Method: AIR	TOC Elevation: 563.922 AHD	
Boring Dia: 0.15 Meters	Water Struck At: 4.5 Meters	Logged By: M.REYNOLDS
Date Drilled: 1/12/98	SWL: 4.92 Meters	

16/12/98 10:58:25 AM

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Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
	0		1		FILL. Clayey silty sand, dark brown, occasional fine cinders/slag fragments.
	0		2		Sandy Clayey SILT. Brown, yellow brown, fine to medium sand, some fine roots.
	235		3		Silty Sandy CLAY. Mottled orange brown and yellow, shale/siltstone fragments towards base.
			4		
	45		5		Gravelly Silty CLAY. Mottled brown, yellow, red, siltstone fragments fine to coarse, very silty (waxy). hydrocarbon odour from 3.0 metres.
			6		
	0		7		Clayey Silty GRAVEL. yellow, light brown, siltstone fragments, considerable clay. Hydrocarbon odour slight at 7.0 metres

Completion Notes:

Well completed with standpipe and lock

Site:

CANBERRA RAILYARDS

Site Address:

Canberra Railyards

Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	1/12/98	Time	Location No	GW 103
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.1		FILL. Clayey silty sand, dark brown, occasional fine cinders/slag fragments.	1	0	
0.1-0.4		Sandy Clayey SILT. Brown, yellow brown, fine to medium sand, some fine roots.	0	0	
0.4-1.2		Silty Sandy CLAY. Mottled orange brown and yellow.		0	
1.2-1.8		Gravelly Silty CLAY. Mottled brown, yellow, red, siltstone fragments fine to coarse, very silty (waxy).	0	3	
1.8-2.5		Clayey Silty GRAVEL. Brown, light brown, siltstone fragments.	0	0	
2.5-7.5	3	Silty CLAY. Brown.	0	0	
	5		0	0	
	7		0	0	
		End of Borehole 7.5 m			

Logged by	MBR	Sampled by	MBR
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Field Classification 0 ... No obvious contamination 1 ... Slight visual contamination and/or slight odour 2 ... Visual contamination and/or odour 3 ... Gross visual contamination and/or strong odour	Comments
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PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301



Drilling Co.: UNDERDALES

Permit No.:

GW103

Drill Method: AIR

TOC Elevation: 563.461 AHD

Boring Dia: 0.15 Meters

Water Struck At: 4 Meters

Logged By:

Date Drilled: 1/12/98

SWL: 4.43 Meters

M.REYNOLDS

16/12/98 10:58:40 AM

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Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
	0		1		FILL. Clayey silty sand, dark brown, occasional fine cinders/slag fragments. Sandy Clayey SILT. Brown, yellow brown, fine to medium sand, some fine roots. Silty Sandy CLAY. Mottled orange brown and yellow.
	0		2		Gravelly Silty CLAY. Mottled brown, yellow, red, siltstone fragments fine to coarse, very silty (waxy). Clayey Silty GRAVEL. Brown, light brown, siltstone fragments.
	0		3		Silty CLAY. Brown.
	0		4		
	0		5		
	0		6		
	0		7		

Completion Notes:

Well completed with standpipe and lock

Site:

CANBERRA RAILYARDS

Site Address:

Canberra Railyards

Project No.: **27K140B**

Page 1

Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	1/12/98	Time	Location No	GW 104
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.1		FILL. Clayey silty sand, dark brown.	0	0	
0.1-0.4		Sandy Clayey SILT. Brown, yellow brown, fine to medium sand, some fine roots.	0	0	
0.4-1.2		Silty Sandy CLAY. Mottled orange brown and yellow, shale/siltstone fragments towards base.	0	0	
1.2-2.8		Gravelly Silty CLAY. Mottled brown, yellow, red.	0	0	
2.8-3.5	3	Clayey Silty GRAVEL. Brown, light brown, siltstone fragments, considerable clay.	0	0	
3.5-7.5	5	Silty CLAY. Brown, some gravel.	0	0	
	7		0	0	
		End of Borehole 7.5 m			

Logged by	MBR	Sampled by	MBR
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Field Classification 0 ... No obvious contamination 1 ... Slight visual contamination and/or slight odour 2 ... Visual contamination and/or odour 3 ... Gross visual contamination and/or strong odour	Comments
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PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301



Drilling Co.: UNDERDALES	Permit No.:	GW104
Drill Method: AIR	TOC Elevation: 564.891 AHD	
Boring Dia: 0.15 Meters	Water Struck At: 4 Meters	Logged By: M.REYNOLDS
Date Drilled: 1/12/98	SWL: 4.43 Meters	

16/12/98 10:58:56 AM

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Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
	0		1		FILL. Clayey silty sand, dark brown, occasional fine cinders/slag fragments. Sandy Clayey SILT. Brown, yellow brown, fine to medium sand, some fine roots. Silty Sandy CLAY. Mottled orange brown and yellow.
	0		2		Gravelly Silty CLAY. Mottled brown, yellow, red, siltstone fragments fine to coarse, very silty (waxy). Clayey Silty GRAVEL. Brown, light brown, siltstone fragments.
	0		3		Silty CLAY. Brown.
	0		5		
	0		7		

Completion Notes:

Well completed with standpipe and lock

Site:

CANBERRA RAILYARDS

Site Address:

Canberra Railyards

Project No.: **27K140B**

Page 1

Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	1/12/98	Time	Location No	GW 105
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.1		FILL. Clayey silty sand, dark brown, occasional fine cinders/slag fragments.	1	0	
0.1-0.4		Sandy Clayey SILT. Brown, yellow brown.	0	0	
0.4-1.2		Silty Sandy CLAY. Mottled orange brown and yellow, shale/siltstone fragments towards base.	0	0	
1.2-1.8		Gravelly Silty CLAY. Mottled brown, yellow, very silty (waxy).	0	0	
1.8-2.5		Clayey Silty GRAVEL. Brown, light brown, siltstone fragments, considerable clay.	0	0	
2.5-7.5	3	Silty CLAY. Brown.	0	0	
	5		0	0	
	7		0	0	
		End of Borehole 7.5 m			
Logged by	MBR		Sampled by	MBR	
Field Classification			Comments		
0 ... No obvious contamination					
1 ... Slight visual contamination and/or slight odour					
2 ... Visual contamination and/or odour					
3 ... Gross visual contamination and/or strong odour					
PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301					



Drilling Co.: UNDERDALES

Permit No.:

GW105

Drill Method: AIR

TOC Elevation: 564.746 AHD

Boring Dia: 0.15 Meters

Water Struck At: 6 Meters

Logged By:

