

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

Job Number : 9E01400

Client : PPK Adelaide

Reference : 27K140C-CANBERRA

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Analyte	Lab No	E17979	E17980	E17981	E17982	E17983
	Sample Id	GW 110	GW 111	GW 112	GW 113	GW 114
	PQL					
E0180 Semivolatile Organic Compounds(µg/L)						
Phenol	10	nd	nd	nd	nd	nd
Aniline	100	nd	nd	nd	nd	nd
Bis(2-chloroethyl) ether	10	nd	nd	nd	nd	nd
2-Chlorophenol	10	nd	nd	nd	nd	nd
1.3-Dichlorobenzene	10	nd	nd	nd	nd	nd
1.4-Dichlorobenzene	10	nd	nd	nd	nd	nd
1.2-Dichlorobenzene	10	nd	nd	nd	nd	nd
Benzyl Alcohol	10	nd	nd	nd	nd	nd
2-Methylphenol	10	nd	nd	nd	nd	nd
N-Nitrosodi-n-propylamine	10	nd	nd	nd	nd	nd
Bis(2-chloroisopropyl) ether	10	nd	nd	nd	nd	nd
3 and 4-Methyl phenol	20	nd	nd	nd	nd	nd
Hexachloroethane	10	nd	nd	nd	nd	nd
Nitrobenzene	10	nd	nd	nd	nd	nd
Isophorone	10	nd	nd	nd	nd	nd
2-Nitrophenol	10	nd	nd	nd	nd	nd
2.4-Dimethylphenol	10	nd	nd	nd	nd	nd
Bis(2-chloroethoxy) methane	10	nd	nd	nd	nd	nd
Benzoic Acid	100	nd	nd	nd	nd	nd
2.4-Dichlorophenol	10	nd	nd	nd	nd	nd
1.2.4-Trichlorobenzene	10	nd	nd	nd	nd	nd
Naphthalene	10	nd	nd	nd	nd	nd
4-Chloroaniline	10	nd	nd	nd	nd	nd
Hexachlorobutadiene	10	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

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Analyte	Lab No	E17979	E17980	E17981	E17982	E17983
	Sample Id	GW 110	GW 111	GW 112	GW 113	GW 114
	PQL					
4-Chloro-3-methylphenol	10	nd	nd	nd	nd	nd
2-Methylnaphthalene	10	nd	nd	nd	nd	nd
Hexachlorocyclopentadiene	10	nd	nd	nd	nd	nd
2,4,6-Trichlorophenol	10	nd	nd	nd	nd	nd
2,4,5-Trichlorophenol	10	nd	nd	nd	nd	nd
2-Chloronaphthalene	10	nd	nd	nd	nd	nd
2-Nitroaniline	10	nd	nd	nd	nd	nd
Dimethyl phthalate	10	nd	nd	nd	nd	nd
2,6-Dinitrotoluene	10	nd	nd	nd	nd	nd
Acenaphthylene	10	nd	nd	nd	nd	nd
3-Nitroaniline	10	nd	nd	nd	nd	nd
Acenaphthene	10	nd	nd	nd	nd	nd
2,4-Dinitrophenol	10	nd	nd	nd	nd	nd
4-Nitrophenol	10	nd	nd	nd	nd	nd
Dibenzofuran	10	nd	nd	nd	nd	nd
Diethyl phthalate	10	nd	nd	nd	nd	nd
Fluorene	10	nd	nd	nd	nd	nd
4-Chlorophenyl phenyl ether	10	nd	nd	nd	nd	nd
4-Nitroaniline	10	nd	nd	nd	nd	nd
4,6-Dinitro-2-methylphenol	10	nd	nd	nd	nd	nd
Azobenzene	100	nd	nd	nd	nd	nd
N-Nitrosodiphenylamine	100	nd	nd	nd	nd	nd
a-BHC	10	nd	nd	nd	nd	nd
4-Bromophenyl phenyl ether	10	nd	nd	nd	nd	nd
Hexachlorobenzene	10	nd	nd	nd	nd	nd

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Analyte	Lab No	E17979	E17980	E17981	E17982	E17983
	Sample Id	GW 110	GW 111	GW 112	GW 113	GW 114
	PQL					
b-BHC	10	nd	nd	nd	nd	nd
Pentachlorophenol	10	nd	nd	nd	nd	nd
g-BHC	10	nd	nd	nd	nd	nd
Phenanthrene	10	nd	nd	nd	nd	nd
Anthracene	10	nd	nd	nd	nd	nd
d-BHC	10	nd	nd	nd	nd	nd
Heptachlor	10	nd	nd	nd	nd	nd
Di-n-butyl phthalate	10	nd	nd	nd	nd	nd
Aldrin	10	nd	nd	nd	nd	nd
Heptachlor epoxide	10	nd	nd	nd	nd	nd
Fluoranthene	10	nd	nd	nd	nd	nd
Pyrene	10	nd	nd	nd	nd	nd
Endosulfan 1	10	nd	nd	nd	nd	nd
4,4-DDE	10	nd	nd	nd	nd	nd
Dieldrin	10	nd	nd	nd	nd	nd
Endrin	10	nd	nd	nd	nd	nd
Endosulfan 2	10	nd	nd	nd	nd	nd
4,4-DDD	10	nd	nd	nd	nd	nd
Endrin aldehyde	10	nd	nd	nd	nd	nd
Butyl benzyl phthalate	10	nd	nd	nd	nd	nd
Endosulfan sulfate	10	nd	nd	nd	nd	nd
4,4-DDT	10	nd	nd	nd	nd	nd
3,3-Dichlorobenzidine	100	nd	nd	nd	nd	nd
Benzo(a)anthracene	10	nd	nd	nd	nd	nd
Chrysene	10	nd	nd	nd	nd	nd

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Analyte	Lab No	E17984	E17985	E17986	E17987	E17988
	Sample Id	GW 115	GW 116	GW 107	GW 108	GW 39
	PQL					
E0180 Semivolatile Organic Compounds(µg/L)						
Phenol	10	nd	nd	nd	nd	nd
Aniline	100	nd	nd	nd	nd	nd
Bis(2-chloroethyl) ether	10	nd	nd	nd	nd	nd
2-Chlorophenol	10	nd	nd	nd	nd	nd
1,3-Dichlorobenzene	10	nd	nd	nd	nd	nd
1,4-Dichlorobenzene	10	nd	nd	nd	nd	nd
1,2-Dichlorobenzene	10	nd	nd	nd	nd	nd
Benzyl Alcohol	10	nd	nd	nd	nd	nd
2-Methylphenol	10	nd	nd	nd	nd	nd
N-Nitrosodi-n-propylamine	10	nd	nd	nd	nd	nd
Bis(2-chloroisopropyl) ether	10	nd	nd	nd	nd	nd
3 and 4-Methyl phenol	20	nd	nd	nd	nd	nd
Hexachloroethane	10	nd	nd	nd	nd	nd
Nitrobenzene	10	nd	nd	nd	nd	nd
Isophorone	10	nd	nd	nd	nd	nd
2-Nitrophenol	10	nd	nd	nd	nd	nd
2,4-Dimethylphenol	10	nd	nd	nd	nd	nd
Bis(2-chloroethoxy) methane	10	nd	nd	nd	nd	nd
Benzoic Acid	100	nd	nd	nd	nd	nd
2,4-Dichlorophenol	10	nd	nd	nd	nd	nd
1,2,4-Trichlorobenzene	10	nd	nd	nd	nd	nd
Naphthalene	10	nd	nd	nd	nd	nd
4-Chloroaniline	10	nd	nd	nd	nd	nd
Hexachlorobutadiene	10	nd	nd	nd	nd	nd

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Analyte	Lab No	E17984	E17985	E17986	E17987	E17988
	Sample Id	GW 115	GW 116	GW 107	GW 108	GW 39
	PQL					
4-Chloro-3-methylphenol	10	nd	nd	nd	nd	nd
2-Methylnaphthalene	10	nd	nd	nd	nd	nd
Hexachlorocyclopentadiene	10	nd	nd	nd	nd	nd
2,4,6-Trichlorophenol	10	nd	nd	nd	nd	nd
2,4,5-Trichlorophenol	10	nd	nd	nd	nd	nd
2-Chloronaphthalene	10	nd	nd	nd	nd	nd
2-Nitroaniline	10	nd	nd	nd	nd	nd
Dimethyl phthalate	10	nd	nd	nd	nd	nd
2,6-Dinitrotoluene	10	nd	nd	nd	nd	nd
Acenaphthylene	10	nd	nd	nd	nd	nd
3-Nitroaniline	10	nd	nd	nd	nd	nd
Acenaphthene	10	nd	nd	nd	nd	nd
2,4-Dinitrophenol	10	nd	nd	nd	nd	nd
4-Nitrophenol	10	nd	nd	nd	nd	nd
Dibenzofuran	10	nd	nd	nd	nd	nd
Diethyl phthalate	10	nd	nd	nd	nd	nd
Fluorene	10	nd	nd	nd	nd	nd
4-Chlorophenyl phenyl ether	10	nd	nd	nd	nd	nd
4-Nitroaniline	10	nd	nd	nd	nd	nd
4,6-Dinitro-2-methylphenol	10	nd	nd	nd	nd	nd
Azobenzene	100	nd	nd	nd	nd	nd
N-Nitrosodiphenylamine	100	nd	nd	nd	nd	nd
a-BHC	10	nd	nd	nd	nd	nd
4-Bromophenyl phenyl ether	10	nd	nd	nd	nd	nd
Hexachlorobenzene	10	nd	nd	nd	nd	nd

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

Analyte	Lab No	E17984	E17985	E17986	E17987	E17988
	Sample Id	GW 115	GW 116	GW 107	GW 108	GW 39
	PQL					
b-BHC	10	nd	nd	nd	nd	nd
Pentachlorophenol	10	nd	nd	nd	nd	nd
g-BHC	10	nd	nd	nd	nd	nd
Phenanthrene	10	nd	nd	nd	nd	nd
Anthracene	10	nd	nd	nd	nd	nd
d-BHC	10	nd	nd	nd	nd	nd
Heptachlor	10	nd	nd	nd	nd	nd
Di-n-butyl phthalate	10	nd	nd	nd	nd	nd
Aldrin	10	nd	nd	nd	nd	nd
Heptachlor epoxide	10	nd	nd	nd	nd	nd
Fluoranthene	10	nd	nd	nd	nd	nd
Pyrene	10	nd	nd	nd	nd	nd
Endosulfan 1	10	nd	nd	nd	nd	nd
4.4-DDE	10	nd	nd	nd	nd	nd
Dieldrin	10	nd	nd	nd	nd	nd
Endrin	10	nd	nd	nd	nd	nd
Endosulfan 2	10	nd	nd	nd	nd	nd
4.4-DDD	10	nd	nd	nd	nd	nd
Endrin aldehyde	10	nd	nd	nd	nd	nd
Butyl benzyl phthalate	10	nd	nd	nd	nd	nd
Endosulfan sulfate	10	nd	nd	nd	nd	nd
4.4-DDT	10	nd	nd	nd	nd	nd
3.3-Dichlorobenzidine	100	nd	nd	nd	nd	nd
Benzo(a)anthracene	10	nd	nd	nd	nd	nd
Chrysene	10	nd	nd	nd	nd	nd

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

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Method Header

Analyte	Lab No	E17989				
	Sample Id	DUP2B				
	PQL					
E0180 Semivolatile Organic Compounds(µg/L)						
Phenol	10	nd				
Aniline	100	nd				
Bis(2-chloroethyl) ether	10	nd				
2-Chlorophenol	10	nd				
1.3-Dichlorobenzene	10	nd				
1.4-Dichlorobenzene	10	nd				
1.2-Dichlorobenzene	10	nd				
Benzyl Alcohol	10	nd				
2-Methylphenol	10	nd				
N-Nitrosodi-n-propylamine	10	nd				
Bis(2-chloroisopropyl) ether	10	nd				
3 and 4-Methyl phenol	20	nd				
Hexachloroethane	10	nd				
Nitrobenzene	10	nd				
Isophorone	10	nd				
2-Nitrophenol	10	nd				
2.4-Dimethylphenol	10	nd				
Bis(2-chloroethoxy) methane	10	nd				
Benzoic Acid	100	nd				
2.4-Dichlorophenol	10	nd				
1.2.4-Trichlorobenzene	10	nd				
Naphthalene	10	nd				
4-Chloroaniline	10	nd				
Hexachlorobutadiene	10	nd				

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

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

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Analyte	Lab No	E17989				
	Sample Id	DUP2B				
	PQL					
4-Chloro-3-methylphenol	10	nd				
2-Methylnaphthalene	10	nd				
Hexachlorocyclopentadiene	10	nd				
2,4,6-Trichlorophenol	10	nd				
2,4,5-Trichlorophenol	10	nd				
2-Chloronaphthalene	10	nd				
2-Nitroaniline	10	nd				
Dimethyl phthalate	10	nd				
2,6-Dinitrotoluene	10	nd				
Acenaphthylene	10	nd				
3-Nitroaniline	10	nd				
Acenaphthene	10	nd				
2,4-Dinitrophenol	10	nd				
4-Nitrophenol	10	nd				
Dibenzofuran	10	nd				
Diethyl phthalate	10	nd				
Fluorene	10	nd				
4-Chlorophenyl phenyl ether	10	nd				
4-Nitroaniline	10	nd				
4,6-Dinitro-2-methylphenol	10	nd				
Azobenzene	100	nd				
N-Nitrosodiphenylamine	100	nd				
a-BHC	10	nd				
4-Bromophenyl phenyl ether	10	nd				
Hexachlorobenzene	10	nd				

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

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

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Job Number : 9E01400

Client : PPK Adelaide

Reference : 27K140C-CANBERRA

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Analyte	Lab No	E17989				
	Sample Id	DUP2B				
	PQL					
b-BHC	10	nd				
Pentachlorophenol	10	nd				
g-BHC	10	nd				
Phenanthrene	10	nd				
Anthracene	10	nd				
d-BHC	10	nd				
Heptachlor	10	nd				
Di-n-butyl phthalate	10	nd				
Aldrin	10	nd				
Heptachlor epoxide	10	nd				
Fluoranthene	10	nd				
Pyrene	10	nd				
Endosulfan 1	10	nd				
4,4-DDE	10	nd				
Dieldrin	10	nd				
Endrin	10	nd				
Endosulfan 2	10	nd				
4,4-DDD	10	nd				
Endrin aldehyde	10	nd				
Butyl benzyl phthalate	10	nd				
Endosulfan sulfate	10	nd				
4,4-DDT	10	nd				
3,3-Dichlorobenzidine	100	nd				
Benzo(a)anthracene	10	nd				
Chrysene	10	nd				

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Analyte	Lab No	E17974	E17975	E17976	E17977	E17978
	Sample Id	GW 205	GW 206	GW 207	GW 208	GW 109
	PQL					
E0110 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 PAH	1	nd	nd	nd	nd	nd
2-Fluorobiphenyl-SURROGATE	1	112%	98%	101%	105%	88%
Anthracene-D10-SURROGATE	1	80%	98%	96%	91%	84%
p-Terphenyl-D14-SURROGATE	1	118%	106%	105%	107%	98%

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Analyte	Lab No	E17979	E17980	E17981	E17982	E17983
	Sample Id	GW 110	GW 111	GW 112	GW 113	GW 114
	PQL					
E0110 PAH's in Water (µg/L)						
Naphthalene	1	nd	nd	nd	nd	nd
Acenaphthylene	1	nd	nd	nd	nd	nd
Acenaphthene	1	2	nd	nd	nd	nd
Fluorene	1	6	nd	nd	nd	nd
Phenanthrene	1	4	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	1	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 PAH	1	13	nd	nd	nd	nd
2-Fluorobiphenyl-SURROGATE	1	98%	94%	84%	87%	109%
Anthracene-D10-SURROGATE	1	101%	99%	79%	84%	113%
p-Terphenyl-D14-SURROGATE	1	110%	109%	96%	99%	120%

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Analyte	Lab No	E17984	E17985	E17986	E17987	E17988
	Sample Id	GW 115	GW 116	GW 107	GW 108	GW 39
	PQL					
E0110 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 PAH	1	nd	nd	nd	nd	nd
2-Fluorobiphenyl-SURROGATE	1	119%	110%	106%	115%	110%
Anthracene-D10-SURROGATE	1	120%	109%	106%	117%	104%
p-Terphenyl-D14-SURROGATE	1	129%	116%	110%	122%	110%

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Analyte	Lab No	E17989				
	Sample Id	DUP2B				
	PQL					
E0110 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 PAH	1	nd				
2-Fluorobiphenyl-SURROGATE	1	106%				
Anthracene-D10-SURROGATE	1	98%				
p-Terphenyl-D14-SURROGATE	1	108%				

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Analyte	Lab No	E17974	E17975	E17976	E17977	E17978
	Sample Id	GW 205	GW 206	GW 207	GW 208	GW 109
	PQL					
E0290 Volatile Organic Compounds (µg/L)						
Benzene	5	nd	nd	nd	nd	nd
Bromobenzene	5	nd	nd	nd	nd	nd
Bromochloromethane	5	nd	nd	nd	nd	nd
Bromodichloromethane	5	nd	nd	nd	nd	nd
Bromoform	5	nd	nd	nd	nd	nd
Bromomethane	5	nd	nd	nd	nd	nd
n-Butylbenzene	5	nd	nd	nd	nd	nd
sec-Butylbenzene	5	nd	nd	nd	nd	nd
tert-Butylbenzene	5	nd	nd	nd	nd	nd
Carbon tetrachloride	5	nd	nd	nd	nd	nd
Chlorobenzene	5	nd	nd	nd	nd	nd
Chloroethane	5	nd	nd	nd	nd	nd
Chloroform	5	nd	nd	nd	nd	nd
Chloromethane	5	nd	nd	nd	nd	nd
2-Chlorotoluene	5	nd	nd	nd	nd	nd
4-Chlorotoluene	5	nd	nd	nd	nd	nd
Dibromochloromethane	5	nd	nd	nd	nd	nd
1,2-Dibromo-3-chloropropane	5	nd	nd	nd	nd	nd
1,2-Dibromoethane (EDB)	5	nd	nd	nd	nd	nd
Dibromomethane	5	nd	nd	nd	nd	nd
1,2-Dichlorobenzene	5	nd	nd	nd	nd	nd
1,3-Dichlorobenzene	5	nd	nd	nd	nd	nd
1,4-Dichlorobenzene	5	nd	nd	nd	nd	nd
Dichlorodifluoromethane	5	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 : 9E01400

Client : PPK Adelaide

Reference : 27K140C-CANBERRA

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Analyte	Lab No	E17974	E17975	E17976	E17977	E17978
	Sample Id	GW 205	GW 206	GW 207	GW 208	GW 109
	PQL					
1.1-Dichloroethene	5	nd	nd	nd	nd	nd
1.2-Dichloroethane	5	nd	nd	nd	nd	nd
1.1-Dichloroethane	5	nd	nd	nd	nd	nd
cis-1.2-Dichloroethene	5	nd	nd	nd	nd	nd
trans-1.2-Dichloroethene	5	nd	nd	nd	nd	nd
1.2-Dichloropropane	5	nd	nd	nd	nd	nd
1.3-Dichloropropane	5	nd	nd	nd	nd	nd
2.2-Dichloropropane	5	nd	nd	nd	nd	nd
1.1-Dichloropropylene	5	nd	nd	nd	nd	nd
cis-1.3-Dichloropropylene	5	nd	nd	nd	nd	nd
trans-1.3-Dichloropropylene	5	nd	nd	nd	nd	nd
Ethylbenzene	5	nd	nd	nd	nd	nd
Hexachlorobutadiene	5	nd	nd	nd	nd	nd
Isopropylbenzene	5	nd	nd	nd	nd	nd
p-Isopropyltoluene	5	nd	nd	nd	nd	nd
Methylene chloride	5	nd	nd	nd	nd	nd
Naphthalene	5	nd	nd	nd	nd	nd
n-Propylbenzene	5	nd	nd	nd	nd	nd
Styrene	5	nd	nd	nd	nd	nd
1.1.1.2-Tetrachloroethane	5	nd	nd	nd	nd	nd
1.1.2.2-Tetrachloroethane	5	nd	nd	nd	nd	nd
Tetrachloroethene	5	nd	nd	nd	nd	nd
Toluene	5	nd	nd	nd	nd	nd
1.2.3-Trichlorobenzene	5	nd	nd	nd	nd	nd
1.2.4-Trichlorobenzene	5	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

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

Job Number : 9E01400

Client : PPK Adelaide

Reference : 27K140C-CANBERRA

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Analyte	Lab No	E17979	E17980	E17981	E17982	E17983
	Sample Id	GW 110	GW 111	GW 112	GW 113	GW 114
	PQL					
E0290 Volatile Organic Compounds (µg/L)						
Benzene	5	nd	nd	nd	nd	nd
Bromobenzene	5	nd	nd	nd	nd	nd
Bromochloromethane	5	nd	nd	nd	nd	nd
Bromodichloromethane	5	nd	nd	nd	nd	nd
Bromoform	5	nd	nd	nd	nd	nd
Bromomethane	5	nd	nd	nd	nd	nd
n-Butylbenzene	5	nd	nd	nd	nd	nd
sec-Butylbenzene	5	nd	nd	nd	nd	nd
tert-Butylbenzene	5	nd	nd	nd	nd	nd
Carbon tetrachloride	5	nd	nd	nd	nd	nd
Chlorobenzene	5	nd	nd	nd	nd	nd
Chloroethane	5	nd	nd	nd	nd	nd
Chloroform	5	nd	nd	nd	nd	nd
Chloromethane	5	nd	nd	nd	nd	nd
2-Chlorotoluene	5	nd	nd	nd	nd	nd
4-Chlorotoluene	5	nd	nd	nd	nd	nd
Dibromochloromethane	5	nd	nd	nd	nd	nd
1,2-Dibromo-3-chloropropane	5	nd	nd	nd	nd	nd
1,2-Dibromoethane (EDB)	5	nd	nd	nd	nd	nd
Dibromomethane	5	nd	nd	nd	nd	nd
1,2-Dichlorobenzene	5	nd	nd	nd	nd	nd
1,3-Dichlorobenzene	5	nd	nd	nd	nd	nd
1,4-Dichlorobenzene	5	nd	nd	nd	nd	nd
Dichlorodifluoromethane	5	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 : 9E01400

Client : PPK Adelaide

Reference : 27K140C-CANBERRA

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Analyte	Lab No	E17979	E17980	E17981	E17982	E17983
	Sample Id	GW 110	GW 111	GW 112	GW 113	GW 114
	PQL					
1.1-Dichloroethene	5	nd	nd	nd	nd	nd
1.2-Dichloroethane	5	nd	nd	nd	nd	nd
1.1-Dichloroethane	5	nd	nd	nd	nd	nd
cis-1.2-Dichloroethene	5	nd	nd	nd	nd	nd
trans-1.2-Dichloroethene	5	nd	nd	nd	nd	nd
1.2-Dichloropropane	5	nd	nd	nd	nd	nd
1.3-Dichloropropane	5	nd	nd	nd	nd	nd
2.2-Dichloropropane	5	nd	nd	nd	nd	nd
1.1-Dichloropropylene	5	nd	nd	nd	nd	nd
cis-1.3-Dichloropropylene	5	nd	nd	nd	nd	nd
trans-1.3-Dichloropropylene	5	nd	nd	nd	nd	nd
Ethylbenzene	5	nd	nd	nd	nd	nd
Hexachlorobutadiene	5	nd	nd	nd	nd	nd
Isopropylbenzene	5	nd	nd	nd	nd	nd
p-Isopropyltoluene	5	nd	nd	nd	nd	nd
Methylene chloride	5	nd	nd	nd	nd	nd
Naphthalene	5	nd	nd	nd	nd	nd
n-Propylbenzene	5	nd	nd	nd	nd	nd
Styrene	5	nd	nd	nd	nd	nd
1.1.1.2-Tetrachloroethane	5	nd	nd	nd	nd	nd
1.1.2.2-Tetrachloroethane	5	nd	nd	nd	nd	nd
Tetrachloroethene	5	nd	nd	nd	nd	nd
Toluene	5	nd	nd	nd	nd	nd
1.2.3-Trichlorobenzene	5	nd	nd	nd	nd	nd
1.2.4-Trichlorobenzene	5	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

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

Job Number : 9E01400

Client : PPK Adelaide

Reference : 27K140C-CANBERRA

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Analyte	Lab No	E17984	E17985	E17986	E17987	E17988
	Sample Id	GW 115	GW 116	GW 107	GW 108	GW 39
	PQL					
E0290 Volatile Organic Compounds (µg/L)						
Benzene	5	nd	nd	nd	nd	nd
Bromobenzene	5	nd	nd	nd	nd	nd
Bromochloromethane	5	nd	nd	nd	nd	nd
Bromodichloromethane	5	nd	nd	nd	nd	nd
Bromoform	5	nd	nd	nd	nd	nd
Bromomethane	5	nd	nd	nd	nd	nd
n-Butylbenzene	5	nd	nd	nd	nd	nd
sec-Butylbenzene	5	nd	nd	nd	nd	nd
tert-Butylbenzene	5	nd	nd	nd	nd	nd
Carbon tetrachloride	5	nd	nd	nd	nd	nd
Chlorobenzene	5	nd	nd	nd	nd	nd
Chloroethane	5	nd	nd	nd	nd	nd
Chloroform	5	nd	nd	nd	nd	nd
Chloromethane	5	nd	nd	nd	nd	nd
2-Chlorotoluene	5	nd	nd	nd	nd	nd
4-Chlorotoluene	5	nd	nd	nd	nd	nd
Dibromochloromethane	5	nd	nd	nd	nd	nd
1,2-Dibromo-3-chloropropane	5	nd	nd	nd	nd	nd
1,2-Dibromoethane (EDB)	5	nd	nd	nd	nd	nd
Dibromomethane	5	nd	nd	nd	nd	nd
1,2-Dichlorobenzene	5	nd	nd	nd	nd	nd
1,3-Dichlorobenzene	5	nd	nd	nd	nd	nd
1,4-Dichlorobenzene	5	nd	nd	nd	nd	nd
Dichlorodifluoromethane	5	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 : 9E01400

Client : PPK Adelaide

Reference : 27K140C-CANBERRA

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Analyte	Lab No	E17984	E17985	E17986	E17987	E17988
	Sample Id	GW 115	GW 116	GW 107	GW 108	GW 39
	PQL					
1.1-Dichloroethene	5	nd	nd	nd	nd	nd
1.2-Dichloroethane	5	nd	nd	nd	nd	nd
1.1-Dichloroethane	5	nd	nd	nd	nd	nd
cis-1.2-Dichloroethene	5	nd	nd	nd	nd	nd
trans-1.2-Dichloroethene	5	nd	nd	nd	nd	nd
1.2-Dichloropropane	5	nd	nd	nd	nd	nd
1.3-Dichloropropane	5	nd	nd	nd	nd	nd
2.2-Dichloropropane	5	nd	nd	nd	nd	nd
1.1-Dichloropropylene	5	nd	nd	nd	nd	nd
cis-1.3-Dichloropropylene	5	nd	nd	nd	nd	nd
trans-1.3-Dichloropropylene	5	nd	nd	nd	nd	nd
Ethylbenzene	5	nd	nd	nd	nd	nd
Hexachlorobutadiene	5	nd	nd	nd	nd	nd
Isopropylbenzene	5	nd	nd	nd	nd	nd
p-Isopropyltoluene	5	nd	nd	nd	nd	nd
Methylene chloride	5	nd	nd	nd	nd	nd
Naphthalene	5	nd	nd	nd	nd	nd
n-Propylbenzene	5	nd	nd	nd	nd	nd
Styrene	5	nd	nd	nd	nd	nd
1.1.1.2-Tetrachloroethane	5	nd	nd	nd	nd	nd
1.1.2.2-Tetrachloroethane	5	nd	nd	nd	nd	nd
Tetrachloroethene	5	nd	nd	nd	nd	nd
Toluene	5	nd	nd	nd	nd	nd
1.2.3-Trichlorobenzene	5	nd	nd	nd	nd	nd
1.2.4-Trichlorobenzene	5	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

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

Job Number : 9E01400

Client : PPK Adelaide

Reference : 27K140C-CANBERRA

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Analyte	Lab No	E17989				
	Sample Id	DUP2B				
	PQL					
E0290 Volatile Organic Compounds ($\mu\text{g/L}$)						
Benzene	5	nd				
Bromobenzene	5	nd				
Bromochloromethane	5	nd				
Bromodichloromethane	5	nd				
Bromoform	5	nd				
Bromomethane	5	nd				
n-Butylbenzene	5	nd				
sec-Butylbenzene	5	nd				
tert-Butylbenzene	5	nd				
Carbon tetrachloride	5	nd				
Chlorobenzene	5	nd				
Chloroethane	5	nd				
Chloroform	5	nd				
Chloromethane	5	nd				
2-Chlorotoluene	5	nd				
4-Chlorotoluene	5	nd				
Dibromochloromethane	5	nd				
1,2-Dibromo-3-chloropropane	5	nd				
1,2-Dibromoethane (EDB)	5	nd				
Dibromomethane	5	nd				
1,2-Dichlorobenzene	5	nd				
1,3-Dichlorobenzene	5	nd				
1,4-Dichlorobenzene	5	nd				
Dichlorodifluoromethane	5	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 : 9E01400

Client : PPK Adelaide

Reference : 27K140C-CANBERRA

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Analyte	Lab No	E17989				
	Sample Id	DUP2B				
	PQL					
1.1-Dichloroethene	5	nd				
1.2-Dichloroethane	5	nd				
1.1-Dichloroethane	5	nd				
cis-1.2-Dichloroethene	5	nd				
trans-1.2-Dichloroethene	5	nd				
1.2-Dichloropropane	5	nd				
1.3-Dichloropropane	5	nd				
2.2-Dichloropropane	5	nd				
1.1-Dichloropropylene	5	nd				
cis-1.3-Dichloropropylene	5	nd				
trans-1.3-Dichloropropylene	5	nd				
Ethylbenzene	5	nd				
Hexachlorobutadiene	5	nd				
Isopropylbenzene	5	nd				
p-Isopropyltoluene	5	nd				
Methylene chloride	5	nd				
Naphthalene	5	nd				
n-Propylbenzene	5	nd				
Styrene	5	nd				
1.1.1.2-Tetrachloroethane	5	nd				
1.1.2.2-Tetrachloroethane	5	nd				
Tetrachloroethene	5	nd				
Toluene	5	nd				
1.2.3-Trichlorobenzene	5	nd				
1.2.4-Trichlorobenzene	5	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

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

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

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

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

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

* During Kjeldahl digestion, nitrate greater than 10mg/L(present in these samples) can oxidize ammonia leading to a low recovery for Kjeldahl nitrogen.

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

**** TKN should always be greater than or equal to ammonia-N concentration. The difference report however is within the uncertainties of the individual tests.**

* During Kjeldahl digestion, nitrate greater than 10mg/L(present in these samples) can oxidize ammonia leading to a low recovery for Kjeldahl nitrogen.

QA/QC APPENDIX NO. 9E01400

<u>Method</u>	<u>Description</u>
E0220	Total Petroleum Hydrocarbons
E0180	Semivolatile Organic Compounds
E0110	Polycyclic Aromatic Hydrocarbons
E0290	Volatile Organic Compounds
E4870	Dissolved Metals by ICP-MS
E48501	Mercury low level
E2600	pH
E2330	Ammonia as N
E2770	TKN
E2720	Sulphate
E2640	Phosphorus-Total
E2450	Total Cyanide

Chromatography QA/QC

	Yes	No	N/A
Retention Time Window			
Within Acceptance Criteria($\pm 2\%$)	√		
Check Standard Within			
Acceptance Criteria($\pm 10\%$)	√		
Recalibration Within			
Acceptance Criteria($\pm 15\%$)	√		
Internal Standard (where applicable)			
shows acceptable recovery	√		

Other QA/QC

Holding time conforming	
With Method Specification	√
Chain of Custody Attached	√

N/A = Not Applicable

Comments

1. Laboratory QA/QC including Method Blanks, Duplicates, Matrix Spike Duplicates, Laboratory Control Samples or CRM's are included in this QA/QC appendix. (Where applicable)
2. Inter-Laboratory proficiency trial results available on request. (Where applicable)
3. Surrogate description and recoveries are recorded in the Report. (Where applicable)
4. Acceptance criteria for specific analytes are available upon request (Refer to SPM-01).
5. Practical Quantitation Limit (PQL is typically 2-10 x method detection limit (MDL)).
6. PQL's are matrix dependent and are increased accordingly where sample extracts are diluted.
7. Results are uncorrected for matrix spike or surrogate recoveries.



per G.W. ANDERSON
Manager Environmental Sydney

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Laboratory Duplicates

[illegible]

PQL = Practical Quantitation Limit

nd = $\leq$ PQL

-- = Not Applicable

(S) Soils : mg/kg (ppm) dry weight

(W) Waters : mg/L (ppm) unless otherwise specified

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Laboratory Duplicates

Analyte	PQL	Dupl 1	Dupl 2	Average	RPD (%)
E0180 Semivolatile Organic Compounds($\mu\text{g/L}$)					
Phenol	10	nd	nd		
Aniline	100	nd	nd		
Bis(2-chloroethyl) ether	10	nd	nd		
2-Chlorophenol	10	nd	nd		
1,3-Dichlorobenzene	10	nd	nd		
1,4-Dichlorobenzene	10	nd	nd		
1,2-Dichlorobenzene	10	nd	nd		
Benzyl Alcohol	10	nd	nd		
2-Methylphenol	10	nd	nd		
N-Nitrosodi-n-propylamine	10	nd	nd		
Bis(2-chloroisopropyl) ether	10	nd	nd		
3 and 4-Methyl phenol	20	nd	nd		
Hexachloroethane	10	nd	nd		
Nitrobenzene	10	nd	nd		
Isophorone	10	nd	nd		
2-Nitrophenol	10	nd	nd		
2,4-Dimethylphenol	10	nd	nd		
Bis(2-chloroethoxy) methane	10	nd	nd		
Benzoic Acid	100	nd	nd		
2,4-Dichlorophenol	10	nd	nd		
1,2,4-Trichlorobenzene	10	nd	nd		
Naphthalene	10	nd	nd		
4-Chloroaniline	10	nd	nd		
Hexachlorobutadiene	10	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

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Laboratory Duplicates

Analyte	PQL	Dupl 1	Dupl 2	Average	RPD (%)
4-Chloro-3-methylphenol	10	nd	nd		
2-Methylnaphthalene	10	nd	nd		
Hexachlorocyclopentadiene	10	nd	nd		
2,4,6-Trichlorophenol	10	nd	nd		
2,4,5-Trichlorophenol	10	nd	nd		
2-Chloronaphthalene	10	nd	nd		
2-Nitroaniline	10	nd	nd		
Dimethyl phthalate	10	nd	nd		
2,6-Dinitrotoluene	10	nd	nd		
Acenaphthylene	10	nd	nd		
3-Nitroaniline	10	nd	nd		
Acenaphthene	10	nd	nd		
2,4-Dinitrophenol	10	nd	nd		
4-Nitrophenol	10	nd	nd		
Dibenzofuran	10	nd	nd		
Diethyl phthalate	10	nd	nd		
Fluorene	10	nd	nd		
4-Chlorophenyl phenyl ether	10	nd	nd		
4-Nitroaniline	10	nd	nd		
4,6-Dinitro-2-methylphenol	10	nd	nd		
Azobenzene	100	nd	nd		
N-Nitrosodiphenylamine	100	nd	nd		
a-BHC	10	nd	nd		
4-Bromophenyl phenyl ether	10	nd	nd		
Hexachlorobenzene	10	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

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Laboratory Duplicates

Analyte	PQL	Dupl 1	Dupl 2	Average	RPD (%)
b-BHC	10	nd	nd		
Pentachlorophenol	10	nd	nd		
g-BHC	10	nd	nd		
Phenanthrene	10	nd	nd		
Anthracene	10	nd	nd		
d-BHC	10	nd	nd		
Heptachlor	10	nd	nd		
Di-n-butyl phthalate	10	nd	nd		
Aldrin	10	nd	nd		
Heptachlor epoxide	10	nd	nd		
Fluoranthene	10	nd	nd		
Pyrene	10	nd	nd		
Endosulfan 1	10	nd	nd		
4,4-DDE	10	nd	nd		
Dieldrin	10	nd	nd		
Endrin	10	nd	nd		
Endosulfan 2	10	nd	nd		
4,4-DDD	10	nd	nd		
Endrin aldehyde	10	nd	nd		
Butyl benzyl phthalate	10	nd	nd		
Endosulfan sulfate	10	nd	nd		
4,4-DDT	10	nd	nd		
3,3-Dichlorobenzidine	100	nd	nd		
Benzo(a)anthracene	10	nd	nd		
Chrysene	10	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