Date Drilled: 1/12/98

SWL: 6.41 Meters

M.REYNOLDS

16/12/98 10:59:15 AM

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Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
			1		FILL. Clayey silty sand, dark brown, occasional fine cinders/slag fragments. Sandy Clayey SILT. Brown, yellow brown.
	0		2		Silty Sandy CLAY. Mottled orange brown and yellow, shale/siltstone fragments towards base.
					Gravelly Silty CLAY. Mottled brown, yellow, very silty (waxy).
	0		3		Clayey Silty GRAVEL. Brown, light brown, siltstone fragments, considerable clay.
					Silty CLAY. Brown.
	0		4		
	0		5		
	0		6		
	0		7		

Completion Notes:

Well completed with standpipe and lock

Site:

CANBERRA RAILYARDS

Site Address:

Canberra Railyards

Project No.: **27K140B**

Page 1

Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	1/12/98	Time	Location No	GW 106
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.1		FILL Bitumen	1	0	
0.1-0.4		Sandy Clayey SILT. Brown, yellow brown, fine to medium sand.	0	0	
0.4-1.2		Silty Sandy CLAY. Mottled orange brown and yellow.	0	0	
1.2-1.8		Gravelly Silty CLAY. Mottled brown, yellow).	0	0	
1.8-2.5		Clayey Silty GRAVEL. light brown, yellow siltstone fragments, considerable clay.	0	0	
2.5-7.5	3	Silty CLAY. yellow brown, some gravel.	0	0	
	5		0	0	
	7		0	0	
		End of Borehole 7.5 m			

Logged by	MBR	Sampled by	MBR
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Field Classification 0 ... No obvious contamination 1 ... Slight visual contamination and/or slight odour 2 ... Visual contamination and/or odour 3 ... Gross visual contamination and/or strong odour	Comments
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PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301



Drilling Co.: UNDERDALES	Permit No.:	GW106
Drill Method: AIR	TOC Elevation: 562.706 AHD	
Boring Dia: 0.15 Meters	Water Struck At: 4 Meters	Logged By:
Date Drilled: 1/12/98	SWL: 4.52 Meters	M.REYNOLDS

16/12/98 10:59:33 AM

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Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
					FILL Bitumen
					Sandy Clayey SILT. Brown, yellow brown, fine to medium sand.
					Silty Sandy CLAY. Mottled orange brown and yellow.
	0		1		Gravelly Silty CLAY. Mottled brown, yellow).
					Clayey Silty GRAVEL. light brown, yellow siltstone fragments, considerable clay.
	0		2		
					Silty CLAY. yellow brown, some gravel.
	0		3		
	0		4		
	0		5		
	0		6		
	0		7		

Completion Notes:

Well completed with standpipe and lock

Site:

CANBERRA RAILYARDS

Site Address:

Canberra Railyards

Project No.: **27K140B**

Page 1

Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	1/12/98	Time	Location No	GW 107
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.7		FILL. Gravelly silty clay, dark brown, orange, black mottling, gravel and coal fragments fine to 60 mm.	1/2 1	0	
0.7-5.5	1	FILL. Ash, clay, metal, coal and timber fragments, black, brown, no strong odour, some gravel to 30 mm.	2/3	0	
	3		2/3	0	
	5		2/3	0	
5.5-7.5	7	CLAY silty brown, red medium to fine sand.	0	0	
		End of Borehole 7.5 m			

Logged by	MBR	Sampled by	MBR
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Field Classification 0 ... No obvious contamination 1 ... Slight visual contamination and/or slight odour 2 ... Visual contamination and/or odour 3 ... Gross visual contamination and/or strong odour	Comments
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PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301



Drilling Co.: UNDERDALES	Permit No.:	GW107
Drill Method: AIR	TOC Elevation: 562.353AHD	
Boring Dia: 0.15 Meters	Water Struck At: 4 Meters	Logged By:
Date Drilled: 1/12/98	SWL: 4.47 Meters	M.REYNOLDS

16/12/98 10:59:51 AM
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Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
					FILL. Gravelly silty clay, dark brown, orange, black mottling, gravel and coal fragments fine to 60 mm.
	0		1		FILL. Ash, clay, metal, coal and timber fragments, black, brown, no strong odour, some gravel to 30 mm.
	0		2		
	0		3		
	0		4		
	0		5		
	0		6		CLAY silty brown, red medium to fine sand.
	0		7		

Completion Notes: Well completed with gattic and lock	Site: CANBERRA RAILYARDS
	Site Address: Canberra Railyards
Project No.: 27K140B	Page 1

Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	1/12/98	Time	Location No	GW 108
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.1		FILL. Clayey silty sand, dark brown, occasional fine cinders/slag fragments.	0	0	
0.1-0.4		Sandy Clayey SILT. Brown, yellow brown, fine to medium sand, some fine roots.	0	0	
0.4-1.2		Silty Sandy CLAY. Mottled orange brown and yellow.	0	0	
1.2-1.8		Gravelly Silty CLAY. Mottled brown, yellow).	0	0	
1.8-2.5	2.0	Clayey Silty GRAVEL. Brown, light brown, siltstone fragments, considerable clay.	0	0	
2.5-5.0	3.0	FILL. Some ash, clay, metal, and timber fragments, black, brown, no strong odour, some gravel to 30 mm.	1	0	
	5.0		1	0	
5.0-7.5	7.0	Clayey Silty GRAVEL. Brown, light brown, siltstone fragments, considerable clay.	0	0	
		End of Borehole 7.5 m			

Logged by	MBR	Sampled by	MBR
Field Classification		Comments	
0 ... No obvious contamination 1 ... Slight visual contamination and/or slight odour 2 ... Visual contamination and/or odour 3 ... Gross visual contamination and/or strong odour			
PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301			



Drilling Co.: UNDERDALES	Permit No.:	GW108
Drill Method: AIR	TOC Elevation: 562.787 AHD	
Boring Dia: 0.15 Meters	Water Struck At: 4 Meters	Logged By:
Date Drilled: 1/12/98	SWL: 4.52 Meters	M.REYNOLDS

Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
	0		1		FILL. Clayey silty sand, dark brown, occasional fine cinders/slag fragments. Sandy Clayey SILT. Brown, yellow brown, fine to medium sand, some fine roots. Silty Sandy CLAY. Mottled orange brown and yellow.
	0		2		Gravelly Silty CLAY. Mottled brown, yellow).
	0		3		FILL. Some ash, clay, metal, and timber fragments, black, brown, no strong odour, some gravel to 30 mm.
	0		4		
	0		5		Clayey Silty GRAVEL. Brown, light brown, siltstone fragments, considerable clay.
	0		6		
	0		7		

16/12/98 11:00:09 AM

C:\PROGRA-2\GBATEC-1\WELLO-127K140B.WL2

Completion Notes:

Well completed with standpipe and lock

Site:

CANBERRA RAILYARDS

Site Address:

Canberra Railyards

Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	2/12/98	Time	Location No	GW109
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.05		FILL. Silty clay, brown, large gravel, roots.	0	0	
0.05-0.10		FILL. Silty clay, orange, small gravel chips.	0	0	
0.1-1.0		FILL. Silty clay, dark brown, large gravel.	0	0	
1.0-5.0		FILL. Silty clay red brown, large gravels.	0	0	
5.0-7.5		Sandy SILT. Light brown, 70% sand slurry.	0	0	
		End of Borehole 7.5 m			