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Method Blank

ANALYTE	SAMPLE ID	Blank				
	PQL					
E0180 Semivolatile Organic Compounds($\mu\text{g/L}$)						
Phenol	10	nd				
Aniline	100	nd				
Bis(2-chloroethyl) ether	10	nd				
2-Chlorophenol	10	nd				
1.3-Dichlorobenzene	10	nd				
1.4-Dichlorobenzene	10	nd				
1.2-Dichlorobenzene	10	nd				
Benzyl Alcohol	10	nd				
2-Methylphenol	10	nd				
N-Nitrosodi-n-propylamine	10	nd				
Bis(2-chloroisopropyl) ether	10	nd				
3 and 4-Methyl phenol	20	nd				
Hexachloroethane	10	nd				
Nitrobenzene	10	nd				
Isophorone	10	nd				
2-Nitrophenol	10	nd				
2.4-Dimethylphenol	10	nd				
Bis(2-chloroethoxy) methane	10	nd				
Benzoic Acid	100	nd				
2.4-Dichlorophenol	10	nd				
1.2.4-Trichlorobenzene	10	nd				
Naphthalene	10	nd				
4-Chloroaniline	10	nd				
Hexachlorobutadiene	10	nd				

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

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

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Method Blank

ANALYTE	SAMPLE ID	Blank				
	PQL					
4-Chloro-3-methylphenol	10	nd				
2-Methylnaphthalene	10	nd				
Hexachlorocyclopentadiene	10	nd				
2,4,6-Trichlorophenol	10	nd				
2,4,5-Trichlorophenol	10	nd				
2-Chloronaphthalene	10	nd				
2-Nitroaniline	10	nd				
Dimethyl phthalate	10	nd				
2,6-Dinitrotoluene	10	nd				
Acenaphthylene	10	nd				
3-Nitroaniline	10	nd				
Acenaphthene	10	nd				
2,4-Dinitrophenol	10	nd				
4-Nitrophenol	10	nd				
Dibenzofuran	10	nd				
Diethyl phthalate	10	nd				
Fluorene	10	nd				
4-Chlorophenyl phenyl ether	10	nd				
4-Nitroaniline	10	nd				
4,6-Dinitro-2-methylphenol	10	nd				
Azobenzene	100	nd				
N-Nitrosodiphenylamine	100	nd				
a-BHC	10	nd				
4-Bromophenyl phenyl ether	10	nd				
Hexachlorobenzene	10	nd				

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

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

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Method Blank

ANALYTE	SAMPLE ID	Blank				
	PQL					
b-BHC	10	nd				
Pentachlorophenol	10	nd				
g-BHC	10	nd				
Phenanthrene	10	nd				
Anthracene	10	nd				
d-BHC	10	nd				
Heptachlor	10	nd				
Di-n-butyl phthalate	10	nd				
Aldrin	10	nd				
Heptachlor epoxide	10	nd				
Fluoranthene	10	nd				
Pyrene	10	nd				
Endosulfan 1	10	nd				
4,4-DDE	10	nd				
Dieldrin	10	nd				
Endrin	10	nd				
Endosulfan 2	10	nd				
4,4-DDD	10	nd				
Endrin aldehyde	10	nd				
Butyl benzyl phthalate	10	nd				
Endosulfan sulfate	10	nd				
4,4-DDT	10	nd				
3,3-Dichlorobenzidine	100	nd				
Benzo(a)anthracene	10	nd				
Chrysene	10	nd				

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

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

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Spike Recoveries

Analyte	Spike	Level	Detected	Recovery Details			
	Level	Spike 1	Spike 2	Rec 1 (%)	Rec 2 (%)	Average (%)	RPD (%)
E0110 PAH's in Water (µg/L)							
Naphthalene	10	8		82%		82%	
Acenaphthylene	10	9		94%		94%	
Acenaphthene	10	8		84%		84%	
Fluorene	10	9		89%		89%	
Phenanthrene	10	9		86%		86%	
Anthracene	10	8		83%		83%	
Fluoranthene	10	10		96%		96%	
Pyrene	10	10		95%		95%	
Benz(a)anthracene	10	10		101%		101%	
Chrysene	10	10		102%		102%	
Benzo(b) & (k)fluoranthene	20	17		85%		85%	
Benzo(a)pyrene	10	8		83%		83%	
Indeno(1.2.3-cd)pyrene	10	8		81%		81%	
Dibenz(a,h)anthracene	10	9		85%		85%	
Benzo(g,h,i)perylene	10	9		89%		89%	

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

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

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Laboratory Control Sample

Analyte	Level	Level	Detected	Recovery Details			
		Result1	Result2	Rec 1 (%)	Rec 2 (%)	Average (%)	RPD (%)
E0110 PAH's in Water (µg/L)							
Naphthalene	10	8		80%		80%	
Acenaphthylene	10	8		80%		80%	
Acenaphthene	10	8		80%		80%	
Fluorene	10	8		80%		80%	
Phenanthrene	10	8		80%		80%	
Anthracene	10	8		80%		80%	
Fluoranthene	10	7		70%		70%	
Pyrene	10	8		80%		80%	
Benz(a)anthracene	10	8		80%		80%	
Chrysene	10	10		100%		100%	
Benzo(b) & (k)fluoranthene	20	15		75%		75%	
Benzo(a)pyrene	10	7		70%		70%	
Indeno(1.2.3-cd)pyrene	10	8		80%		80%	
Dibenz(a,h)anthracene	10	8		80%		80%	
Benzo(g,h,i)perylene	10	8		80%		80%	

PQL = Practical Quantitation Limit
-- = Not Applicable

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

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Method Blank

[illegible]

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

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

All results are within the acceptance criteria:

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QAQC : Method Blank

ANALYTE	SAMPLE ID	Blank				
	PQL					
E0290 Volatile Organic Compounds ($\mu\text{g/L}$)						
Benzene	5	nd				
Bromobenzene	5	nd				
Bromochloromethane	5	nd				
Bromodichloromethane	5	nd				
Bromoform	5	nd				
Bromomethane	5	nd				
n-Butylbenzene	5	nd				
sec-Butylbenzene	5	nd				
tert-Butylbenzene	5	nd				
Carbon tetrachloride	5	nd				
Chlorobenzene	5	nd				
Chloroethane	5	nd				
Chloroform	5	nd				
Chloromethane	5	nd				
2-Chlorotoluene	5	nd				
4-Chlorotoluene	5	nd				
Dibromochloromethane	5	nd				
1,2-Dibromo-3-chloropropane	5	nd				
1,2-Dibromoethane (EDB)	5	nd				
Dibromomethane	5	nd				
1,2-Dichlorobenzene	5	nd				
1,3-Dichlorobenzene	5	nd				
1,4-Dichlorobenzene	5	nd				
Dichlorodifluoromethane	5	nd				

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

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

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Method Blank

ANALYTE	SAMPLE ID	Blank				
	PQL					
1.1-Dichloroethene	5	nd				
1.2-Dichloroethane	5	nd				
1.1-Dichloroethane	5	nd				
cis-1.2-Dichloroethene	5	nd				
trans-1.2-Dichloroethene	5	nd				
1.2-Dichloropropane	5	nd				
1.3-Dichloropropane	5	nd				
2.2-Dichloropropane	5	nd				
1.1-Dichloropropylene	5	nd				
cis-1.3-Dichloropropylene	5	nd				
trans-1.3-Dichloropropylene	5	nd				
Ethylbenzene	5	nd				
Hexachlorobutadiene	5	nd				
Isopropylbenzene	5	nd				
p-Isopropyltoluene	5	nd				
Methylene chloride	5	nd				
Naphthalene	5	nd				
n-Propylbenzene	5	nd				
Styrene	5	nd				
1.1.1.2-Tetrachloroethane	5	nd				
1.1.2.2-Tetrachloroethane	5	nd				
Tetrachloroethene	5	nd				
Toluene	5	nd				
1.2.3-Trichlorobenzene	5	nd				
1.2.4-Trichlorobenzene	5	nd				

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

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

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

[illegible]

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Spike Recoveries

[illegible]

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

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

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Laboratory Control Sample

Analyte	Level	Level	Detected	Recovery Details			
		Result1	Result2	Rec 1 (%)	Rec 2 (%)	Average (%)	RPD (%)
E4870 Dissolved Metals in Waters							
Arsenic	0.100	0.106		106%		106%	
Cadmium	0.1000	0.10		100%		100%	
Chromium	0.100	0.095		95%		95%	
Copper	0.100	0.108		108%		108%	
Manganese	0.100	0.108		108%		108%	
Nickel	0.100	0.108		108%		108%	
Lead	0.100	0.102		102%		102%	
Zinc	0.100	0.108		108%		108%	
E48501 Dissolved Mercury in Waters							
Mercury	0.001	0.00094		94%		94%	

PQL = Practical Quantitation Limit
-- = Not Applicable

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

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Laboratory Duplicates

[illegible]

PQL = Practical Quantitation Limit

nd $\equiv < \text{PQL}$

-- = Not Applicable

(S) Soils : mg/kg (ppm) dry weight

(W) Waters : mg/L (ppm) unless otherwise specified

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Laboratory Control Sample

[illegible]

PQL = Practical Quantitation Limit
-- = Not Applicable

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

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

QAQC : Method Blank

[illegible]

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

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

All results are within the acceptance criteria:

Refer to Amdel-Sydney Quality Control Manual SPM-01 5th Edition 1/6/98

Appendix L

Well Gauging Data

Well Gauging Data - Canberra Rail Site

Groundwater Well	RL (m AHD)		Depth to Water		RL Ground water (m AHD)
	Top Standpipe	Top Casing	(m BTOSP)	(m BTOC)	
GW1	564.560	564.480	6.60	-	557.960
GW2	564.760	564.633	6.46	-	558.300
GW4	565.002	564.720	-	7.18	557.540
GW5	563.461	563.338	-	4.26	559.078
GW6	563.709	563.491	-	5.19	558.301
GW8	563.548	563.358	-	5.19	558.168
GW9	564.224	564.102	-	6.64	557.462
GW10	562.540	562.386	-	1.71	560.676
GW11	563.387	563.293	-	3.45	559.843
GW12	562.265	561.977	-	4.88	557.097
GW13	563.241	563.091	-	3.52	559.571
GW14	562.878	562.720	-	5.23	557.490
GW16	563.291	563.206	-	5.64	557.566
GW17	575.396	575.278	2.02	-	573.376
GW19	574.234	574.006	1.72	-	572.514
GW21	573.755	573.556	1.79	-	571.965
GW22	573.527	573.337	2.23	-	571.297
GW24	572.695	572.576	1.66	-	571.035
GW26	572.102	571.948	2.16	-	569.942
GW28	571.878	571.774	3.25	-	568.628
GW30	574.496	574.315	2.15	-	572.346
GW32	579.653	579.437	-	3.40	576.037
GW33	568.304	568.195	-	2.32	565.875
GW34	565.854	565.766	-	-	-
GW35	566.244	566.169	-	2.02	564.149
GW36	568.286	568.210	-	4.35	563.860
GW37	556.594	556.562	1.40	-	555.194
GW38	561.689	561.464	5.73	-	555.959
GW39	-	560.435	-	4.87	555.565
PMW1	-	572.290	-	1.06	571.230
PMW2	572.408	572.341	-	1.14	571.201
PMW3	572.086	572.012	-	0.45	571.562
GW101	-	564.191	-	6.41	557.781
GW102	-	563.922	-	4.92	559.002
GW103	-	563.461	-	4.44	559.021
GW104	-	564.891	-	6.93	557.961
GW105	-	564.746	-	6.81	557.936
GW106	-	562.706	-	5.32	557.386
GW107	-	562.353	-	4.47	557.883
GW108	-	562.787	-	4.52	558.267
GW109	-	561.110	-	3.39	557.720
GW110	-	562.318	-	5.10	557.218
GW111	-	562.229	-	5.49	556.739
GW112	-	561.208	-	5.62	555.588
GW113	-	561.291	-	5.39	555.901
GW114	-	561.518	-	5.29	556.228
GW115	-	561.727	-	5.48	556.247
GW116	-	561.463	-	5.25	556.213

Well Gauging Data - Canberra Rail Site

Groundwater Well	RL (m AHD)		Depth to Water		RL Ground water (m AHD)
	Top Standpipe	Top Casing	(m BTOSP)	(m BTOC)	
GW201	-	563.706	-	5.69	558.016
GW202	-	563.929	-	5.97	557.959
GW203	-	565.182	-	7.26	557.922
GW204	-	563.091	-	5.02	558.071
GW205	-	-	-	-	-
GW206	-	-	-	-	-
GW207	-	-	-	-	-
GW208	-	-	-	-	-
GW209	-	-	-	-	-
GW210	-	-	-	-	-
GW211	-	563.561	-	5.73	557.831
GW301	-	562.846	-	5.04	557.806
GW302	-	563.329	-	3.46	559.869
GW303	-	563.451	-	5.64	557.811
GW304	-	562.554	-	4.48	558.074
GW305	-	562.327	-	5.09	557.237
GW306	-	562.660	-	4.95	557.710
GW307	-	562.694	-	3.02	559.674
GW308	-	562.667	-	4.08	558.587
GW309	-	562.680	-	4.66	558.020
GW310	-	563.168	-	5.32	557.848
GW311	-	562.468	-	3.90	558.568
GW312	-	561.625	-	5.69	555.935
GW313	-	561.572	-	5.62	555.952

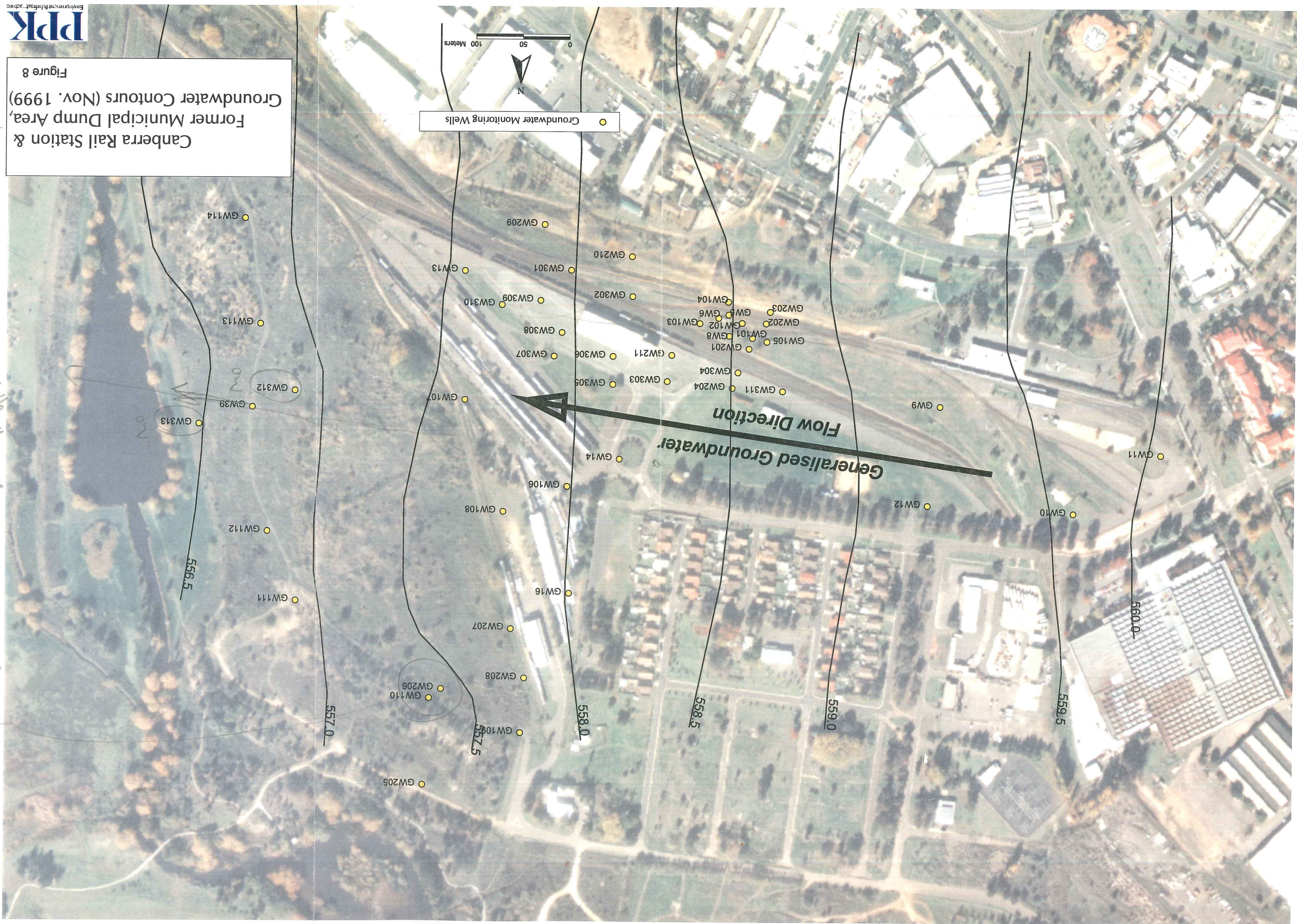
SWL Jerrabomba Creek

553.819 m AHD

Appendix M

Groundwater Flow Contours

Figure 8



Canberra Rail Corridor -
Shell Depot Area,
Groundwater Contours (Nov. 1999)
Figure 9



Canberra Rail Corridor -
Mobil, Caltex, BP Depot Area,
Groundwater Contours (Nov. 1999)
Figure 10