Logged by	MBR	Sampled by	MBR
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Field Classification 0 ... No obvious contamination 1 ... Slight visual contamination and/or slight odour 2 ... Visual contamination and/or odour 3 ... Gross visual contamination and/or strong odour	Comments
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PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301



Drilling Co.: UNDERDALES	Permit No.:	GW109
Drill Method: AIR	TOC Elevation: 561.110 AHD	
Boring Dia: 0.15 Meters	Water Struck At: 4 Meters	Logged By:
Date Drilled: 2/12/98	SWL: 4.61 Meters	M.REYNOLDS

16/12/98 11:00:29 AM

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Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
	0		1		FILL. Silty clay, brown, large gravel, roots. FILL. Silty clay, orange, small gravel chips. FILL. Silty clay, dark brown, large gravel.
	0		2		
	0		3		
	0		4		
	0		5		Sandy SILT. Light brown, 70% sand slurry.
	0		6		
	0		7		

Completion Notes:
Well completed with standpipe and lock

Site:
CANBERRA RAILYARDS

Site Address:
Canberra Railyards

Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	2/12/98	Time	Location No	GW110
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.05		FILL. Silty clay, brown, large gravel, roots.	0	0	
0.05-0.10		FILL. Silty clay, orange, small gravel chips.	0	0	
0.1-1.0		FILL. Silty clay, dark brown, large gravel.	0	0	
1.0-5.0		FILL. Silty clay red brown, large gravels.	0	0	
			0	0	
			0	0	
5.0-7.5		Sandy SILT. Light brown, 70% sand slurry.	0	0	
		End of Borehole 7.5 m			

Logged by	MBR	Sampled by	MBR
------------------	-----	-------------------	-----

Field Classification 0 ... No obvious contamination 1 ... Slight visual contamination and/or slight odour 2 ... Visual contamination and/or odour 3 ... Gross visual contamination and/or strong odour	Comments
---	-----------------

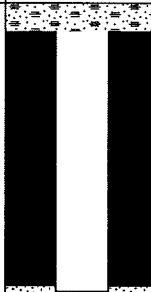
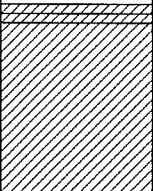
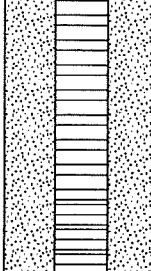
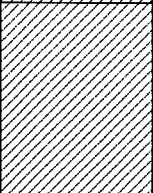
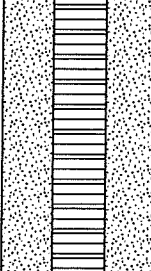
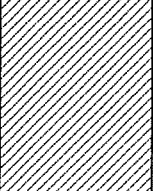
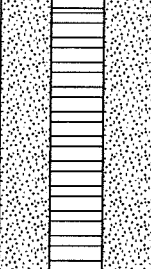
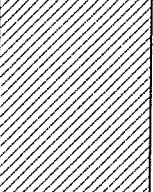
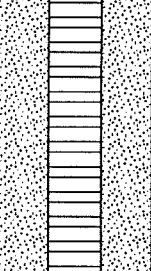
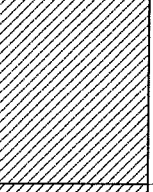
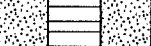
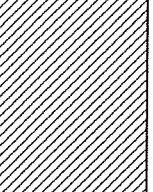
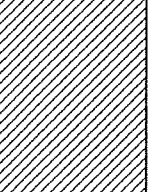
PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301



Drilling Co.: UNDERDALES	Permit No.:	GW110
Drill Method: AIR	TOC Elevation: 562.318 AHD	
Boring Dia: 0.15 Meters	Water Struck At: 4.5 Meters	Logged By:
Date Drilled: 2/12/98	SWL: 5.10 Meters	M.REYNOLDS

16/12/98 11:00:48 AM

C:\PROGRAMS\2\GATEC-1\WELLS-127K140B.WL2

Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
	0		1		FILL. Silty clay, brown, large gravel, roots. FILL. Silty clay, orange, small gravel chips. FILL. Silty clay, dark brown, large gravel.
	0		2		FILL. Silty clay red brown, large gravels.
	0		3		
	0		4		
	0		5		Sandy SILT. Light brown, 70% sand slurry.
	0		6		
	0		7		

Completion Notes:

Well completed with standpipe and lock

Site:
CANBERRA RAILYARDS

Site Address:
Canberra Railyards

Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	2/12/98	Time	Location No	GW111
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.05		FILL. Silty clay, brown, large gravel, roots.	0	0	
0.05-0.10		FILL. Silty clay, orange, small gravel chips.	0	0	
0.1-1.0		FILL. Silty clay, dark brown, large gravel.	0	0	
1.0-6.0		FILL. Silty clay red brown, large gravels.	0	0	
			0	0	
			0	0	
6.0-7.5		Sandy SILT. Light brown, 70% sand slurry.	0	0	
		End of Borehole 7.5 m			
Logged by		MBR	Sampled by		MBR
Field Classification			Comments		
0 ... No obvious contamination					
1 ... Slight visual contamination and/or slight odour					
2 ... Visual contamination and/or odour					
3 ... Gross visual contamination and/or strong odour					
PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301					



Drilling Co.: UNDERDALES	Permit No.:	GW111
Drill Method: AIR	TOC Elevation: 562.229 AHD	
Boring Dia: 0.15 Meters	Water Struck At: 4.5 Meters	Logged By: M.REYNOLDS
Date Drilled: 2/12/98	SWL: 5.49 Meters	

16/12/98 11:01:07 AM

C:\PROGRA-2\GBATEC-1\WELLO-127K140B.WL2

Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
	0		1		FILL. Silty clay, brown, large gravel, roots. FILL. Silty clay, orange, small gravel chips. FILL. Silty clay, dark brown, large gravel.
	0		2		
	0		3		
	0		4		
	0		5		Sandy SILT. Light brown, 70% sand slurry.
	0		6		
	0		7		

Completion Notes:

Well completed with standpipe and lock

Site:

CANBERRA RAILYARDS

Site Address:

Canberra Railyards

Project No.: **27K140B**

Page 1

Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	2/12/98	Time	Location No	GW112
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.05		FILL. Silty clay, brown, large gravel, roots.	0	0	
0.05-0.10		FILL. Silty clay, orange, small gravel chips.	0	0	
0.1-1.0		FILL. Silty clay, dark brown, large gravel.	0	0	
1.0-5.0		FILL. Silty clay red brown, large gravels.	0	0	
			0	0	
			0	0	
5.0-7.5		Sandy SILT. Light brown, 70% sand slurry.	0	0	
		End of Borehole 7.5 m			
Logged by		MBR	Sampled by		MBR
Field Classification			Comments		
0 ... No obvious contamination 1 ... Slight visual contamination and/or slight odour 2 ... Visual contamination and/or odour 3 ... Gross visual contamination and/or strong odour					
PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301					



Drilling Co.: UNDERDALES

Permit No.:

GW112

Drill Method: AIR

TOC Elevation: 561.208 AHD

Boring Dia: 0.15 Meters

Water Struck At: 4.5 Meters

Logged By:

Date Drilled: 2/12/98

SWL: 5.62 Meters

M.REYNOLDS

16/12/98 11:01:25 AM

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Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
			1		FILL. Silty clay, brown, large gravel, roots. FILL. Silty clay, orange, small gravel chips. FILL. Silty clay, dark red brown, large gravel.
	0		2		FILL. Silty clay, grey, landfill waste, metal bits, old newspaper, plastic & large gravels.
	0		3		
	0		4		
	0		5		Sandy SILT. Light brown, 70% sand slurry.
	0		6		
	0		7		

Completion Notes:

Well completed with standpipe and lock

Site:

CANBERRA RAILYARDS

Site Address:

Canberra Railyards

Project No.: **27K140B**

Page 1

Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	2/12/98	Time	Location No	GW113
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.05		FILL. Silty clay, brown, large gravel, roots.	0	0	
0.05-0.10		FILL. Silty clay, orange, small gravel chips.	0	0	
0.1-1.0		FILL. Silty clay, dark red brown, large gravel.	0	0	
1.0-5.0		FILL. Silty clay, grey, landfill waste, metal bits, old newspaper, plastic & large gravels.	1	0	
			1	0	
			1	0	
5.0-7.5		Sandy SILT. Light brown, 70% sand slurry.	0	0	
		End of Borehole 7.5m			

Logged by	MBR	Sampled by	MBR
Field Classification		Comments	
0 ... No obvious contamination 1 ... Slight visual contamination and/or slight odour 2 ... Visual contamination and/or odour 3 ... Gross visual contamination and/or strong odour			
PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301			



Drilling Co.: UNDERDALES	Permit No.:	GW113
Drill Method: AIR	TOC Elevation: 561.291AHD	
Boring Dia: 0.15 Meters	Water Struck At: 4.5 Meters	Logged By: M.REYNOLDS
Date Drilled: 2/12/98	SWL: 5.39 Meters	

16/12/98 11:01:44 AM

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Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
					FILL. Silty clay, brown, large gravel, roots. FILL. Silty clay, orange, small gravel chips. FILL. Silty clay, dark red brown, large gravel.
	0		1		FILL. Silty clay, grey, landfill waste, metal bits, old newspaper, plastic & large gravels.
	0		2		
	0		3		
	0		4		
	0		5		Sandy SILT. Light brown, 70% sand slurry.
	0		6		
	0		7		

Completion Notes:

Well completed with standpipe and lock

Site:

CANBERRA RAILYARDS

Site Address:

Canberra Railyards

Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	2/12/98	Time	Location No	GW114
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.05		FILL. Silty clay, brown, large gravel, roots.	0	0	
0.05-0.10		FILL. Silty clay, orange, small gravel chips.	0	0	
0.1-1.0		FILL. Silty clay, darkbrown, large gravel.	0	0	
1.0-6.0		FILL. Silty clay, red brown, large gravels.	0	0	
			0	0	
			0	0	
6.0-7.5		Sandy SILT. Light brown, 70% sand slurry.	0	0	
		End of Borehole 7.5 m			
Logged by		MBR	Sampled by		MBR
Field Classification			Comments		
0 ... No obvious contamination					
1 ... Slight visual contamination and/or slight odour					
2 ... Visual contamination and/or odour					
3 ... Gross visual contamination and/or strong odour					
PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301					



Drilling Co.: UNDERDALES	Permit No.:	GW114
Drill Method: AIR	TOC Elevation: 561.518 AHD	
Boring Dia: 0.15 Meters	Water Struck At: 4.5 Meters	Logged By: M.REYNOLDS
Date Drilled: 2/12/98	SWL: 5.29 Meters	

16/12/98 11:02:02 AM

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Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
	0		1		FILL. Silty clay, brown, large gravel, roots. FILL. Silty clay, orange, small gravel chips. FILL. Silty clay, darkbrown, large gravel.
	0		2		FILL. Silty clay, red brown, large gravels.
	0		3		
	0		4		
	0		5		
	0		6		Sandy SILT. Light brown, 70% sand slurry.
	0		7		

Completion Notes:

Well completed with standpipe and lock

Site:

CANBERRA RAILYARDS

Site Address:

Canberra Railyards

Project No.: **27K140B**

Page 1

Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	2/12/98	Time	Location No	GW115
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.05		FILL. Silty clay, brown, large gravel, roots.	0	0	
0.05-0.10		FILL. Silty clay, orange, small gravel chips.	0	0	
0.1-1.0		FILL. Silty clay, dark red brown, large gravel.	0	0	
1.0-6.0		FILL. Silty clay, red brown, large gravels.	0	0	
			0	0	
			0	0	
6.0-7.5		Sandy SILT. Light brown, 70% sand slurry.	0	0	
		End of Borehole 7.5 m			

Logged by	MBR	Sampled by	MBR
Field Classification		Comments	
0 ... No obvious contamination 1 ... Slight visual contamination and/or slight odour 2 ... Visual contamination and/or odour 3 ... Gross visual contamination and/or strong odour			
PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301			



Drilling Co.: UNDERDALES	Permit No.:	GW115
Drill Method: AIR	TOC Elevation: 561.727 AHD	
Boring Dia: 0.15 Meters	Water Struck At: 4.5 Meters	Logged By:
Date Drilled: 2/12/98	SWL: 5.48 Meters	M.REYNOLDS

Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
16/12/98 11:02:20 AM	0		1		FILL. Silty clay, brown, large gravel, roots. FILL. Silty clay, orange, small gravel chips. FILL. Silty clay, dark red brown, large gravel.
					FILL. Silty clay, red brown, large gravels.
			2		
			3		
			4		
			5		
			6		Sandy SILT. Light brown, 70% sand slurry.
7					

Completion Notes:
Well completed with standpipe and lock

Site:
CANBERRA RAILYARDS

Site Address:
Canberra Railyards

Project No.: **27K140B** Page 1

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Project	CANBERRA RAIL YARDS		Job Number	27K140B
Date	2/12/98	Time	Location No	GW116
Coordinates (AMG)		N	E	Reduced Level (mAHD)

Soil Classification and Description of Each Visible Soil Profile

Depth (m)	Sample Number	Soil Description	Field Class.	Headspace Vapour (ppm)	Analytes Selected
0-0.05		FILL. Silty clay, brown, large gravel, roots.	0	0	
0.05-0.10		FILL. Silty clay, orange, small gravel chips.	0	0	
0.1-1.0		FILL. Silty clay, dark brown, large gravel.	0	0	
1.0-6.0		FILL. Silty clay, red brown, large gravels.	0	0	
			0	0	
			0	0	
6.0-7.5		Sandy SILT. Light brown, 70% sand slurry.	0	0	
		End of Borehole 7.5 m			