Appendix N

Groundwater Permeability Testing

Waterloo Hydrogeologic

180 Columbia St. W.

Waterloo, Ontario, Canada

ph.(519)746-1798

slug/bail test analysis
HVORSLEV's method

Page 1

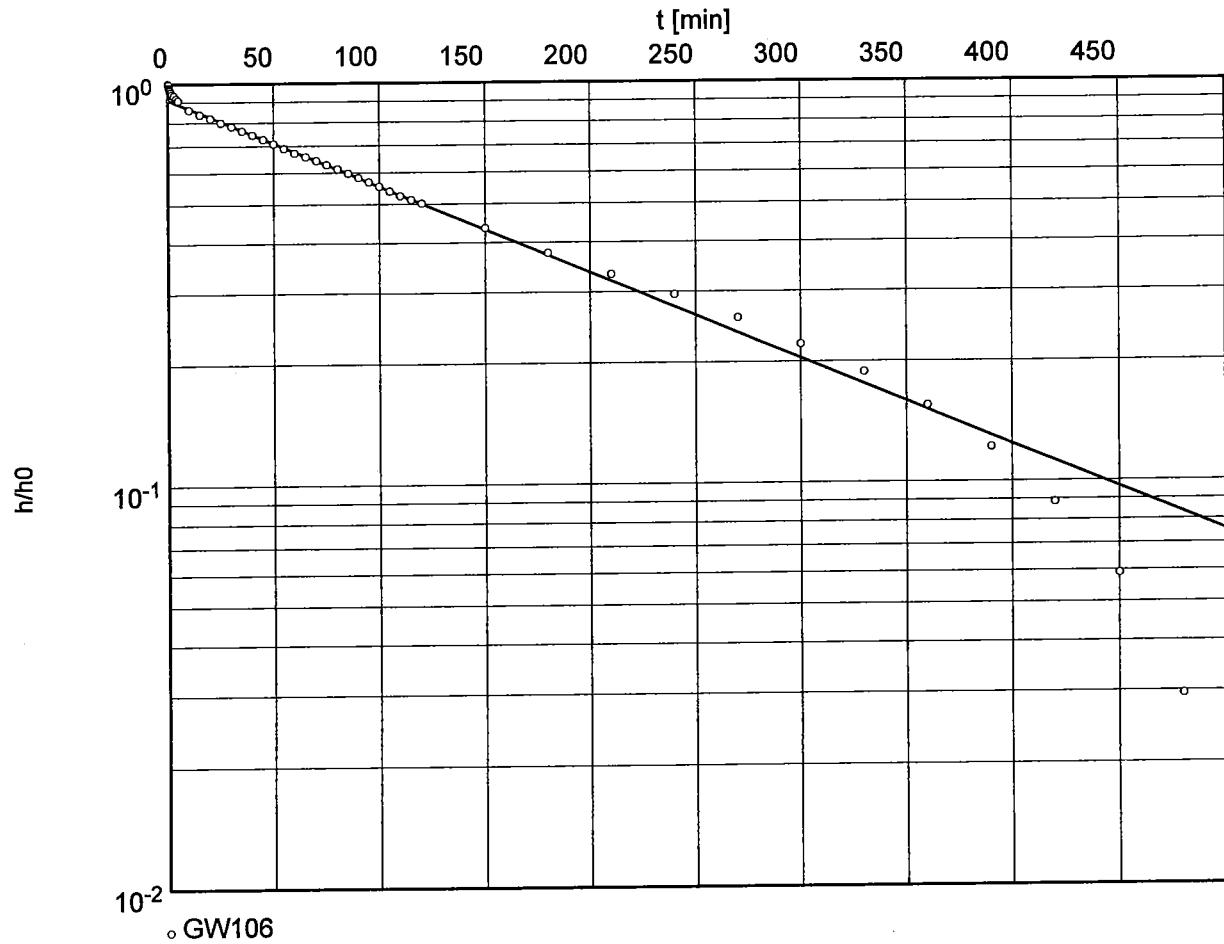
Project:

Evaluated by:

Date: 04.03.1999

Slug Test No.

Test conducted on:

Hydraulic conductivity [m/min]: 2.98×10^{-6}

Waterloo Hydrogeologic

180 Columbia St. W.

Waterloo, Ontario, Canada

ph.(519)746-1798

slug/bail test analysis
HVORSLEV's method

Page 1

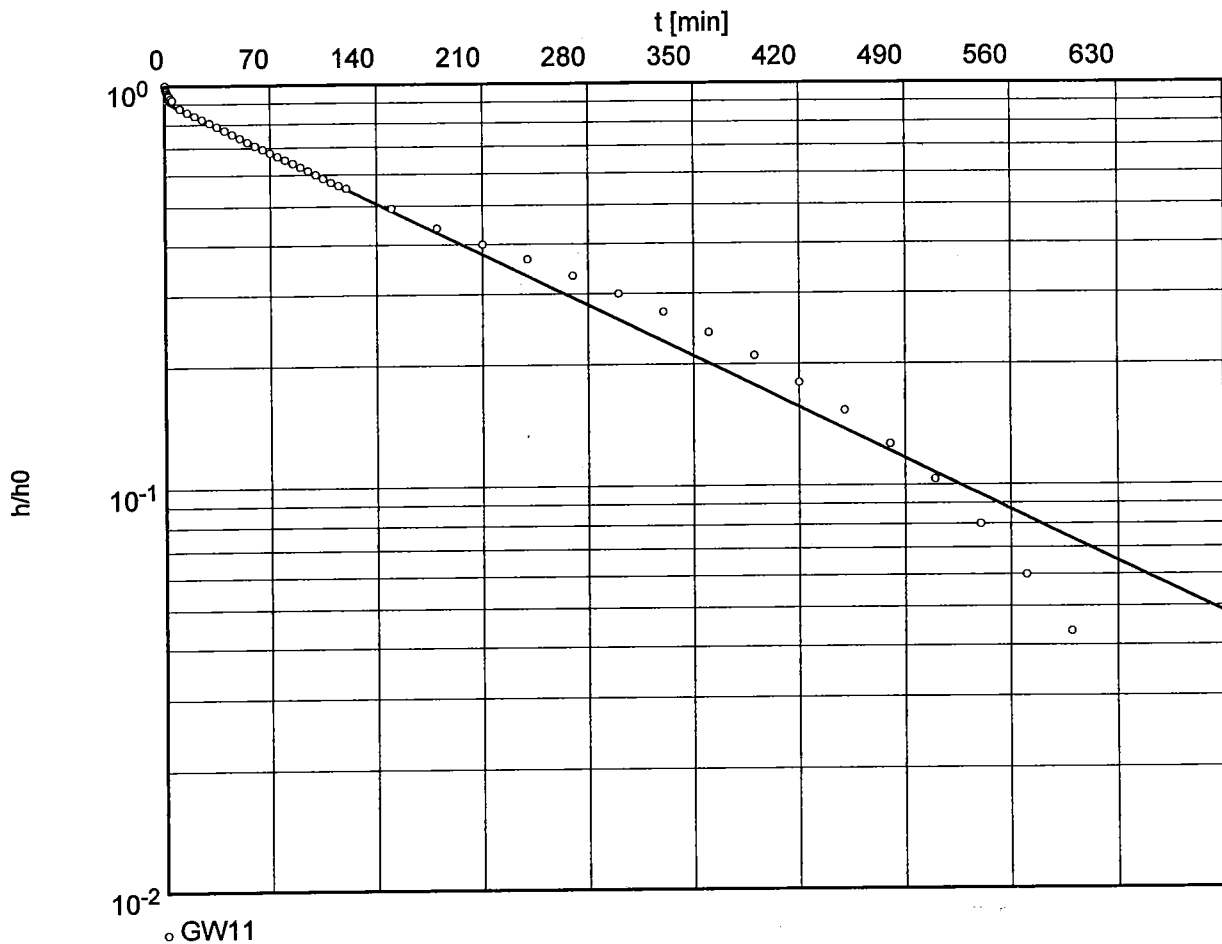
Project:

Evaluated by:

Date: 05.03.1999

Slug Test No.

Test conducted on:

Hydraulic conductivity [m/min]: 3.79×10^{-6}

Waterloo Hydrogeologic 180 Columbia St. W. Waterloo, Ontario, Canada ph.(519)746-1798		slug/bail test analysis HVORSLEV's method		Page 2	
				Project:	
				Evaluated by:	Date: 05.03.1999
Slug Test No.			Test conducted on:		
			GW11		
Static water level: 4.600 m below datum					
	Pumping test duration	Water level	Change in		
	[min]	[m]	Waterlevel		
			[m]		
1	0.00	4.300	-0.300		
2	0.25	4.300	-0.300		
3	0.50	4.305	-0.295		
4	0.75	4.307	-0.293		
5	1.00	4.309	-0.291		
6	1.50	4.312	-0.288		
7	2.00	4.315	-0.285		
8	3.00	4.317	-0.283		
9	4.00	4.321	-0.279		
10	5.00	4.324	-0.276		
11	10.00	4.337	-0.263		
12	15.00	4.343	-0.257		
13	20.00	4.348	-0.252		
14	25.00	4.353	-0.247		
15	30.00	4.358	-0.242		
16	35.00	4.363	-0.237		
17	40.00	4.368	-0.232		
18	45.00	4.373	-0.227		
19	50.00	4.378	-0.222		
20	55.00	4.383	-0.217		
21	60.00	4.388	-0.212		
22	65.00	4.392	-0.208		
23	70.00	4.396	-0.204		
24	75.00	4.400	-0.200		
25	80.00	4.404	-0.196		
26	85.00	4.408	-0.192		
27	90.00	4.412	-0.188		
28	95.00	4.416	-0.184		
29	100.00	4.420	-0.180		
30	105.00	4.424	-0.176		
31	110.00	4.428	-0.172		
32	115.00	4.431	-0.169		
33	120.00	4.434	-0.166		
34	150.00	4.452	-0.148		
35	180.00	4.468	-0.132		
36	210.00	4.480	-0.120		
37	240.00	4.490	-0.110		
38	270.00	4.500	-0.100		
39	300.00	4.510	-0.090		
40	330.00	4.519	-0.081		
41	360.00	4.528	-0.072		
42	390.00	4.537	-0.063		
43	420.00	4.546	-0.054		
44	450.00	4.554	-0.046		
45	480.00	4.562	-0.038		
46	510.00	4.569	-0.031		
47	540.00	4.576	-0.024		
48	570.00	4.582	-0.018		
49	600.00	4.587	-0.013		

Waterloo Hydrogeologic

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slug/bail test analysis
HVORSLEV's method

Page 1

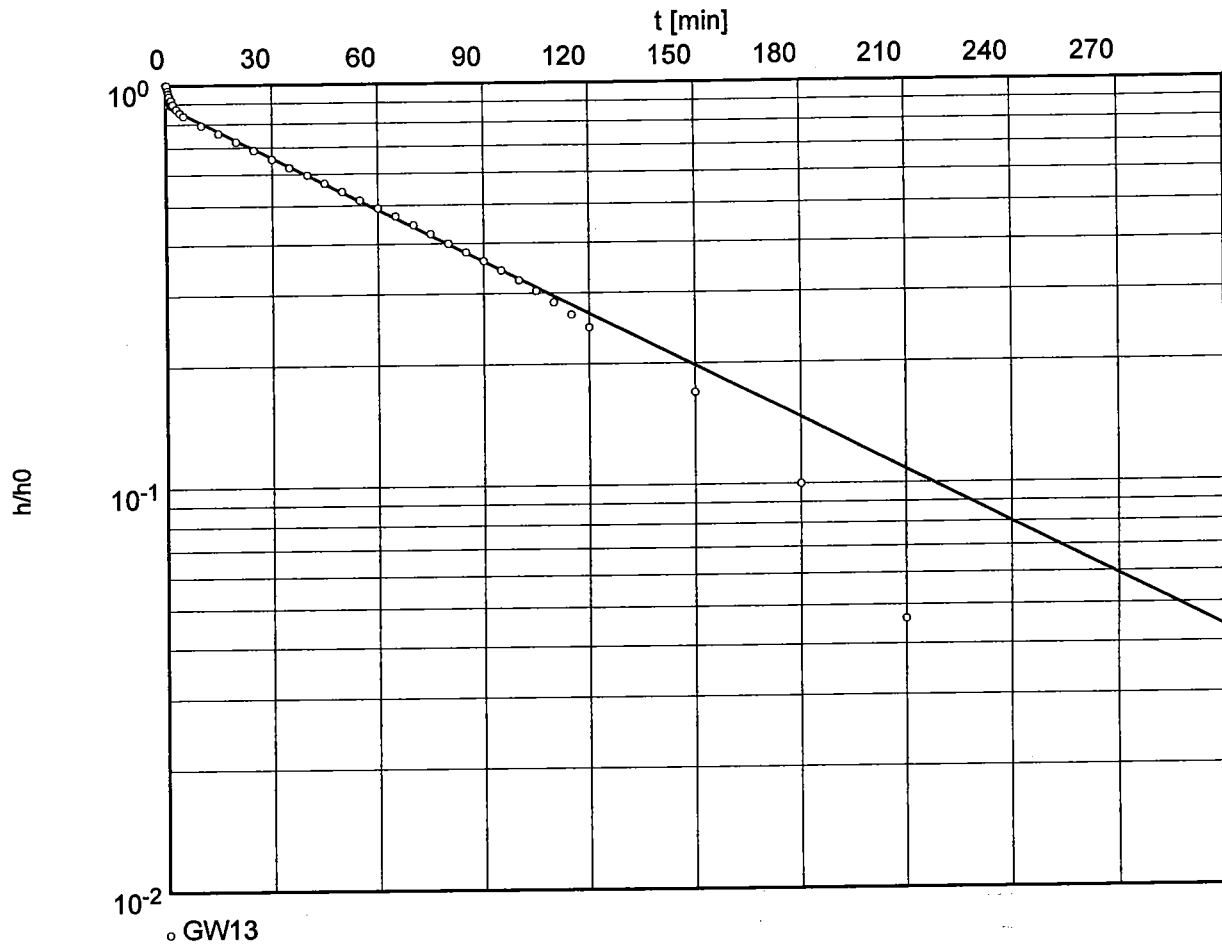
Project:

Evaluated by:

Date: 05.03.1999

Slug Test No.

Test conducted on:

Hydraulic conductivity [m/min]: 1.16×10^{-5}

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slug/bail test analysis
HVORSLEV's method

Page 1

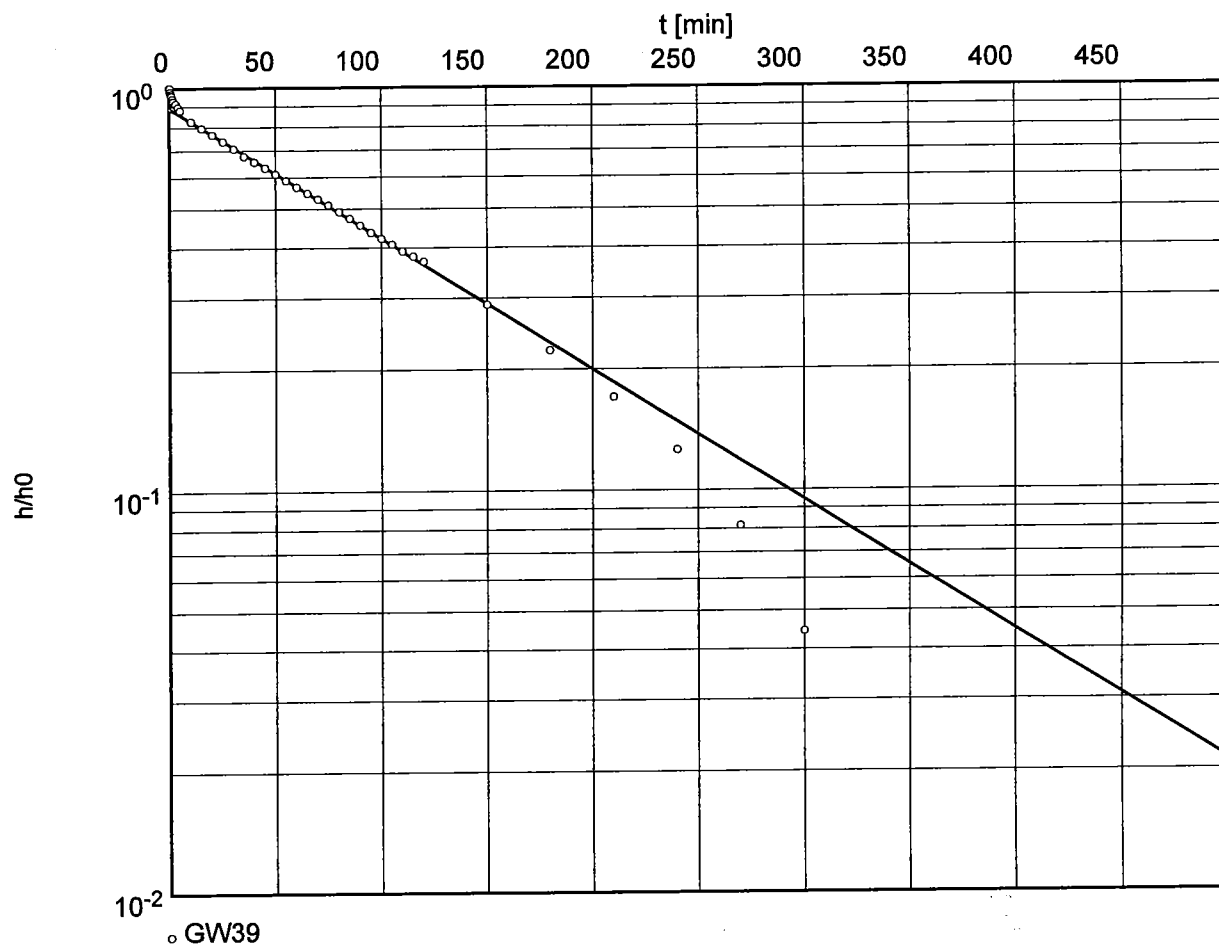
Project:

Evaluated by:

Date: 04.03.1999

Slug Test No.

Test conducted on:

Hydraulic conductivity [m/min]: 3.24×10^{-6}

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slug/bail test analysis
HVORSLEV's method

Page 1

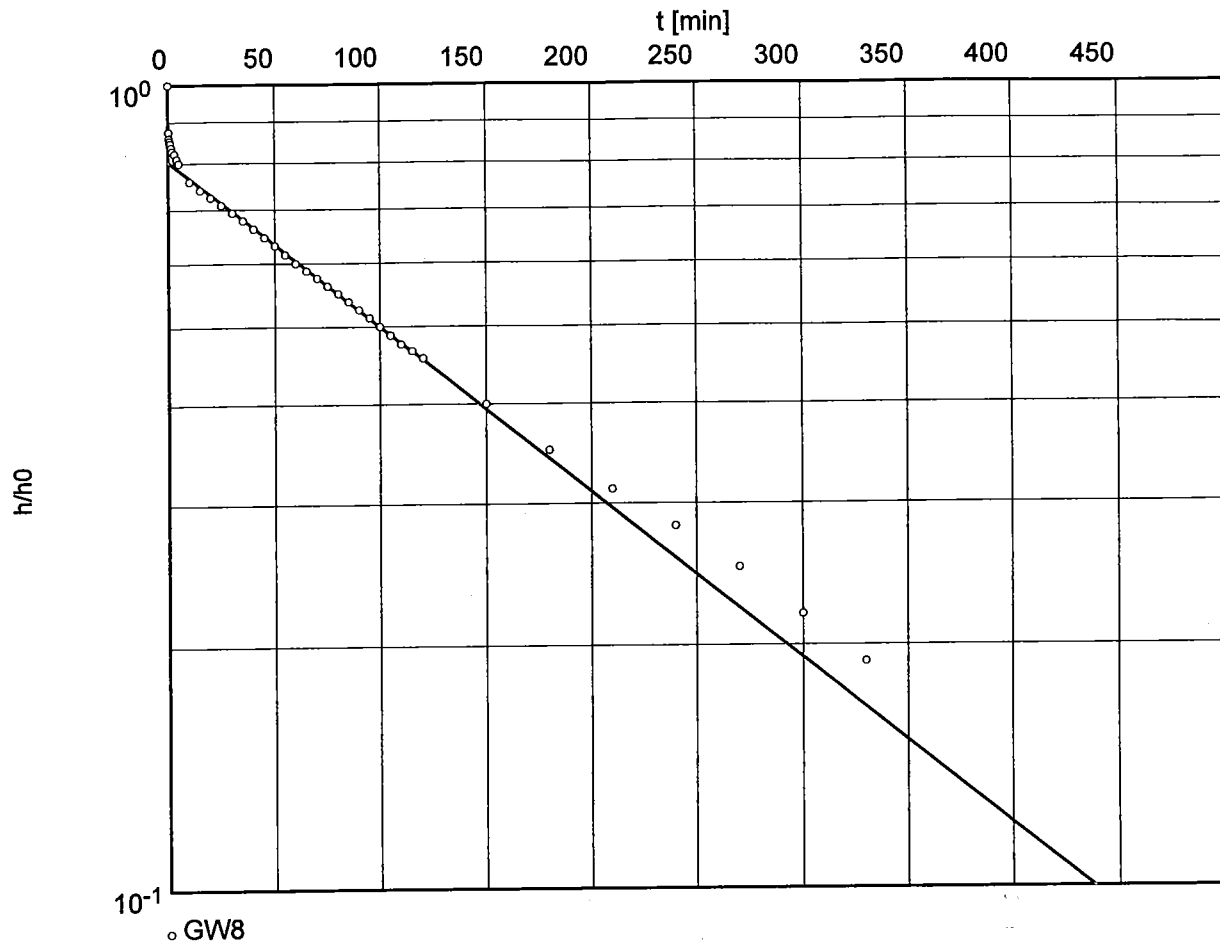
Project:

Evaluated by:

Date: 04.03.1999

Slug Test No.

Test conducted on:

Hydraulic conductivity [m/min]: 4.07×10^{-6}

GW8

Static water level: 5.220 m below datum

[illegible]

Appendix O

Excerpt – Health Risk Assessment

Table 3. Source Zone 1 - Lead contaminated surface soils along rail lines

Description	Parameter	Definition	Reference
Receptors			
Distance	0 m	on-site human receptor exposure in a confined or unconfined space - commercial/industrial land use	(1)
Distance	28 m	off-site human receptor in direction of the predominating north westerly wind direction* - residential land use	(1 & 12)
Distance	100 m	off-site ecological receptor - Port Pirie River	(1)
Surface soil definition			
Cadmium**	210 mg/kg	maximum concentration of cadmium in surface soil	(1)
Lead	13,000 mg/kg	maximum concentration of lead in surface soil	(1)
Area	122,000 m ²	total area of soils above threshold concentration	(1)
Length	1,100 m	length of soils above threshold concentrations parallel to the predominant north westerly wind direction	(1 & 12)
Velocity	14.17 m/sec	maximum air speed in mixing zone	(12)
Depth	0 to 0.5 mBGL	depth of soil considered in surface soil assessment	(1)
Air Emissions	179 g/m ² /yr (Appendix C)	volume of dust generated per square metre on-site in contaminant area	(13)
Subsurface soil definition			
Cadmium	200 mg/kg	maximum concentration of cadmium in surface soil	(1)
Lead	2,300 mg/kg	maximum concentration of lead in subsurface soil	(1)
Thickness	1 m	estimation of capillary zone thickness	(14)
Thickness	1.58 m	vadose zone thickness is estimated from average depths to groundwater less than capillary zone thickness	(1)
Porosity	0.38	estimation of effective porosity of vadose zone consistent with lithology	(15)
Depth	2.58 m	depth to groundwater based on site-averaged SWLs measured from ground level	(1)
Depth	0.5	depth to top of subsurface soils above threshold concentrations	(1)
Thickness	1.0	thickness of subsurface soils above threshold concentrations	(1)
pH	8.22	soil/groundwater pH	(1)
Groundwater definition			
Lead	9.0 x 10 ⁻⁵ mg/L	maximum concentration of lead in groundwater	(1)
Recharge	35 cm/yr	groundwater infiltration rate based on mean total rainfall	(12)
Conductivity	10 ⁻³ cm/sec	estimation of saturated hydraulic conductivity consistent with lithology	(16)
Gradient	0.00125	site-averaged groundwater gradient	(1)
Porosity	0.38	estimation of effective porosity of water-bearing unit consistent with lithology	(15)
Length	1,100 m	length of soils above threshold concentrations parallel to the site-averaged groundwater flow direction	(1)
Width	15 m	nominal width of plume at source area	(1)
Thickness	2 m	nominal groundwater plume thickness (extension into aquifer)	(1)

* The predominating wind direction has been calculated from Bureau of Meteorology Data (9) and is included in Appendix C

** Source Zone 1 cadmium is above industrial threshold criteria in only 5 locations (within the lead contaminated areas) in surface soils and would be accommodated by any clean-up measures used in the remediation of lead. As a result the modelling of cadmium as a major health risk was not considered.

3. Exposure Pathway Characterisation

Complete exposure pathways have been considered for continued commercial/industrial (rail) use of the Port Pirie site (on-site) and existing neighbouring land uses (residential). Exposure pathways have been analysed with regard to sources of contamination, human and ecological receptors and transport mechanisms for COCs between identified sources and receptors for each of the 4 source zones identified. For subsurface soils and groundwater, it has been assumed that no significant direct exposure will occur. Construction or maintenance workers should take appropriate occupational health and safety measures if working in contact with these materials.

3.1 Exposure Pathways

Source Zone 1

This source zone included lead impacted surface soils, principally along the rail corridor. The following complete exposure pathways have been identified:

- Exposure of on-site commercial workers by direct contact with impacted soils and ingestion and inhalation of impacted dust.
- Exposure of off-site residents located nominally 28m downwind^(1 & 9) by ingestion and inhalation of impacted dust.
- Exposure of groundwater receptors, assumed to be the Port Pirie River 100 m hydraulically downgradient⁽¹⁾, via leaching of lead and subsequent migration of impacted groundwater.

3.2 Applicable Exposure Factors

Where Australian or site specific exposure factors have not been available, default parameters consistent with US EPA or American Industrial Health Council guidance have been used. Australian⁽⁸⁾ or site specific exposure parameters are as follows: WHO?

- For residential receptors, an exposure duration of 70 years (24 hours per day);
- For commercial receptors, an exposure duration of 30 years (8 hours per day, five days per week, 48 weeks per year);

3.3 Toxicological Factors

The following toxicological factors have been used in this assessment.

3.3.1 Lead

There is only limited data available regarding acceptable intake levels for lead internationally. In the US, the ATSDR has not derived a minimal risk level for lead, and the USEPA Carcinogenic Assessment Group has not recommended a quantitative estimate of carcinogenic risk⁽³⁾.

This assessment has used an approach consistent with that used to derive Australian NEHF health-based investigation levels. A reference dose has been based on the FAO/WHO provisional weekly tolerable intake (PWTI) figure of 25 µg/kg/week and assumes that soil contributes nominally 50% of the daily intake. The resulting reference dose of 1.86 µg/kg/day has been used.

This approach assumes background lead concentrations consistent with a normal urban environment. Background lead concentrations in Port Pirie are obviously in excess of these levels. However, it is considered that this approach will allow remediation of the site to a level that the sites contribution of lead to the environment is consistent with what would be acceptable in other urban environments.

Table 7. Site Specific Target Levels for Surface Soils

Source Zone	Constituent of Concern	Maximum Concentration *	SSTL - Complete Exposure Pathway				
			Soil leaching to groundwater, Port Pirie River	Soil leaching to groundwater, residential bore	Ingestion / inhalation / direct contact, on-site commercial workers	Ingestion / inhalation / direct contact, on-site residents	Inhalation, off-site residents
1	Lead	13,000	0.14	17	> Res	N/A	> Res

Notes:

All concentrations expressed as mg/kg per dry soil weight

Shaded numbers denote COC concentrations exceeding SSTLs for one or more complete exposure pathway

* The maximum concentration is defined as the maximum concentration for the COC reported ⁽¹⁾ in the source zone

> Res greater than residual concentration i.e. the maximum concentration possible before free product is formed

N/A not applicable

4.2 Discussion - Risk and the Derivation of Site Specific Target Levels

Site specific target levels (SSTLs) are derived via the RBCA model which calculates risk of acceptable exposure. The terminology "> Res" (greater than the residual concentration of a COC) and "> Sol" (greater than the maximum soluble concentration of a COC) imply that the concentration required to exceed the acceptable risk is greater than that which can occur without the formation of a separate phase. When the residual concentration or solubility is exceeded, the matrix within which the COC is situated i.e. soil (specifically the water attached to the soil particles) or groundwater, is no longer able to accommodate any additional COC and subsequently forms colloidal or semi-aqueous phase liquids or soil/gw or, in the case of solids, forms a precipitate.

Where SSTLs have been reported as exceeding the concentration at which residual phase is formed, the risks associated with the relevant pathway have also been checked

Where risks have exceeded the risk targets (10^{-5} or 1) but SSTLs of > Res or > Sol have been reported, the following interpretation/actions have been made:

- For vapour pathways, the vapour concentration above free phase liquid is theoretically equal to that for maximum solubility. Therefore no additional risks due to residual phase is predicted.
- For ingestion of soils or groundwater, inhalation of particulates or direct contact pathways, additional residual phase may pose additional risks. More conservative SSTLs have been calculated by multiplying the site maximum concentration by the predicted risk which is divided by the acceptable risk.

4.2.1 Source Zone 1

This scenario considers lead in surface and subsurface soils and groundwater, in relation to the current and continued use of the site for industrial (rail) purposes. The situation of surrounding residences and the nearby location of the Port Pirie River are also considered. The risk summary for Source Zone 1 indicates the following:

- The hazard index (HI) of 1.1 derived for the soil exposure pathway is related to dermal contact and the ingestion of surface soils. For the protection of on-site commercial workers the recommended SSTL would therefore be 11,800 mg/kg which is exceeded by the source zone maximum concentration of 13,000 mg/kg.
- Results suggest that the groundwater pathway poses an unacceptable risk (HI = 780). This pathway risk is predominated by exposure to lead via its leaching from the soil and subsequent ingestion of contaminated groundwater off-site / transport to the Port Pirie River at concentrations exceeding those recommended by ANZECC⁽¹⁰⁾ (SSTL 0.14 mg/kg). However, this risk does not correlate with existing groundwater data, which suggests only isolated exceedances of groundwater criteria have occurred, despite the likely presence of high concentrations of lead in soils for a considerable time period. The exceedance is likely to be a result of modelling not accounting for lead adsorption to the clay particles, which is likely to be a predominant mechanism for this COC. Furthermore, a considerable proportion of lead in ore dust may be physically confined within the dust particles, and not available for solubilisation and subsequent leaching to off-site receptors. Site data (groundwater monitoring results) therefore suggest this is not a significant pathway.
- The maximum source zone concentration of lead in groundwater (0.09 mg/L) did not exceed the derived groundwater lead SSTL, 0.14 mg/L, and is not expected to result in unacceptable impacts to the Port Pirie river.

6. Conclusions

6.1 Risks to Human Health and the Environment

Regarding protection of current developments on the site and in the vicinity, possible impacts to human health or the environment identified are as follows:

- Source Zone 1 which considered site-wide lead contamination of soils and groundwater derived an SSTL of 11,800 mg/kg (maximum site concentration 13,000 mg/kg) for surface soils. Risk levels associated with groundwater exposure pathways would appear to be within acceptable limits. This is verified by groundwater monitoring⁽¹⁾ which shows that lead contaminated groundwater is an isolated issue, appears to be transported marginally downgradient of impacted soil areas (modelling deficiencies were discussed in section 4.2.1) and is unlikely to affect off-site receptors to any significant degree.

8. References

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- (2) The Port Pirie Lead Implementation Program: Review of Progress and Consideration of Future Directions (1984-1993), (1993). Maynard, E. J., Calder, I. C. and Phipps C. V., South Australian Health Commission, Adelaide.
- (3) ATSDR Toxicological Profile: Lead, Draft for Public Comment (August 1995), Agency for Toxic Substances and Disease Registry, US Public Health Service.
- (4) ATSDR Toxicological Profile: Fuel Oils, Draft for Public Comment (August 1995), Agency for Toxic Substances and Disease Registry, US Public Health Service.
- (5) ATSDR Toxicological Profile: Polyaromatic Hydrocarbons (PAHs), Draft for Public Comment (August 1995), Agency for Toxic Substances and Disease Registry, US Public Health Service.
- (6) ASTM E1739-95: Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites (1995).
- (7) Contaminant Hydrogeology, 1993. Fetter, C. W., Maxwell Macmillan International, Sydney, Australia.
- (8) Selection of Representative TPH Fractions Based on Fate and Transport Considerations, Volume III, 1997. TPH Criteria Working Group Fate and Transport Technical Action Group.
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- (11) Dutch Groundwater Target Level for TPH C₁₀-C₃₆. Environmental Quality Objectives in the Netherlands: a review of environmental quality objectives and their policy framework in the Netherlands, 1994. Risk Assessment and Environmental Quality Division, Directorate for Chemicals, External Safety and Radiation Protection, Ministry of Housing, Spatial Planning and the Environment.
- (12) Port Pirie Climate Data, 1994. Bureau of Meteorology, National Climate Centre, Melbourne.
- (13) Compilation of Air Emission Factors, USEPA AP-42. United States Environment Protection Agency, 1996.
- (14) Groundwater Hydrology, 2nd Edition, 1980. Todd, D. K., John Wiley & Sons, Inc., New York, USA.
- (15) Physical and Chemical Hydrogeology, 1990. Domenico, P. A. and Schwartz, F. W., John Wiley & Sons, Inc., New York, USA.
- (16) Applied Hydrogeology, 2nd Edition, 1988. Fetter, C. W., Merrill Publishing Co., Columbus, Ohio, USA.
- (17) Development of fraction specific reference doses (RfDs) and Reference concentrations (RfCs) for Total Petroleum Hydrocarbons, Volume IV, 1997. TPH Criteria Working Group Toxicology Technical Action Group.

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

Site Name: Port Pirie HRA
Site Location: Source Zone 1

Job Identification: 78H151C
Date Completed: 02-01-98
Completed By: David Wenig

Software: GSI RBCA Spreadsheet
Version: 1.0.1

NOTE: values which differ from Tier 1 default values are shown in bold *italics* and underlined.

Exposure Parameter	Definition (Units)	Residential			Commercial/Industrial	
		Adult	(1-6yrs)	(1-16 yrs)	Chronic	Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)	<u>70</u>	6	16	<u>30</u>	1
BW	Body Weight (kg)	70	15	35	70	
ED	Exposure Duration (yr)	30	6	16	<u>30</u>	1
t	Averaging time for vapor flux (yr)	30			<u>30</u>	1
EF	Exposure Frequency (days/yr)	350			<u>80</u>	180
EF Derm	Exposure Frequency for dermal exposure	350			<u>80</u>	
IRgw	Ingestion Rate of Water (L/day)	2			1	
IRs	Ingestion Rate of Soil (mg/day)	100	200		50	100
IRadj	Adjusted soil ing. rate (mg-yr/kg-d)	1.1E+02			9.7E+01	
IRa in	Inhalation rate indoor (m³3/day)	15			20	
IRa out	Inhalation rate outdoor (m³3/day)	20			20	10
SA	Skin surface area (dermal) (cm²2)	5.8E+03		2.0E+03	5.8E+03	5.8E+03
SAadj	Adjusted dermal area (cm²2-yr/kg)	2.1E+03			2.1E+03	
M	Soil to Skin adherence factor	1				
AAFs	Age adjustment on soil ingestion	FALSE			FALSE	
AAFd	Age adjustment on skin surface area	FALSE			FALSE	
tox	Use EPA tox data for air (or PEL based)?	TRUE				
gwMCL?	Use MCL as exposure limit in groundwater?	TRUE				

Matrix of Exposed Persons to Complete Exposure Pathways		Residential	Commercial/Industrial	
			Chronic	Constructn
Outdoor Air Pathways:				
SS.v	Volatiles and Particulates from Surface Soils	TRUE	TRUE	FALSE
S.v	Volatilization from Subsurface Soils	FALSE	FALSE	
GW.v	Volatilization from Groundwater	FALSE	FALSE	
Indoor Air Pathways:				
S.b	Vapors from Subsurface Soils	FALSE	FALSE	
GW.b	Vapors from Groundwater	FALSE	FALSE	
Soil Pathways:				
SS.d	Direct Ingestion and Dermal Contact	FALSE	TRUE	FALSE
Groundwater Pathways:				
GW.i	Groundwater Ingestion	FALSE	TRUE	
S.I	Leaching to Groundwater from all Soils	FALSE	TRUE	

Matrix of Receptor Distance and Location On- or Off-Site		Residential		Commercial/Industrial	
		Distance	On-Site	Distance	On-Site
GW	Groundwater receptor (cm)	1.0E+04	FALSE	1.0E+04	FALSE
S	Inhalation receptor (cm)	2.8E+03	FALSE		TRUE

Matrix of Target Risks		Individual		Cumulative	
		Individual	Cumulative	Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	1.0E-06			
TRc	Target Risk (class C carcinogens)	1.0E-05			
THQ	Target Hazard Quotient	1.0E+00			
Opt	Calculation Option (1, 2, or 3)	2			
Tier	RBCA Tier	2			