Logged by	MBR	Sampled by	MBR
------------------	-----	-------------------	-----

Field Classification 0 ... No obvious contamination 1 ... Slight visual contamination and/or slight odour 2 ... Visual contamination and/or odour 3 ... Gross visual contamination and/or strong odour	Comments
---	-----------------

PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301



Drilling Co.: UNDERDALES	Permit No.:	GW116
Drill Method: AIR	TOC Elevation: 561.463 AHD	
Boring Dia: 0.15 Meters	Water Struck At: 4.5 Meters	Logged By:
Date Drilled: 2/12/98	SWL: 5.25 Meters	M.REYNOLDS

16/12/98 11:02:38 AM

C:\PROGRA~2\IGBATEC~1\WELLO~1\27K140B.WL2

Sample	PID (ppm)	Completion	Depth Meters	Lithology	Description
					FILL. Silty clay, brown, large gravel, roots. FILL. Silty clay, orange, small gravel chips. FILL. Silty clay, dark brown, large gravel.
	0		1		FILL. Silty clay, red brown, large gravels.
	0		2		
	0		3		
	0		4		
	0		5		
	0		6		Sandy SILT. Light brown, 70% sand slurry.
	0		7		

Completion Notes:
Well completed with standpipe and lock

Site:
CANBERRA RAILYARDS

Site Address:
Canberra Railyards

Appendix E

Groundwater Sampling Field
Parameter Sheets

Client: INDEC		Purging Date: 5/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 5/12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	8.00		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	6.41		
Product thickness (mm):	-	Depth to be purged (m):	1.59		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume:		litres 3	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged:		2	
Start time (2400hr):		Total purge volume:		litres 6	
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.59	1.26	-	-	18.6
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>			TPH		Ammonia
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>			BTEX		SVOCs
Is there a hydrocarbon sheen?: <input checked="" type="radio"/> Yes No			VOCs		CrVI
Odour: <i>yes Strong H/C</i>			Cyanide		Other
Colour: <i>cloudy</i>			PAHs		Other
Turbidity: <i>B</i> M H			Metals (see custody form for list)		
Weather Conditions					
Rain: <i>No</i>		Temperature: <i>22</i> °C		Cloud cover: <i>25</i> %	
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Job Number: 27K140A

Well No. *UW102*

Client: INDEC		Purging Date: <i>5 /12/98</i>			
Site Location: CANBERRA Railyard		Sampling Date: <i>5 /12/98</i>			
Casing Diameter (mm):	<i>50</i>	Well depth from TOC (m):	<i>8.00</i>		
Depth to floating product (m):	<i>-</i>	Depth to groundwater from TOC (m):	<i>4.92</i>		
Product thickness (mm):	<i>-</i>	Depth to be purged (m):	<i>3.08</i>		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume:	litres <i>6</i>		
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged:	<i>2</i>		
Start time (2400hr):		Total purge volume:	litres <i>12</i>		
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	<i>7.49</i>	<i>1.37</i>	<i>-</i>	<i>-</i>	<i>18.2</i>
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: <input checked="" type="radio"/> Yes No			VOCs	CrVI	
Odour: <i>yes Strong H/C</i>			Cyanide	Other	
Colour: <i>cloudy brown</i>			PAHs	Other	
Turbidity: <input checked="" type="radio"/> M H			Metals	(see custody form for list)	
Weather Conditions					
Rain:	<i>No</i>	Temperature:	<i>22 °C</i>	Cloud cover:	<i>25 %</i>
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Client: INDEC		Purging Date: 5/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 5/12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	8.00		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	4.43		
Product thickness (mm):	-	Depth to be purged (m):	3.57		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume:		litres 7	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged:		3	
Start time (2400hr):		Total purge volume:		litres 21	
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.86	1.06	-	-	18.0
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		TPH		Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		BTEX		SVOCs	
Is there a hydrocarbon sheen?: Yes <input type="radio"/> No <input checked="" type="radio"/>		VOCs		CrVI	
Odour: <i>yes</i>		Cyanide		Other	
Colour: <i>clear</i>		PAHs		Other	
Turbidity: L M H		Metals (see custody form for list)			
Weather Conditions					
Rain: <i>No</i>		Temperature: 22 °C		Cloud cover: 25%	
Other comments and observations:					
Purgers name: MBR		Signature: M Reynolds			
Samplers name: MBR		Signature: M Reynolds			

Job Number: 27K140A

Well No. GW104

Client: INDEC		Purging Date: 5/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 5/12/98			
Casing Diameter (mm):	Well depth from TOC (m):		8.00		
Depth to floating product (m):	Depth to groundwater from TOC (m):		6.67		
Product thickness (mm):	Depth to be purged (m):		1.33		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume:	litres 2 1/2		
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged:	2		
Start time (2400hr):		Total purge volume:	litres 5		
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.56	1.10	-	-	18.6
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: Yes <input checked="" type="radio"/>			VOCs	CrVI	
Odour: No			Cyanide	Other	
Colour: light brown			PAHs	Other	
Turbidity: <input checked="" type="radio"/> M <input type="radio"/> H			Metals	(see custody form for list)	
Weather Conditions					
Rain: No		Temperature: 22 °C		Cloud cover: 25 %	
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Client: INDEC		Purging Date: 5 /12/98			
Site Location: CANBERRA Railyard		Sampling Date: 5 /12/98			
Casing Diameter (mm):		Well depth from TOC (m):		8.00	
Depth to floating product (m):		Depth to groundwater from TOC (m):		6.41	
Product thickness (mm):		Depth to be purged (m):		1.59	
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input checked="" type="radio"/> bailer <input type="radio"/>		One purge volume:		litres 3	
Tubing material: HDPE <input type="radio"/> PVC <input checked="" type="radio"/> S/Steel <input type="radio"/>		No. of times purged:		3	
Start time (2400hr):		Total purge volume:		litres 9	
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.59	1.32	-	-	18.6
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		TPH	Ammonia		
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input checked="" type="radio"/>		BTEX	SVOCs		
Is there a hydrocarbon sheen?: Yes No		VOCs	CrVI		
Odour: No		Cyanide	Other		
Colour: cloudy brown		PAHs	Other		
Turbidity: <input checked="" type="radio"/> M <input type="radio"/> H		Metals	(see custody form for list)		
Weather Conditions					
Rain: No		Temperature: 22 °C		Cloud cover: 25 %	
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Job Number: 27K140A

Well No. 9W106

Client: INDEC		Purging Date: 4 /12/98			
Site Location: CANBERRA Railyard		Sampling Date: 4 /12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	8.00		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	4.52		
Product thickness (mm):	-	Depth to be purged (m):	3.48		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume:	litres 7		
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged:	3		
Start time (2400hr):		Total purge volume:	litres 21		
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.56	1.87	-	-	18.0
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <u>Yes</u> No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: Yes <input type="radio"/> <u>No</u>			VOCs	CrVI	
Odour: Nil			Cyanide	Other	
Colour: cloudy brown			PAHs	Other	
Turbidity: <u>1</u> M H			Metals	(see custody form for list)	
Weather Conditions					
Rain: <u>No</u>	Temperature: 23 °C	Cloud cover: 10 %			
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Client: INDEC		Purging Date: 6/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 6/12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	8.00		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	4.47		
Product thickness (mm):	-	Depth to be purged (m):	3.53		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input checked="" type="radio"/> bailer <input type="radio"/>		One purge volume:	litres 7		
Tubing material: HDPE <input type="radio"/> PVC <input checked="" type="radio"/> S/Steel <input type="radio"/>		No. of times purged:	2		
Start time (2400hr):		Total purge volume:	litres 14		
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.86	1.30	-	-	18.8
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input checked="" type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input checked="" type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: Yes <input type="radio"/> No <input checked="" type="radio"/>			VOCs	CrVI	
Odour: Nil			Cyanide	Other	
Colour: cloudy brown			PAHs	Other	
Turbidity: <input checked="" type="radio"/> M <input type="radio"/> H			Metals	(see custody form for list)	
Weather Conditions					
Rain:	No	Temperature:	26 °C	Cloud cover:	90%
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Job Number: 27K140A

Well No. 9W108

Client: INDEC		Purging Date: 6/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 6/12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	8.00		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	4.52		
Product thickness (mm):	-	Depth to be purged (m):	3.48		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume:	litres 7		
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged:	3		
Start time (2400hr):		Total purge volume:	litres 21		
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.39	1.38	-	-	18.2
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <u>Yes</u> No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: Yes <input type="radio"/> <u>No</u>			VOCs	CrVI	
Odour: <u>No</u>			Cyanide	Other	
Colour: <u>cloudy brown</u>			PAHs	Other	
Turbidity: <u>Q</u> M H			Metals	(see custody form for list)	
Weather Conditions					
Rain:	<u>No</u>	Temperature:	<u>20</u> °C	Cloud cover:	<u>90</u> %
Other comments and observations:					
Purgers name: MBR			Signature	M Reynolds	
Samplers name: MBR			Signature:	M Reynolds	

Client: INDEC		Purging Date: 7/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 7/12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	8.00		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	3.39		
Product thickness (mm):	-	Depth to be purged (m):	4.61		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input checked="" type="radio"/> bailer <input type="radio"/>		One purge volume:	litres 9		
Tubing material: HDPE <input type="radio"/> PVC <input checked="" type="radio"/> S/Steel <input type="radio"/>		No. of times purged:	3		
Start time (2400hr):		Total purge volume:	litres 27		
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.52	0.76	-	-	18.2
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <u>Yes</u> No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input checked="" type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input checked="" type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: Yes <input type="radio"/> No <input checked="" type="radio"/>			VOCs	CrVI	
Odour: No			Cyanide	Other	
Colour: cloudy brown			PAHs	Other	
Turbidity: L <input checked="" type="radio"/> H <input type="radio"/>			Metals (see custody form for list)		
Weather Conditions					
Rain:	No	Temperature:	25 °C	Cloud cover:	5 %
Other comments and observations: <i>Dup # taken here</i>					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Job Number: 27K140A

Well No. GW110

Client: INDEC		Purging Date: 7/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 7/12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	8.00		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	5.10		
Product thickness (mm):	-	Depth to be purged (m):	2.90		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume:	litres 6		
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged:	3		
Start time (2400hr):		Total purge volume:	litres 18		
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.63	0.87	-	-	18.4
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes <input type="radio"/> No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: Yes <input type="radio"/> No <input checked="" type="radio"/>			VOCs	CrVI	
Odour: Slight (Not noted during logging)			Cyanide	Other	
Colour: light brown			PAHs	Other	
Turbidity: ① M H			Metals	(see custody form for list)	
Weather Conditions					
Rain:	No	Temperature:	25 °C	Cloud cover:	5 %
Other comments and observations:					
Purgers name: MBR			Signature:	M Reynolds	
Samplers name: MBR			Signature:	M Reynolds	

Client: INDEC		Purging Date: 7/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 7/12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	8.00		
Depth to floating product (m):	~	Depth to groundwater from TOC (m):	5.49		
Product thickness (mm):	~	Depth to be purged (m):	2.51		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input checked="" type="radio"/> bailer <input type="radio"/>		One purge volume:		litres 5	
Tubing material: HDPE <input type="radio"/> PVC <input checked="" type="radio"/> S/Steel <input type="radio"/>		No. of times purged:		3	
Start time (2400hr):		Total purge volume:		litres 13	
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.38	0.96	~	-	18.2
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		TPH	Ammonia		
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		BTEX	SVOCs		
Is there a hydrocarbon sheen?: Yes <input type="radio"/> No <input checked="" type="radio"/>		VOCs	CrVI		
Odour: No		Cyanide	Other		
Colour: light brown		PAHs	Other		
Turbidity: <input checked="" type="radio"/> M <input type="radio"/> H		Metals	(see custody form for list)		
Weather Conditions					
Rain: No		Temperature: 25 °C	Cloud cover: 5 %		
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Job Number: 27K140A

Well No. GW 112

Client: INDEC		Purging Date: 7/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 7/12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	8.00		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	5.62		
Product thickness (mm):	-	Depth to be purged (m):	2.38		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input checked="" type="radio"/> bailer <input type="radio"/>		One purge volume: litres			
Tubing material: HDPE <input type="radio"/> PVC <input checked="" type="radio"/> S/Steel <input type="radio"/>		No. of times purged:			
Start time (2400hr):		Total purge volume: litres			
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.47	0.68	-	-	18.3
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input checked="" type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input checked="" type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: Yes <input type="radio"/> No <input checked="" type="radio"/>			VOCs	CrVI	
Odour: No			Cyanide	Other	
Colour: light brown			PAHs	Other	
Turbidity: (L) M H			Metals	(see custody form for list)	
Weather Conditions					
Rain:	No	Temperature:	25 °C	Cloud cover:	5 %
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Client: INDEC		Purging Date: 7/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 7/12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	8.00		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	5.39		
Product thickness (mm):	-	Depth to be purged (m):	2.61		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input checked="" type="radio"/> bailer <input type="radio"/>		One purge volume: litres 5			
Tubing material: HDPE <input type="radio"/> PVC <input checked="" type="radio"/> S/Steel <input type="radio"/>		No. of times purged: 4			
Start time (2400hr):		Total purge volume: litres 20			
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.38	0.86	-	-	18.2
After 4 purge volumes:	7.42	0.79	-	-	18.0
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <u>Yes</u> No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input checked="" type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input checked="" type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: Yes <input type="radio"/> No <input checked="" type="radio"/>			VOCs	CrVI	
Odour: No			Cyanide	Other	
Colour: light brown			PAHs	Other	
Turbidity: <u>L</u> M H			Metals	(see custody form for list)	
Weather Conditions					
Rain: No		Temperature: 25 °C		Cloud cover: 5 %	
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Job Number: 27K140A