Surface Parameters	Definition (Units)	Residential	Constrctn
A	Contaminated soil area (cm²2)	<u>1.2E+09</u>	1.0E+06
W	Length of affect. soil parallel to wind (cm)	<u>1.1E+05</u>	1.0E+03
W.gw	Length of affect. soil parallel to groundwater (cm)	<u>1.1E+05</u>	
Uair	Ambient air velocity in mixing zone (cm/s)	<u>1.4E+03</u>	
delta	Air mixing zone height (cm)	<u>4.0E+02</u>	
Lss	Thickness of affected surface soils (cm)	<u>5.0E+01</u>	
Pe	Particulate areal emission rate (g/cm²2/s)	<u>5.7E-10</u>	

Groundwater Parameters	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater infiltration rate (cm/yr)	<u>3.5E+01</u>
Ugw	Groundwater Darcy velocity (cm/yr)	<u>3.9E+01</u>
Ugw.tr	Groundwater seepage velocity (cm/yr)	<u>1.0E+02</u>
Ks	Saturated hydraulic conductivity (cm/s)	1.0E-03
grad	Groundwater gradient (cm/cm)	1.3E-03
Sw	Width of groundwater source zone (cm)	1.5E+03
Sd	Depth of groundwater source zone (cm)	2.0E+02
phi.eff	Effective porosity in water-bearing unit	3.8E-01
foc.sat	Fraction organic carbon in water-bearing unit	1.0E-03
BIO?	Is bioattenuation considered?	FALSE
BC	Biodegradation Capacity (mg/L)	
Soil Parameters	Definition (Units)	Value
hc	Capillary zone thickness (cm)	<u>1.0E+02</u>
hv	Vadose zone thickness (cm)	<u>1.6E+02</u>
rho	Soil density (g/cm³3)	1.7
foc	Fraction of organic carbon in vadose zone	0.01
phi	Soil porosity in vadose zone	0.38
Lgw	Depth to groundwater (cm)	<u>2.6E+02</u>
Ls	Depth to top of affected subsurface soil (cm)	<u>5.0E+01</u>
Lsubs	Thickness of affected subsurface soils (cm)	<u>2.1E+02</u>
pH	Soil/groundwater pH	<u>8.22</u>
		<u>capillary</u> <u>vadose</u> <u>foundation</u>
phi.w	Volumetric water content	0.342
phi.a	Volumetric air content	0.038

Building Parameters	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	2.0E+02	3.0E+02
ER	Building air exchange rate (s⁻¹1)	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	0.01	

Transport Parameters	Definition (Units)	Residential	Commercial
Groundwater			
ax	Longitudinal dispersivity (cm)		1.0E+03
ay	Transverse dispersivity (cm)		3.3E+02
az	Vertical dispersivity (cm)		5.0E+01
Vapor			
dcy	Transverse dispersion coefficient (cm)	3.2E+02	
dcz	Vertical dispersion coefficient (cm)	2.1E+02	

Use of
RBCA
not
suggested

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.1

Site Name: Port Pirie HRA

Completed By: David Wenig

Site Location: Source Zone 1

Date Completed: 1/2/1998

1 OF 1

SURFACE SOIL SSTL VALUES (< 1.6 FT BGS)

Target Risk (Class A & B) 1.0E-6

☒ MCL exposure limit?

Calculation Option: 2

Target Risk (Class C) 1.0E-5

☐ PEL exposure limit?

Groundwater DAF Option: Domenico - No Decay

Target Hazard Quotient 1.0E+0

(One-directional vert. dispersion)

SSTL Results For Complete Exposure Pathways ("X" If Complete)

CONSTITUENTS OF CONCERN			Representative Concentration	SSTL Results For Complete Exposure Pathways ("X" If Complete)								SSTL Exceeded?	Required CRF
CAS No.	Name	(mg/kg)		X	Soil Leaching to Groundwater			X	Ingestion, Inhalation and Dermal Contact		Construction Worker	Applicable SSTL	
					Residential: (on-site)	Commercial: 328 feet	Regulatory(MCL): 328 feet		Residential: 92 feet	Commercial: (on-site)	Commercial: (on-site)	(mg/kg)	"■" If yes
7439-92-1	Lead	1.3E+4			NA	1.7E+1	1.4E-1		>Res	>Res	NA	1.4E-1	■

>Res indicates risk-based target concentration greater than constituent residual saturation value

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.2

Site Name: Port Pirie HRA

Completed By: David Wenig

Site Location: Source Zone 1

Date Completed: 1/2/1998

1 OF 1

SUBSURFACE SOIL SSTL VALUES (> 1.6 FT BGS)

Target Risk (Class A & B) 1.0E-6

☒ MCL exposure limit?

Calculation Option: 2

Target Risk (Class C) 1.0E-5

☐ PEL exposure limit?

Groundwater DAF Option: Domenico - No Decay
(One-directional vert. dispersion)

Target Hazard Quotient 1.0E+0

SSTL Results For Complete Exposure Pathways ("x" If Complete)

CONSTITUENTS OF CONCERN		Representative Concentration	X	Soil Leaching to Groundwater			Soil Volatilization to Indoor Air		Soil Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
				Residential: (on-site)	Commercial: 328 feet	Regulatory(MCL): 328 feet	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)	(mg/kg)	"■" If yes	Only if "yes" left
CAS No.	Name	(mg/kg)											
7439-92-1	Lead	2.3E+3		NA	1.7E+1	1.4E-1	NA	NA	NA	NA	1.4E-1	■	1.6E+04

>Res indicates risk-based target concentration greater than constituent residual saturation value

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Software: GSI RBCA Spreadsheet
Version: 1.0.1

Serial: G-391-XFX-490

RBCA SITE ASSESSMENT

Tier 2 Worksheet 9.3

Site Name: Port Pine HRA

Completed By: David Wenig

Site Location: Source Zone 1

Date Completed: 1/2/1998

1 OF 1

GROUNDWATER SSTL VALUES

Target Risk (Class A & B) 1.0E-6

☒ MCL exposure limit?

Calculation Option: 2

Target Risk (Class C) 1.0E-5

☐ PEL exposure limit?

Groundwater DAF Option: Domenico - No Decay

Target Hazard Quotient 1.0E+0

(One-directional vert. dispersion)

SSTL Results For Complete Exposure Pathways ("X" If Complete)

CONSTITUENTS OF CONCERN		Representative Concentration	X	Groundwater Ingestion			Groundwater Volatilization to Indoor Air		Groundwater Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded?	Required CRF
CAS No.	Name	(mg/L)		Residential (on-site)	Commercial: 328 feet	Regulatory(MCL): 328 feet	Residential: (on-site)	Commercial: (on-site)	Residential (on-site)	Commercial: (on-site)	(mg/L)	"X" If yes	Only if "yes" left
7439-92-1	Lead	9.0E-2		NA	1.6E+1	1.4E-1	NA	NA	NA	NA	1.4E-1	☐	<1

> Sol indicates risk-based target concentration greater than constituent solubility

RBCA SITE ASSESSMENT
Tier 2 Worksheet 8.3

Site Name: Port Pirie HRA
Site Location: Source Zone 1

Completed By: David Wenig
Date Completed: 1/2/1998

1 of 1

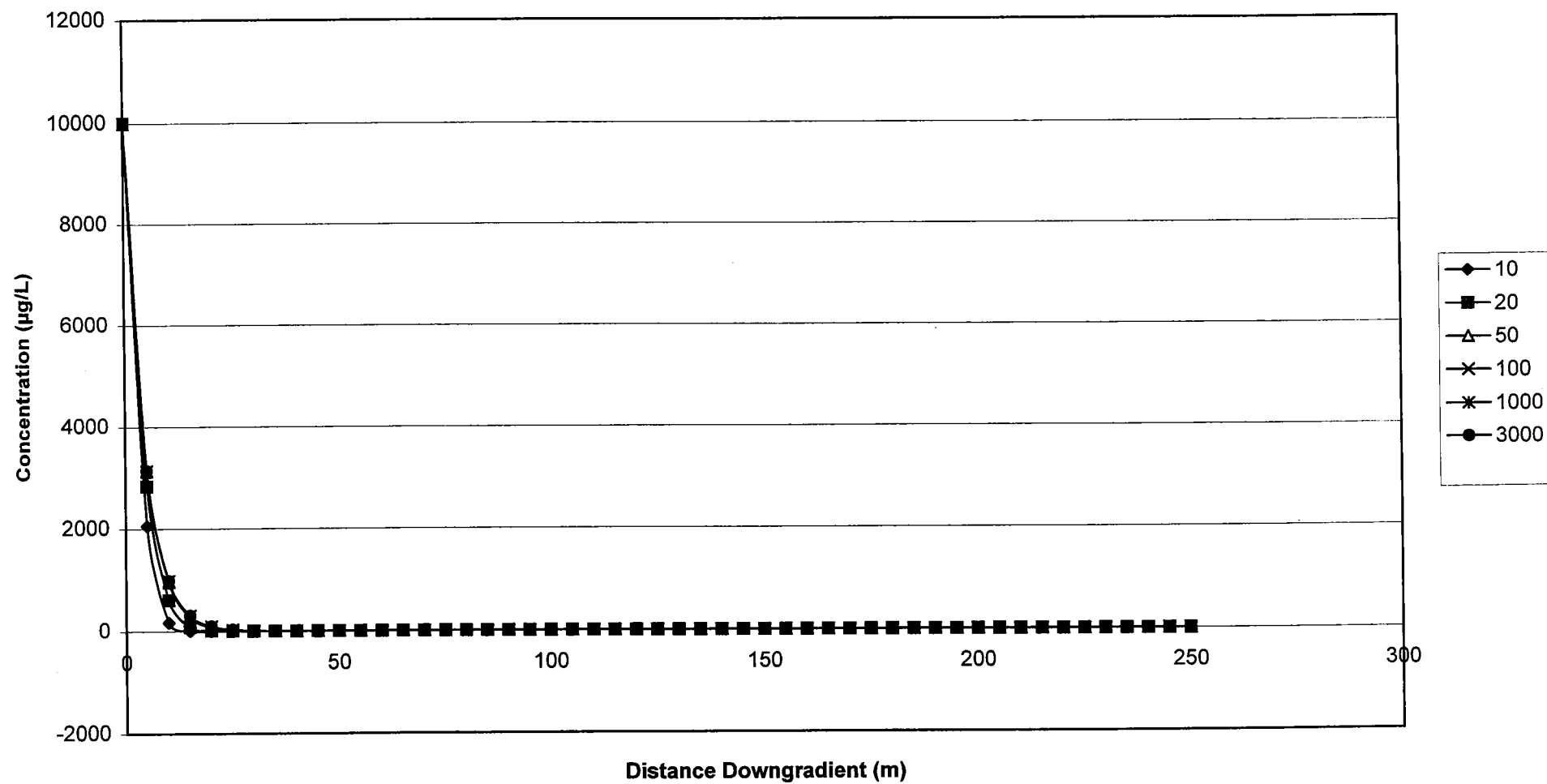
TIER 2 BASELINE RISK SUMMARY TABLE

EXPOSURE PATHWAY	BASELINE CARCINOGENIC RISK					BASELINE TOXIC EFFECTS				
	Individual COC Risk		Cumulative COC Risk		Risk Limit(s) Exceeded?	Hazard Quotient		Hazard Index		Toxicity Limit(s) Exceeded?
	Maximum Value	Target Risk	Total Value	Target Risk		Maximum Value	Applicable Limit	Total Value	Applicable Limit	
OUTDOOR AIR EXPOSURE PATHWAYS										
Complete:	NC	1.0E-5	NC	N/A	■	9.0E-2	1.0E+0	9.0E-2	N/A	□
INDOOR AIR EXPOSURE PATHWAYS										
Complete:	NC	1.0E-5	NC	N/A	■	NC	1.0E+0	NC	N/A	■
SOIL EXPOSURE PATHWAYS										
Complete:	NC	1.0E-5	NC	N/A	■	1.1E+0	1.0E+0	1.1E+0	N/A	■
GROUNDWATER EXPOSURE PATHWAYS										
Complete:	NC	1.0E-5	NC	N/A	■	7.8E+2	1.0E+0	7.8E+2	N/A	■
CRITICAL EXPOSURE PATHWAY (Select Maximum Values From Complete Pathways)										
	0.0E+0	1.0E-5	0.0E+0	N/A	□	7.8E+2	1.0E+0	7.8E+2	N/A	■

Appendix P

Groundwater Modelling Results

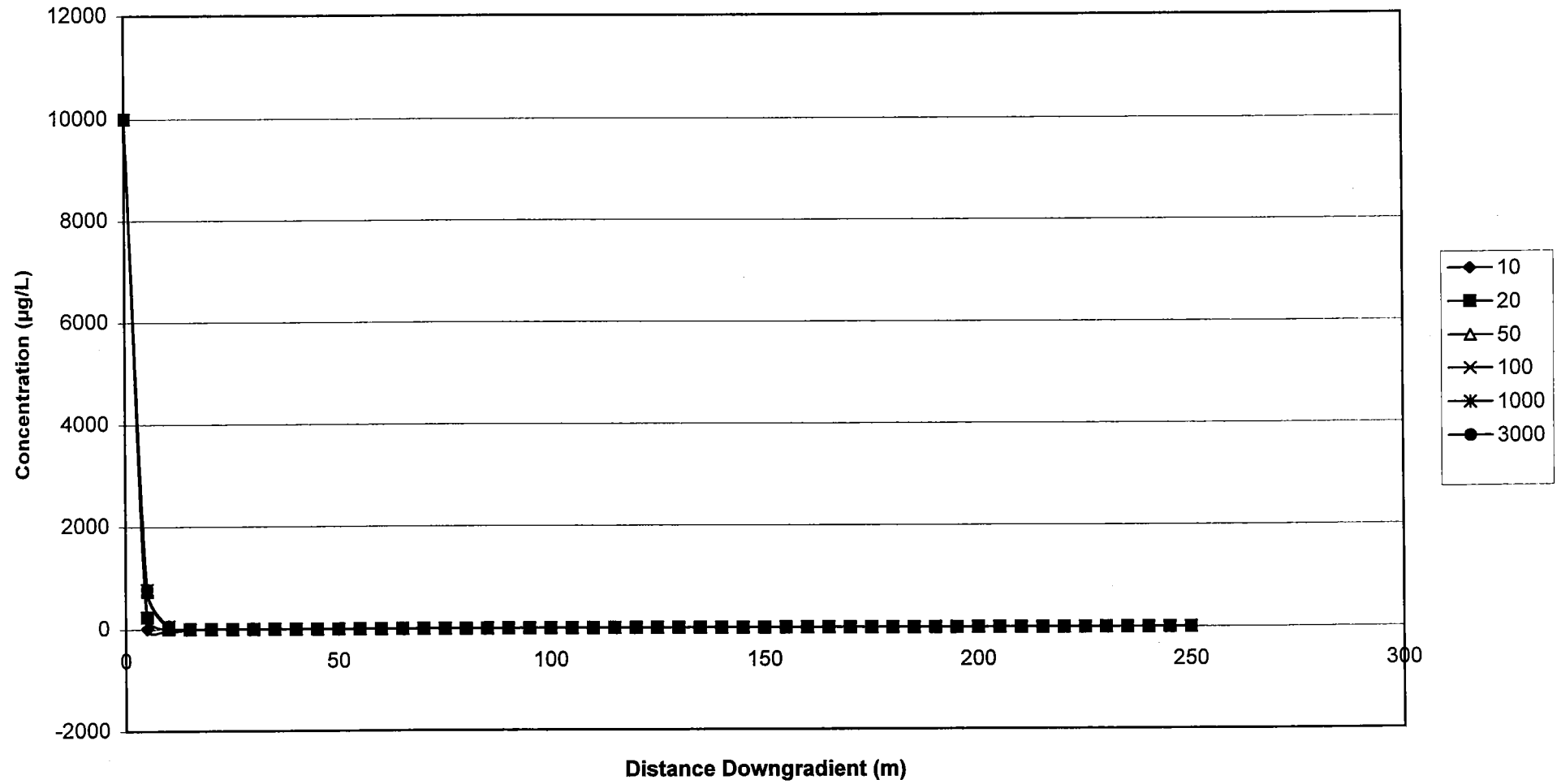
Results of 1-D Fate and Transport Modelling
(Assumed Dispersivity = 10 metres)



Assumed Dispersivity = 10 metres

	10	20	50	100	1000	3000
0	10000	10000	10000	10000	10000	10000
5	2051.63	2827.17	3121.68	3135.36	3135.53	3135.53
10	173.39	609.8	958.09	982.8	983.15	983.15
15	4.6	84.7	281.15	307.78	308.27	308.27
20	0.03	6.79	75.67	96.11	96.66	96.66
25	0	0.3	17.84	29.81	30.31	30.31
30	0	0.01	3.54	9.11	9.5	9.5
35	0	0	0.57	2.71	2.98	2.98
40	0	0	0.07	0.78	0.93	0.93
45	0	0	0.01	0.21	0.29	0.29
50	0	0	0	0.05	0.09	0.09
55	0	0	0	0.01	0.03	0.03
60	0	0	0	0	0.01	0.01
65	0	0	0	0	0	0
70	0	0	0	0	0	0
75	0	0	0	0	0	0
80	0	0	0	0	0	0
85	0	0	0	0	0	0
90	0	0	0	0	0	0
95	0	0	0	0	0	0
100	0	0	0	0	0	0
105	0	0	0	0	0	0
110	0	0	0	0	0	0
115	0	0	0	0	0	0
120	0	0	0	0	0	0
125	0	0	0	0	0	0
130	0	0	0	0	0	0
135	0	0	0	0	0	0
140	0	0	0	0	0	0
145	0	0	0	0	0	0
150	0	0	0	0	0	0
155	0	0	0	0	0	0
160	0	0	0	0	0	0
165	0	0	0	0	0	0
170	0	0	0	0	0	0
175	0	0	0	0	0	0
180	0	0	0	0	0	0
185	0	0	0	0	0	0
190	0	0	0	0	0	0
195	0	0	0	0	0	0
200	0	0	0	0	0	0
205	0	0	0	0	0	0
210	0	0	0	0	0	0
215	0	0	0	0	0	0
220	0	0	0	0	0	0
225	0	0	0	0	0	0
230	0	0	0	0	0	0
235	0	0	0	0	0	0
240	0	0	0	0	0	0
245	0	0	0	0	0	0
250	0	0	0	0	0	0

Results of 1-D Fate and Transport Modelling
(Assumed Dispersivity = 1 metre)



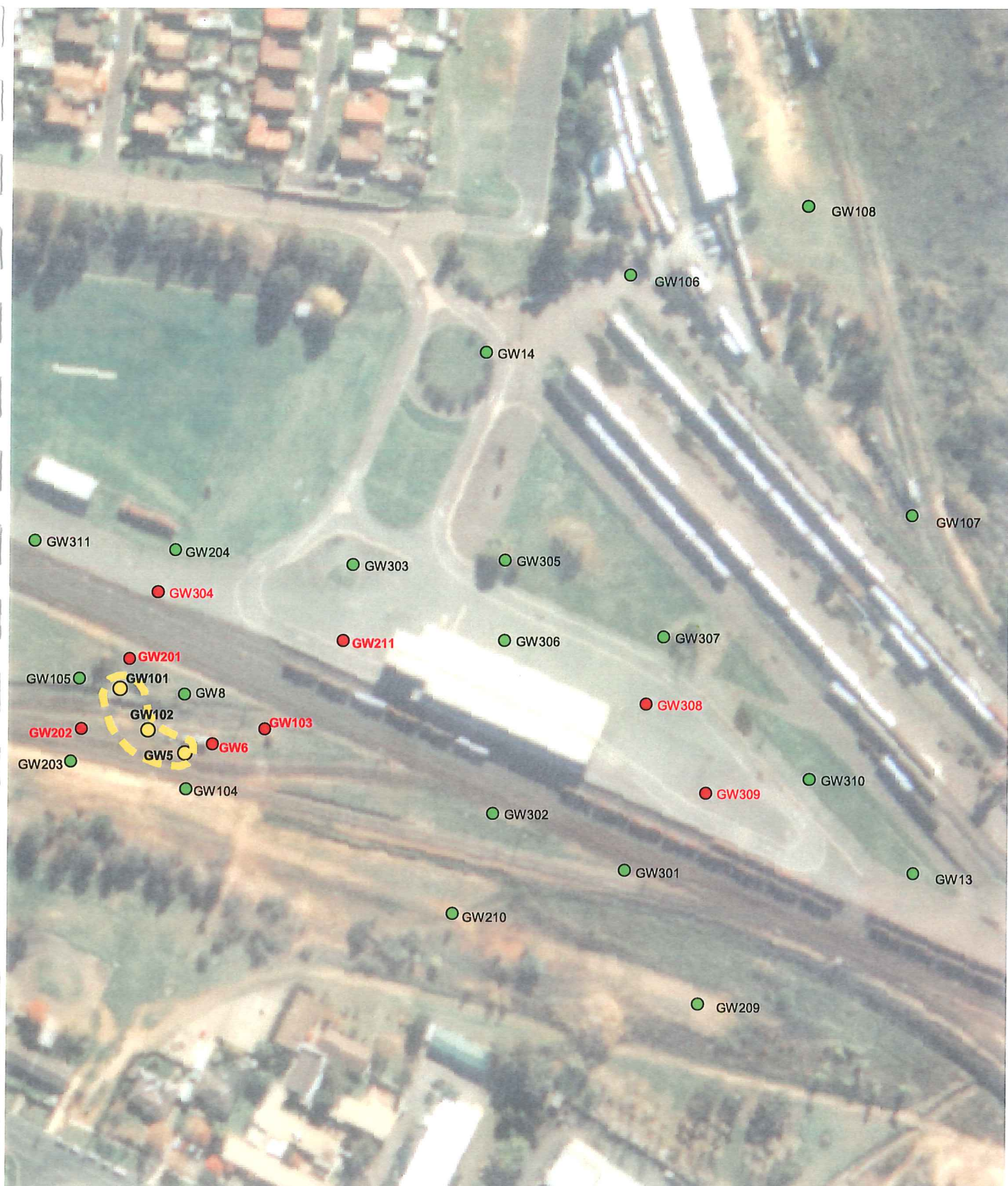
Assumed Dispersivity = 1 metre

	10	20	50	100	1000	3000
0	10000	10000	10000	10000	10000	10000
5	10.47	234.99	738.66	780.71	781.01	781.01
10	0	0.04	26.79	59.91	61	61
15	0	0	0.15	3.86	4.76	4.76
20	0	0	0	0.14	0.37	0.37
25	0	0	0	0	0.03	0.03
30	0	0	0	0	0	0
35	0	0	0	0	0	0
40	0	0	0	0	0	0
45	0	0	0	0	0	0
50	0	0	0	0	0	0
55	0	0	0	0	0	0
60	0	0	0	0	0	0
65	0	0	0	0	0	0
70	0	0	0	0	0	0
75	0	0	0	0	0	0
80	0	0	0	0	0	0
85	0	0	0	0	0	0
90	0	0	0	0	0	0
95	0	0	0	0	0	0
100	0	0	0	0	0	0
105	0	0	0	0	0	0
110	0	0	0	0	0	0
115	0	0	0	0	0	0
120	0	0	0	0	0	0
125	0	0	0	0	0	0
130	0	0	0	0	0	0
135	0	0	0	0	0	0
140	0	0	0	0	0	0
145	0	0	0	0	0	0
150	0	0	0	0	0	0
155	0	0	0	0	0	0
160	0	0	0	0	0	0
165	0	0	0	0	0	0
170	0	0	0	0	0	0
175	0	0	0	0	0	0
180	0	0	0	0	0	0
185	0	0	0	0	0	0
190	0	0	0	0	0	0
195	0	0	0	0	0	0
200	0	0	0	0	0	0
205	0	0	0	0	0	0
210	0	0	0	0	0	0
215	0	0	0	0	0	0
220	0	0	0	0	0	0
225	0	0	0	0	0	0
230	0	0	0	0	0	0
235	0	0	0	0	0	0
240	0	0	0	0	0	0
245	0	0	0	0	0	0
250	0	0	0	0	0	0

Appendix Q

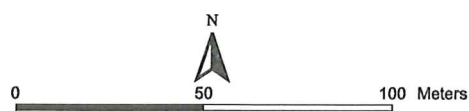
Graphical Representation of
Observed Hydrocarbon Impacts





LEGEND

- Observed Impacts
 - Dissolved Hydrocarbon
 - Free Phase Product
 - No Observed Hydrocarbon
- Inferred extent of Phase Separated Hydrocarbon Plume



Canberra Railway & Former Locomotive Refuelling Area - Representation of Observed Hydrocarbon Impacts

Figure 12



• GW37

• GW1

• GW38

GW2

GW4

• GW34

GW35

• GW36

• GW33

• GW28

LEGEND
• Observed Hydrocarbon Impacts
• No Observed Hydrocarbon Impacts

N
0 50 100 Meters

Canberra Railway Corridor -
Shell Depot Area,
Graphical Representation of
Observed Hydrocarbon Impacts
Figure 13



Canberra Railway Corridor -
Mobil, Caltex, BP Depot Area,
Graphical Representation of
Observed Hydrocarbon Impacts

Figure 14

Phase II Environmental Site Assessment

Canberra Railway Station and Rail Corridor

Indec Consulting

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12 November 1998

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Dear **Colin**

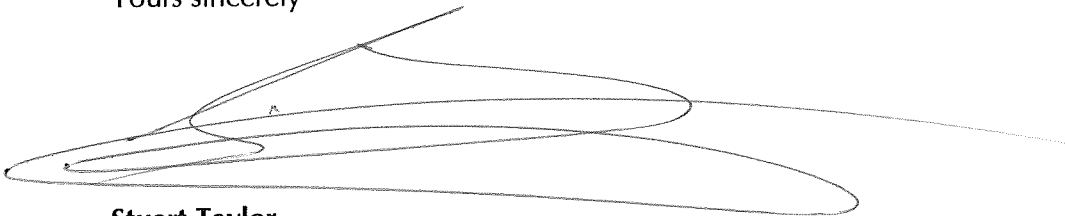
Report on Phase II Environmental Site Assessment Works: Australian National Canberra Railyards, Canberra

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

The results and findings of the Phase II Assessment program, have identified requirements for further assessment works to delineate the impacted areas identified within the report and to allow for the consideration of site specific risk assessment and remediation (if required).

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 or Mr Craig Smith 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 a Phase II environmental assessment of the Canberra railway station yards and rail corridor, located in the south east of Canberra in the suburbs of Kingston and Fyshwick.

The objectives of the Phase II assessment program were to investigate and report on potential soil and groundwater contamination resulting from current and former site activities and operations. The scope of works undertaken to achieve these objectives were based upon the findings of a Phase I Environmental Audit of the site, undertaken by PPK and reported in March 1998 (PPK, Document Number 98-182).

The purpose of this report is to present the results and findings of the investigation program, together with an assessment of the relative significance of the issues identified and to derive recommendations for further site characterisation and/or site remediation based on the continued industrial (rail) use of the site.

The Phase II assessment program comprised soil sampling by push tube and rotary air drilling at nineteen (19) locations, and by excavator test pit construction at eighteen (18) locations across the site. Sampling of both soil and groundwater was performed by the drilling, construction and sampling of twenty-nine (29) permanent groundwater monitoring wells, and sampling of groundwater only was performed at three (3) previously existing groundwater monitoring wells (installed by others). All of the above locations were sited to target the areas of contamination identified in the Phase I Audit report and subsequent Phase II site inspection.

The results and findings of the Phase II investigation program undertaken during June - July 1998 has identified 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 areas of impacted soils and groundwaters, considered to be the result of either current or former on site sources of contamination, were identified within the main station complex, former municipal waste dump, and adjacent to the former cement works, adjacent to Newcastle Street.

Main Station Area

The predominant soil and groundwater impacts identified within the main station area, are associated with the former locomotive refuelling area, located to the south west of the former goods shed. Observed impacts include the presence of vapour phase contamination within subsurface soils and the presence of dissolved phase petroleum hydrocarbons, 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 is considered to represent the potential for significant environmental impacts for the site. This is 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. Waste and fill materials identified during the investigation program included ash, cinders, slag, asbestos containing materials, coal, metal objects and an abandoned heating oil tank. 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 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. No sampling of the groundwater was undertaken within the main fill area.

Eastern Rail Corridor (adjacent former Cement Works)

High concentrations of heavy metals, particularly lead and zinc were reported within the upper soil profile, 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. The lateral extent of any subsurface ash and cinders surrounding sampling point was not determined during the initial investigation works.

Analysis of the 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 concentration of dissolved phase metals were 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.

Off Site Sources of Suspected Contamination

Localised areas of impacted soils and groundwaters, 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.

Olfactory evidence of petroleum hydrocarbon impacts within the subsurface soil profiles were reported in four of the six soil and groundwater sampling locations targeted adjacent to the northern boundary of the Shell depot, located adjacent to the Monaro Highway. Absorbed phase TPH concentrations within the soil profile and dissolved phase TPH, BTEX and PAH components within the groundwater were identified in two of the sampling bores located to the immediate north - north east of the depot. No hydrocarbon impacts were reported in the adjacent monitoring wells located to the immediate east of the fuel depot, potentially indicating that the observed impacts may be resulting from the north western portion of the Shell Depot. 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.

Olfactory evidence of petroleum hydrocarbon impacts within the subsurface soil profiles 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 at depths between 2m and 3m. 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. No obvious dissolved phase or absorbed phase impacts were identified adjacent to the southern boundary of the BP Depot. 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.

In accordance with the proposed continued industrial (rail) use of the site, the results and findings of the Phase II investigation have identified requirements for further assessment works to delineate the specified impacted areas and to allow for the consideration of site specific risk assessment and remediation (if required). The proposed scope of works for subsequent investigations incorporates;

- additional well construction and sampling around the Shell, Mobil and Caltex/Ampol fuel depots. It is recommended that INDEC advises these companies of the results and findings of the Phase II program and that these companies are asked to either assess the situation and the impacts to the AN site on their own or to contribute to the continuation of the assessment works relevant to their properties;
- additional well construction and sampling around the former refuelling tank;
- additional well construction, test pitting and sampling within the municipal waste fill area and adjacent to the Jerabomberra creek and wetlands. Consideration needs to be given by INDEC (AN) as to which party is responsible for the waste fill area and who will retain the liability for any future impacts. Consideration also needs to be given to the possible requirements for future site remediation;
- additional well construction and sampling needs to be undertaken across the site in general to determine background concentrations of heavy metals, particularly lead and mercury;
- additional soil sampling needs to be undertaken to delineate the extent of impacted fill materials adjacent to the former cement site;

In accordance with standard PPK protocols, detailed work scopes and cost estimates for the nominated additional investigations 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 (INDEC) to investigate and report on potential soil and groundwater contamination at the Canberra Railway Station and rail corridor, located in the south east of Canberra, in the suburbs of Kingston and Fyshwick.

The potential for soil and/or groundwater contamination arising from current and historical site operations was identified in a Phase I Environmental Audit, undertaken by PPK and reported in March 1998 (PPK, Document Number 98-182). PPK was subsequently engaged to undertake a Phase II Environmental Site Assessment (ESA) in accordance with the proposed scope of works documented in the PPK submission of 25 May 1998 (PPK, Reference Number 27KP/TaylorSP).

The principal objectives of the Phase II Environmental Site Assessment (ESA) Program were to;

- determine the nature and extent of soil and groundwater impacts present on site as a result of the current and historical usage of the 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 assessment included the following activities:

- review of existing site information contained in the Phase I Environmental Audit report;
- site walk-over survey, to confirm the reported conditions and identify any additional items for investigation;
- design and implementation of a targeted soil sampling and analysis program;
- design and implementation of targeted groundwater sampling and analysis program; and
- assessment of investigation findings and preparation of Phase II ESA report.

The scope of works for the Phase II ESA included the main train station area, the adjacent leased railway land and the rail corridor north west of the Newcastle Street Bridge. No investigations south east of the Newcastle Street Bridge or in the former abattoir site adjacent to the rail corridor in Queanbeyan were undertaken during this consultancy study.

This report presents the findings of the ESA 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:

- (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 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.

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Our Reference 27K140B/SPT

2 February 1999

Daniel Walters
Environment ACT
Level 2 South Wing, Macarther House
12 Wattle Street
LYNEHAM, ACT 2602

Dear Daniel

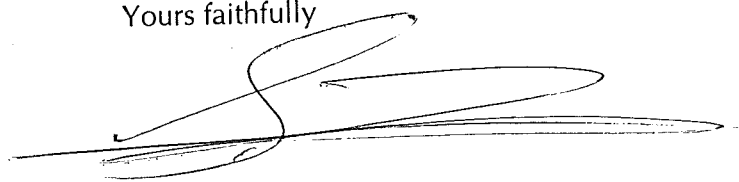
Review of Environmental Site Assessment Reports - Australian National Railyards, Canberra, ACT

Further to our most recent telephone conversation, please find enclosed copies of the relevant site assessment reports compiled by PPK.

I have asked INDEC Consulting (AN Project Managers) to provide a letter of introduction for yourself which details the relevant issues of the proposed site transfer and their expectations of Environment ACT. It is anticipated that this letter will be forwarded to yourself by the end of this week, with the intention for a preliminary meeting between INDEC, PPK and Environment ACT to occur next Friday (12 February 1999).

If you have any questions or require any clarification on the reports or ESA programs please do not hesitate to call me on the above number or 0414 245 353. Should you require further clarification on the transfer process or roles of state and federal parties, please contact Peter Knappe of INDEC Consulting on 08 8215 040.

Yours faithfully



Stuart Taylor

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

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 disused locomotive refuelling facility;
- contamination from fill materials consisting of ash and cinders in western part of the site;
- 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 Party Responsible for the Assessment

INDEC Consulting
300 Flinders Street
ADELAIDE SA 5000.

2.4 Environmental Consultant

PPK Environment & Infrastructure Pty Ltd
101 Pirie Street
Adelaide SA 5000.

2.5 Proposed Land Use

It is understood that the current use of the site, ie. use as an operational railway station and rail corridor will continue for the immediate future and as such the site will be assessed in terms of an industrial/commercial exposure setting.

2.6 Operator of the Site

The site is wholly owned and operated by AN.

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 - Phase II Assessment Objectives

Based on historical information, in conjunction with the results and findings of the Phase I Audit and subsequent Phase II site observations, it was considered that the following potential contaminants may be present as a result of current and former site operations and practices:

- heavy metals and polynuclear aromatic hydrocarbons (PAHs) from power station foundry operations and past on-site disposal of foundry wastes;
- petroleum hydrocarbons resulting from product losses and spillages associated with the former locomotive refuelling facility and fuel storage depots;
- petroleum hydrocarbons, heavy metals and monoaromatic hydrocarbons (MAHs) from potential leakage of waste oil and grease; and
- heavy metals, solvents and pesticides from the storage of paints and poisons.

The principal objectives of the Phase II ESA Program were to:

- determine the nature and extent of soil and groundwater impacts present on site as a result of the current and historical usage of the 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.

The potential for contamination of underlying groundwater was considered to be possible due to the anticipated shallow nature of the local groundwater.

The analytical suites for the soil samples collected during the site work were selected on the basis of the information concerning potential contamination. The analytical suite nominated for the groundwater assessment program was selected to incorporate general screen parameters and potential localised contaminants associated with specific site operations.

5. Phase II - Soil Assessment Program

5.1 Soil Sampling Rationale

The soil sampling program was based on the scope of works nominated within the project proposal document "Proposal to Conduct Phase 2 Environmental Works - Canberra Railway" (PPK reference 27KP/TaylorSP dated 25 May 1998).

In order to facilitate a methodical and targeted sampling program, PPK segregated the Canberra site into seven distinct sub areas based on current and former site activities and operations. 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 seven sub areas targeted for localised soil sampling comprised:

- **Sub Area A:** main train station, western rail yards area and main rail sidings and shunt lines.
- **Sub Area B:** former locomotive refuelling facility.
- **Sub Area C:** area leased by Robbo's Pet Barn (incorporating former goods shed).
- **Sub Area D:** sites leased by the ARHS and William Edmunds plumbers and gasfitters.
- **Sub Area E:** vacant dump site.
- **Sub Area F:** that section of the rail corridor crossing the Jerrabomberra Creek, up to the Ipswich Street bridge.
- **Sub Area G:** the rail corridor between Ipswich Street and Newcastle Street, including the major fuel sidings.

The general location of the seven sub areas are shown graphically on Drawing 01, Appendix B.

5.2 Soil Sampling Procedures

Soil samples were recovered from nineteen soil bores, twenty nine groundwater wells (all drilled using a truck mounted drilling rig to a maximum depth of 12.0 m) and from eighteen test pits (excavated with a 20 tonne excavator to a maximum depth of 5.1 m). Soil logging, 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.

Environmental borehole logs and test pit logs of all soil sampling locations are presented in Appendix D.

5.3 Sampling Depths and Analytes

Soil samples were generally recovered from all soil bores and groundwater wells at the following depth intervals:

- surface 0-150 mm;
- at least one other sample in the top 500 mm (eg 150-300 mm or 400-500 mm);
- approximately 1000 mm;
- at approximately 1m intervals to the maximum depth of the borehole.