Well No. Gw114

Client: INDEC		Purging Date: 7 /12/98			
Site Location: CANBERRA Railyard		Sampling Date: 7 /12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	8.00		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	5.29		
Product thickness (mm):	-	Depth to be purged (m):	2.71		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume:		litres 5	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged:		4	
Start time (2400hr):		Total purge volume:		litres 20	
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.62	1.00	-	-	18.0
After 4 purge volumes:	7.66	0.89	-	-	17.8
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>			TPH		Ammonia
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>			BTEX		SVOCs
Is there a hydrocarbon sheen?: Yes <input type="radio"/> No <input checked="" type="radio"/>			VOCs		CrVI
Odour: No			Cyanide		Other
Colour: light brown			PAHs		Other
Turbidity: <input checked="" type="radio"/> L M H			Metals (see custody form for list)		
Weather Conditions					
Rain: No		Temperature: 25 °C		Cloud cover: 5 %	
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Client: INDEC		Purging Date: 7/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 7/12/98			
Casing Diameter (mm):	<i>50</i>	Well depth from TOC (m):	<i>8.00</i>		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	<i>5.48</i>		
Product thickness (mm):	-	Depth to be purged (m):	<i>2.52</i>		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input checked="" type="radio"/> bailer <input type="radio"/>		One purge volume:		litres <i>5</i>	
Tubing material: HDPE <input type="radio"/> PVC <input checked="" type="radio"/> S/Steel <input type="radio"/>		No. of times purged:		<i>3</i>	
Start time (2400hr):		Total purge volume:		litres <i>15</i>	
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	<i>7.49</i>	<i>0.76</i>	-	-	<i>18.0</i>
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input checked="" type="radio"/>		TPH	Ammonia		
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input checked="" type="radio"/>		BTEX	SVOCs		
Is there a hydrocarbon sheen?: Yes <input type="radio"/> No <input checked="" type="radio"/>		VOCs	CrVI		
Odour: <i>No</i>		Cyanide	Other		
Colour: <i>light brown</i>		PAHs	Other		
Turbidity: <i>0</i> M H		Metals (see custody form for list)			
Weather Conditions					
Rain: <i>No</i>		Temperature: <i>25 °C</i>		Cloud cover: <i>5</i> %	
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Job Number: 27K140A

Well No. GW116

Client: INDEC		Purging Date: 7/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 7/12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	7.00		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	5.25		
Product thickness (mm):	-	Depth to be purged (m):	1.75		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume: litres 34			
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged: 3			
Start time (2400hr):		Total purge volume: litres 12			
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.46	0.89	-	-	18.0
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: Yes <input checked="" type="radio"/>			VOCs	CrVI	
Odour: No			Cyanide	Other	
Colour: light brown			PAHs	Other	
Turbidity: (L) M H			Metals	(see custody form for list)	
Weather Conditions					
Rain: No	Temperature: 25 °C	Cloud cover: 5 %			
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Client: INDEC		Purging Date: 8 /12/98			
Site Location: CANBERRA Railyard		Sampling Date: 8 /12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	2.33		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	1.13		
Product thickness (mm):	-	Depth to be purged (m):	2.2		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume:	litres 2.5		
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged:	3		
Start time (2400hr):		Total purge volume:	litres 8		
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.41	1.29	-	-	18.8
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes <input type="radio"/> No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		TPH	Ammonia		
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		BTEX	SVOCs		
Is there a hydrocarbon sheen?: <input checked="" type="radio"/> Yes <input type="radio"/> No		VOCs	CrVI		
Odour: <i>Strong hydrocarbon</i>		Cyanide	Other		
Colour: <i>cloudy brown</i>		PAHs	Other		
Turbidity: L <input checked="" type="radio"/> M <input type="radio"/> H		Metals	(see custody form for list)		
Weather Conditions					
Rain: <i>No</i>	Temperature: 26 °C	Cloud cover: 25 %			
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Groundwater Field Parameters



Job Number: 27K140A

Well No. PMW 2

Client: INDEC		Purging Date: 8 /12/98			
Site Location: CANBERRA Railyard		Sampling Date: 8 /12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	2.35		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	1.22		
Product thickness (mm):	-	Depth to be purged (m):	1.13		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume:		litres 2	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged:		4	
Start time (2400hr):		Total purge volume:		litres 8	
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.39	1.31	-	-	18.8
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>			TPH		Ammonia
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>			BTEX		SVOCs
Is there a hydrocarbon sheen?: <input checked="" type="radio"/> Yes No			VOCs		CrVI
Odour: hydrocarbon			Cyanide		Other
Colour: light brown			PAHs		Other
Turbidity: <input checked="" type="radio"/> M H			Metals (see custody form for list)		
Weather Conditions					
Rain: No		Temperature: 26 °C		Cloud cover: 25%	
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Client: INDEC		Purging Date: 8/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 8/12/98			
Casing Diameter (mm): 50	Well depth from TOC (m): 2.14				
Depth to floating product (m): -	Depth to groundwater from TOC (m): 0.86				
Product thickness (mm): ✓	Depth to be purged (m): 1.28				
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume:	litres 2		
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged:	3		
Start time (2400hr):		Total purge volume:	litres 6		
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.99	0.99	-	-	18.6
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: Yes <input type="radio"/> No <input checked="" type="radio"/>			VOCs	CrVI	
Odour: No			Cyanide	Other	
Colour: light brown			PAHs	Other	
Turbidity: <input checked="" type="radio"/> M <input type="radio"/> H			Metals	(see custody form for list)	
Weather Conditions					
Rain: No	Temperature: 26 °C	Cloud cover: 25 %			
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Client: INDEC		Purging Date: 6/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 6/12/98			
Casing Diameter (mm): 50	Well depth from TOC (m): 12.00				
Depth to floating product (m): -	Depth to groundwater from TOC (m): 4.56				
Product thickness (mm): -	Depth to be purged (m): 7.44				
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume:	litres 15		
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged:	2		
Start time (2400hr):		Total purge volume:	litres 30		
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.75	0.97	-	-	18.0
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: Yes No			VOCs	CrVI	
Odour: Nil/			Cyanide	Other	
Colour: clear			PAHs	Other	
Turbidity: L M H			Metals	(see custody form for list)	
Weather Conditions					
Rain: No	Temperature: 26 °C		Cloud cover: 90 %		
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Job Number: 27K140A

Well No. CW2

Client: INDEC		Purging Date: 6 /12/98			
Site Location: CANBERRA Railyard		Sampling Date: 6 /12/98			
Casing Diameter (mm):		Well depth from TOC (m):		9.80	
Depth to floating product (m):		Depth to groundwater from TOC (m):		3.32	
Product thickness (mm):		Depth to be purged (m):		6.48	
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume:		litres 13	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged:		2	
Start time (2400hr):		Total purge volume:		litres 26	
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.29	1.06	-	-	18.0
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>			TPH		Ammonia
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>			BTEX		SVOCs
Is there a hydrocarbon sheen?: Yes <input type="radio"/> No <input checked="" type="radio"/>			VOCs		CrVI
Odour: Yes mild H/C			Cyanide		Other
Colour: cloudy brown			PAHs		Other
Turbidity: <input checked="" type="radio"/> L M H			Metals (see custody form for list)		
Weather Conditions					
Rain: No		Temperature: 20 °C		Cloud cover: 90%	
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Client: INDEC		Purging Date: 6/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 6/12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	8.60		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	4.36		
Product thickness (mm):	-	Depth to be purged (m):	4.24		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input checked="" type="radio"/> bailer <input type="radio"/>		One purge volume:	litres 8		
Tubing material: HDPE <input type="radio"/> PVC <input checked="" type="radio"/> S/Steel <input type="radio"/>		No. of times purged:	2		
Start time (2400hr):		Total purge volume:	litres 16		
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.61	2.89	-	-	18.0
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: Yes <input type="radio"/> No <input checked="" type="radio"/>			VOCs	CrVI	
Odour: yes Strong H/C			Cyanide	Other	
Colour: clear			PAHs	Other	
Turbidity: L M H			Metals	(see custody form for list)	
Weather Conditions					
Rain:	No	Temperature:	20 °C	Cloud cover:	90 %
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Groundwater Field Parameters



Job Number: 27K140A

Well No. gw 5

Client: INDEC		Purging Date: 5/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 5/12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	7.50		
Depth to floating product (m):	* 4.43	Depth to groundwater from TOC (m):	4.26		
Product thickness (mm):	3mm	Depth to be purged (m):	3.24		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: wattera <input type="radio"/> whaler <input checked="" type="radio"/> bailer <input type="radio"/>		One purge volume: litres			
Tubing material: HDPE <input type="radio"/> PVC <input checked="" type="radio"/> S/Steel <input type="radio"/>		No. of times purged:			
Start time (2400hr):		Total purge volume: litres			
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:					
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: wattera <input type="radio"/> whaler <input type="radio"/> bailer <input checked="" type="radio"/>			TPH		Ammonia
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input checked="" type="radio"/>			BTEX		SVOCs
Is there a hydrocarbon sheen?: Yes No			VOCs		CrVI
Odour:			Cyanide		Other
Colour:			PAHs		Other
Turbidity: L M H			Metals (see custody form for list)		
Weather Conditions					
Rain:		Temperature: °C		Cloud cover: %	
Other comments and observations: <div style="text-align: center; font-size: 1.2em; font-family: cursive;"> Product on water !! Not Sampled </div>					
Purgers name: MBR			Signature M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Client: INDEC		Purging Date: 5 /12/98			
Site Location: CANBERRA Railyard		Sampling Date: 5 /12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	7.50		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	4.35		
Product thickness (mm):	-	Depth to be purged (m):	3.15		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input checked="" type="radio"/> bailer <input type="radio"/>		One purge volume:	litres 6		
Tubing material: HDPE <input type="radio"/> PVC <input checked="" type="radio"/> S/Steel <input type="radio"/>		No. of times purged:	2.5		
Start time (2400hr):		Total purge volume:	litres 16		
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.59	1.48	-	-	18.2
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes <input type="radio"/> No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input checked="" type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input checked="" type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: Yes <input type="radio"/> No <input checked="" type="radio"/>			VOCs	CrVI	
Odour: No			Cyanide	Other	
Colour: clear			PAHs	Other	
Turbidity: L M H			Metals	(see custody form for list)	
Weather Conditions					
Rain:	No	Temperature:	22 °C	Cloud cover:	25%
Other comments and observations: Dup 2 taken here					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Client: INDEC		Purging Date: 5 /12/98			
Site Location: CANBERRA Railyard		Sampling Date: 5 /12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	7.00		
Depth to floating product (m):	-	Depth to groundwater from TOC (m):	4.33		
Product thickness (mm):	-	Depth to be purged (m):	2.67		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>		One purge volume: litres 25			
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>		No. of times purged: 3			
Start time (2400hr):		Total purge volume: litres 15			
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.79	1.61	-	-	18.0
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <input checked="" type="radio"/> Yes No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>			TPH	Ammonia	
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>			BTEX	SVOCs	
Is there a hydrocarbon sheen?: Yes <input type="radio"/> No <input checked="" type="radio"/>			VOCs	CrVI	
Odour: No			Cyanide	Other	
Colour: clear			PAHs	Other	
Turbidity: L M H			Metals	(see custody form for list)	
Weather Conditions					
Rain: No	Temperature: 22 °C	Cloud cover: 25 %			
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		

Client: INDEC		Purging Date: 4/12/98			
Site Location: CANBERRA Railyard		Sampling Date: 4/12/98			
Casing Diameter (mm):	50	Well depth from TOC (m):	8.615		
Depth to floating product (m):	--	Depth to groundwater from TOC (m):	6.02		
Product thickness (mm):	-	Depth to be purged (m):	2.59		
Purging Information					
Purge 5 casing volumes or until 'dry' 1 casing volume = 2 L/m for wells of 50 mm ID 1 casing volume = 8 L/m for wells of 100 mm ID					
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>	One purge volume:		litres 5		
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>	No. of times purged:		2		
Start time (2400hr):	Total purge volume:		litres 10		
Field Results While Purging					
	pH	Conductivity (mS/cm)	Redox (mV)	DO (ppm)	Temp. °C
After 1 purge volume:	7.42	0.98	—	—	18.6
After 4 purge volumes:					
After 5 purge volumes:					
Extra if required					
Extra if required					
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.					
Are the field results acceptable to allow sampling? (circle one): <u>Yes</u> No (if No, append additional purge data)					
Sampling Details			Analysis Required (tick if yes)		
Method/pump type: watterra <input type="radio"/> whaler <input type="radio"/> bailer <input type="radio"/>	TPH		Ammonia		
Tubing material: HDPE <input type="radio"/> PVC <input type="radio"/> S/Steel <input type="radio"/>	BTEX		SVOCs		
Is there a hydrocarbon sheen?: Yes No	VOCs		CrVI		
Odour: No	Cyanide		Other		
Colour: light brown	PAHs		Other		
Turbidity: <u>1</u> M H	Metals (see custody form for list)				
Weather Conditions					
Rain: No	Temperature: 23 °C	Cloud cover: % 10			
Other comments and observations:					
Purgers name: MBR			Signature: M Reynolds		
Samplers name: MBR			Signature: M Reynolds		