Soil sampling intervals from the test pits was similar to that above for the test pits located in predominantly natural soils. For those test pits located in areas of deep fill (eg the vacant dump site) the sampling frequency in the fill was somewhat reduced.

Additional soil samples were recovered where visual and/or olfactory evidence of contamination was evident or where a change in soil lithology was encountered.

The proposed assessment program nominated the analysis of all soil samples for volatile organic compounds with a Photo-ionisation Detector (PID). The analysis uses a headspace technique in accordance with the 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. The objectives of field headspace screening is to provide additional quantitative information, which in conjunction with on-site subjective analysis of field soil conditions, can facilitate the selection of preliminary sampling requirements. Due to a technical malfunction with the PID during the Phase II site investigation works, PID analysis was only performed on the samples taken from the first four borehole locations. The selection of samples for initial laboratory analysis for samples collected from all other sampling locations, was based on the field observations of the investigators, combined with the historical evidence of likely contamination.

Selected soil 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 undertaken.

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

Heavy Metals

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 and the existence of widespread surficial fill materials.

pH

pH is a measure of the relative acidity and/or alkalinity of the soil. pH has a major effect upon the fate of particular heavy metals and other chemical constituents within the environment and the potential for leachate production.

Total Petroleum Hydrocarbons (TPH) and Monoaromatic Hydrocarbons (BTEX)

Based on the widespread storage and use of fuels and lubricating oil products on the majority of AN sites and the potential for subsequent significant environmental impacts, TPH and BTEX analyses were undertaken where evidence of hydrocarbon contamination is known or suspected.

Polynuclear Aromatic Hydrocarbons (PAHs)

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.

Organochlorine Pesticides (OCPs)

OCPs are reported to have been used as white ant and other pest control treatments on the majority of Australian National facilities. OCPs have the potential for posing significant human health and environmental risks due to their relative toxicity and long persistence times.

Semi Volatile Organic Compounds (SVOCs)

The 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 soil sample, 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 (VOCs)

The 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 soil sample, various organic compounds, particularly where current and/or former site usage is varied (ie. storage of various fuels and solvents) or unknown.

Cyanide

Cyanide solutions and salts are known to have been used and disposed of on-site in conjunction with heat treatment operations.

Chain Of Custody documents and analytical request documents are presented in Appendix D.

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.

Original certified laboratory results including QA/QC data reports are presented in Appendix F.

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.

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. A / 2

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:

• C6-C9 ? 10 mg/kg.

- 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.

5.6 Soil 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.

5.6.1 Sub Area A - Main Train Station, Western Rail Yards Area and Main Rail Sidings and Shunt Lines

Sub Area A incorporates the Canberra train station building, the western portion of the railyards and the main rail sidings and shunt lines. The Phase I Audit of the site identified the potential for substantial ash and cinders filling in the western part of the site from a former power station. Coal storage and disposal was also identified as a potential source of contamination in this part of the site.

Soil Sampling Points

A total of nine dedicated soil bores (BH40 to BH48 inclusive) were drilled to depths of between 0.4 m and 1 m and four test pits (TP114 to TP117 inclusive) were excavated to depths of 1.3 m to 1.8 m in this area. Soil samples were also collected from four groundwater monitoring wells (GW9 to GW12 inclusive) which were drilled to depths of between 4.5 m to 8.5 m. Soil cores recovered during drilling and from the soil exposures created by the test pits were examined to determine the nature and thickness of any fill materials. Soil samples were also taken to assess the nature of any surface or subsurface contamination.

The locations of the soil sampling points are shown approximately on Drawings 03 and 06, contained in Appendices C and G.

Analytical Program

Selected soil samples from all dedicated soil bores, and from the four test pit locations were analysed for PAHs, OCPs and a suite of metals, with selected samples also being analysed for TPHs. Three soil samples collected from TP116 were analysed for PAHs only. This location corresponded to approximately 0.65 metres of ash/cinder fill material. Surface soil samples collected from the four groundwater monitoring bores (designated BH9 through BH12 inclusive) were analysed for TPH, BTEX, a suite of metals, PAHs and OCPs, with one deeper sample (BH9 - 4.0 metres) being analysed for TPH, BTEX, a suite of metals and PAHs.

Analytical results for all soil samples indicated that no analyte concentrations were in excess of the proposed assessment criteria for continued industrial (rail) use.

Field Observations and Contamination Assessment

The soil profile encountered during the drilling of the nine soil bores, four groundwater wells and the excavation of the four test pits was generally characterised by a layer of fill material overlying various strata of natural clays, which in turn overlie weathered siltstone.

The fill material was not present within borehole locations BH41 and BH44 but was encountered at all other soil intrusion locations to depths varying from 0.05 m to 0.85 m. The fill generally consists of clayey soils containing some ballast, ash and coal, and occasionally cinders. The ash and coal was encountered both scattered throughout strata of clay fill and as apparently separate layers. The presence of ash and coal was most noticeable in those soil sampling locations closest to Cunningham Street.

With the exception of the ash, coal and occasionally cinders, no other visual contamination was observed, and no olfactory evidence of contamination was detected. The oil staining observed during the Phase I Audit within the rail lines adjacent to the passenger building was not investigated during the Phase II ESA. The former refuelling facility and adjacent stockpiles of coal are discussed in the "Sub Area B" section of this report.

The natural clays are somewhat variable and often mottled in colour, varying between brown, yellow, red and grey. Generally only minor quantities of sand was present, although some red to black gravel was encountered, described as "ironstone gravel" in the logs enclosed in Appendix D. The clays also became more gravelly immediately overlying the weathered siltstone, as often a transition from clay to gravelly clay to clayey siltstone was encountered.

Siltstone was encountered at shallow depths at some soil intrusion locations (0.25 m at TP117) but was not encountered at all at TP115 which was excavated to a depth of 1.8 m. The siltstone was generally grey in colour but varied in strength, causing refusal at several drilling and excavation locations, whereas at GW9 approximately 7 m penetration into the siltstone was achieved without refusal.

Laboratory analysis of all soil samples submitted, reported analyte concentrations below the proposed assessment criteria for continued industrial (rail) use. *other uses*

5.6.2 Sub Area B - Former Locomotive Refuelling Facility

Located in the main station rail yards, just south west of the former goods shed (currently Robbo's Pet Barn), Sub Area B was targeted during the assessment program due to the area being previously 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 odour in the area were noted during the Phase I Audit. Stockpiles of coal and surface littering of ash and coal were also observed during the previous Audit.

Soil Sampling Points

Soil sampling was performed a one dedicated soil borehole (BH7), one excavated test pit (TP118) and also during the installation of three groundwater wells (GW5, GW6 and GW8).

The test pit was located adjacent to the coal stockpiles, while the three groundwater wells and one soil bore were located adjacent to the former refuelling tank. The locations of the sampling points are shown approximately Drawings 03 and 06 contained in Appendices C and G.

Analytical Program

Selected soil samples from the dedicated soil borehole (3 samples) were analysed for TPH, BTEX, PAHs and a suite of metals, with the upper sub-surface sample (0.25 - 0.35 m) also being analysed for OCPs. Two (2) samples from the test pit were analysed for a suite of metals and PAHs. Eight soil samples of varying depth intervals were also

submitted from the soil bores completed as the groundwater monitoring bores (designated BH5, BH6 and BH8). These samples were all submitted and analysed for TPH, BTEX, PAHs and a suite of metals

Field Observations and Contamination Assessment

The soil profile encountered at all of the soil intrusion locations within Sub Area B is very similar to that encountered in Sub Area A. A thin layer of fill was encountered at all locations, overlying clay which in turn overlies siltstone or shale.

Fill depths varied from 0.05 m at GW5 to 0.7 m at GW7. The fill was predominantly clayey, although at TP118 the fill resembled more of an imported quarry gravel. Some ash, coal and cinders was encountered within the fill at GW7 and GW8, and some coal pieces were observed at the surface at TP118.

The natural clays and underlying siltstone or shale were similar to those encountered in Sub Area A, although some quartzitic gravel was encountered in BH7 and TP118, in addition to some occasional "ironstone" gravel.

Some olfactory evidence of hydrocarbon contamination was detected predominantly within the weathered siltstone at GW5 and GW6 at depths of around 3 m to 4 m. Some probable staining of the siltstone was also noted at GW5.

Laboratory analysis of all soil samples submitted, reported analyte concentrations below the proposed assessment criteria for continued industrial (rail) use.

5.6.3 Sub Area C - Area Leased by Robbo's Pet Barn (incorporating the former goods shed

This area includes the former goods shed (currently leased to Robbo's Pet Barn), surrounding bitumen paved areas and grassed islands. Significant distortions (up to approximately 400 mm) of some parts of the bitumen pavement have occurred, suggesting possible settlement of uncompacted deep filling under part of this Sub Area. Anecdotal evidence from some of the ARHS enthusiasts suggest that dumping of municipal waste occurred under a large part of this Sub Area, possibly including the area of the former goods shed.

Soil Sampling Points

Apart from the possibility of deep filling of unknown origin, no other potential environmental impacts on the soil or groundwater were identified during the Phase I Audit. As such, the sampling locations were chosen for general background information, and to determine the extent and nature of any filling in the area. Three test pits (TP111 to TP113) were excavated to investigate the depth and nature of any fill, and two groundwater wells (GW13 and GW14) were utilised to supplement this information.

The locations of these soil sampling points are shown approximately on Drawings 03 and 06 in Appendices C and G.

Analytical Program

Selected soil samples from the three test pit locations (1 per location) were analysed for a general suite of metals, with one sample being additionally analysed for PAHs. The sample chosen for PAH analysis coincided with the identification of a grey ash product at 0.9 metres depth. A total of four (4) soil samples were submitted for analysis from the two groundwater monitoring bores (designated BH13 and BH14). These samples, primarily from the surface or near surface soils were submitted and analysed for pH, metals, OCPs and OPPs, with soil samples collected from BH14, being analysed for PAHs, given some ash was identified in the near surface fill material.

Field Observations and Contamination Assessment

Deep filling was encountered at TP111 only. The fill encountered at this location consisted of building rubble including broken concrete, timber and fibre cement sheeting, as well as suspected municipal waste including pieces of clothing fabric and a car tyre. Some odour, probably related to the decomposition of organic material was detected. The depth of fill at this location could not be determined by excavator test pit due to the rapid inflow of groundwater at a depth of 2.7 m. This water obscured visibility below this depth, however fill materials were evident to a depth of 3.6 m. Excavation of the test pit was terminated due to the impracticality of logging and sampling the material below the water table, and the possible introduction of potential contaminants into the groundwater. *asbestos?*

Fill was also encountered at TP112 to a depth of 1.1 m, however this fill generally consisted of clay soil with some ash at a depth of 0.9 m. Filling at the other soil sampling locations was either shallow (<350 mm) or non-existent (as at GW13).

The natural soil encountered consisted of mottled clays, with occasional inclusions of quartzitic and ironstone gravel. The underlying geology was not encountered at any of the sampling locations, although some weathered siltstone fragments was encountered towards the base of GW14, possibly representing a transition to weathered siltstone rock.

No visual or olfactory evidence of contamination was detected within any of the natural soil strata.

Laboratory analysis of all soil samples submitted, returned analyte concentrations below the proposed assessment criteria for continued industrial (rail) use. ? A ?

5.6.4 Sub Area D - Sites Leased by the ARHS and William Edmunds Plumbers and Gasfitters

Sub Area D comprises the northern most and eastern most part of the site where railway associated activities are still conducted. The ARHS occupy the bulk of this Sub Area, using most of the available rail sidings for storage of old locomotives and rolling stock. William Edmunds occupies the former Brambles shed and compound.

The major potential for contamination in this Sub Area identified in the Phase I Audit report stems from the inappropriate storage of oil, paints and solvent, disposal of oily wastes to stormwater, storage and handling of coal stockpiles, and the probable presence of substantial filling under the entire area.

How are trains filled.

Soil Sampling Points

Soil sampling was performed from one dedicated soil borehole (BH15), and one groundwater well (GW16) was also used for the collection of soil samples.

BH15 was located adjacent to a stockpile of coal while GW16 is located adjacent to the outside wall of the large shed used by the ARHS for storage and maintenance of their locomotives.

The location of these soil sampling points are shown approximately on Drawings 03 and 06 in Appendices C and G.

Analytical Program

Selected soil samples from both locations were analysed for a suite of metals and pH. At BH15, all selected samples (4 in total) were additionally analysed for PAHs (Fill material identified which contained ash/cinders to 5.0 metres depth), and the surface sample for OCPs and OPPs.

Field Observations and Contamination Assessment

Deep fill (5 m) was encountered at BH15. The upper 700 mm consisted of gravelly clay soil with some coal fragments. This overlayed a thick layer of ash, clay, metal, timber fragments and some gravel, with faint odours being detected. The filling at GW16 comprised only the top 750 mm of the soil profile and consisted of clay and silt, with some gravel and coal.

The underlying natural soils resembled mottled clays, similar to those found in Sub Areas A, B and C. The faint odours detected within the fill at BH15 were also present within the underlying clay whereas no visual or olfactory evidence of contamination was detected within the natural soils at GW16.

At GW16 siltstone was encountered at a depth of 1.7 m, while at BH15 the underlying geology was not encountered to the maximum depth of investigation at this location (6.5 m).

Laboratory analysis of all soil samples submitted, reported analyte concentrations below the proposed assessment criteria for continued industrial (rail) use.

5.6.5 Sub Area E - Vacant Dump Site

Covering the northern and eastern area of the main rail yards site, this Sub Area is undeveloped and consists of broken ground vegetated with grass, shrubs and trees. Anecdotal evidence suggests that this area was used as a municipal landfill. During the

last year or so of its operation however, only building rubble and soil was allowed to be dumped. Aerial photographs of the site also suggest extensive filling in this area.

Along the eastern boundary of the site an embankment runs down to the flood plain of the Jerrabomberra Creek, adjacent to the silt trap. To the north of the site, the Jerrabomberra wetlands Conservation Park abuts the site.

Soil Sampling Points

In order to investigate the nature and depth of the fill materials, ten test pits (TP101 to TP110) were excavated in the area of the suspected dump site. Soil samples were also collected from one groundwater monitoring well (GW39) installed in this Sub Area.

The locations of the eleven soil sampling locations are shown approximately on Drawings 03 and 06 enclosed in Appendices C and G.

Analytical Program

A total of 23 soil samples from the 11 locations within the suspected dump area were analysed for a range of potential chemical contaminants. The soil samples submitted for analysis were chosen in order to fully characterise the type and nature of the fill materials within the suspected dump area, with the physical description of wastes being utilised to further target potential contaminants. Generally, 100% of the selected samples were analysed for metals, 50% for pH and SVOCs, 25% for PAHs, 10% for TPH/BTEX and 5% for OCPs.

Field Observations and Contamination Assessment

The materials encountered support the anecdotal evidence, with the uppermost part of the profile (600 mm to 1000 mm) generally consisting of gravelly and clayey fill. Building rubble including bricks, bitumen, broken concrete and timber were also encountered within the upper portion of the profile.

Underlying this layer, miscellaneous general household rubbish was encountered. Items including car parts (including car tyres), refrigerators, clothing, plastic and glass bottles, and newspapers were encountered. Some broken fragments of fibre cement sheeting and pipework suspected of containing asbestos were also encountered, although the presence of these products was not extensive. It appeared that much of the green waste (garden clippings, tree pruning, etc) had been partially burnt. Anecdotal evidence confirms that the landfill was "burnt off". In general a noticeable to strong odour was present within the layers of burnt material.

Some general rubbish, including old 205 litre drums, car tyres, scrap metal and building rubble was also observed on the surface of this Sub Area.

Natural soil was encountered at depths varying from 2.0 m (at TP108) to 4.1 m (at TP105) and approximately 6 m (at GW39). Maximum fill depths may well exceed the values encountered at the test pit locations, as the locations for test pit construction were generally selected in the flatter or lying areas of the dump, for ease of excavation. Due to the broken nature of the ground (with many small mounded areas), the

maximum depth of filling in these mounded areas may be 1 m to 2 m greater than those encountered in the test pits.

The underlying natural soil was encountered at all soil sampling locations within Sub Area E. The natural soil generally resembled a grey to grey green silty clay, with some orange mottling present at depth. Groundwater was observed flowing into some of the test pits within the natural soil, approximately 1 m below the top of the natural soil.

Table 5.1 provides a summary of laboratory results for soil samples which reported analyte concentrations in excess of the proposed assessment criteria for continued industrial (rail) use.

Table 5.1 Summary of Analyte Concentrations in Excess of Proposed Assessment Criteria (Sub Area E)

Borehole ID	Depth	Analyte	Concentration
TP102	2.6 m	benzo(a)pyrene	11 mg/kg

An elevated concentration of benzo(a)pyrene (BaP), was reported in a sub-surface soil sample collected from TP102 at 2.6 metres depth. The sample corresponded to a lens of burnt foliage, within the general fill matrix. Of the other samples selected for PAH, or SVOC analysis (11 samples), 10 returned BaP concentrations below the level of laboratory reporting, with one (TP110 - 0.15) returning a level of 0.7 mg/kg, all below the proposed assessment criteria for continued industrial (rail) use.

The samples collected and selected for analysis were chosen to represent the full range of materials contained within the fill matrix, and although burnt foliage was not specifically targeted for sampling, it was recorded that other areas did contain such materials. The only other sample which recorded a BaP level above the laboratory detection limit, coincided with a sample of fill containing fine ash.

Laboratory analysis of all other soil samples submitted, returned analyte concentrations below the proposed assessment criteria for continued industrial (rail) use.

5.6.6 Sub Area F - Rail Corridor Adjacent Jerrabomberra Creek, North West of the Ipswich Street Bridge

Sub Area F comprises the section of rail corridor immediately south east of the main rail yards area, and north east of the Ipswich Street bridge, including the Jerrabomberra Creek crossing.

The land to the south of the rail corridor is undeveloped and vegetated with trees, shrubs and long grass. To the north, a green buffer zone is present between the rail corridor and the adjacent commercial / light industrial development.

No potential environmental contamination issues were identified in this part of the site during the Phase I Audit.

Soil Sampling Points

Soil sampling was performed from two groundwater wells (GW37 and GW38), located on the south side of the rail corridor.

The locations of these groundwater wells are shown approximately on Drawing 07 enclosed in Appendix G.

Analytical Program

Selected near surface soil samples were collected and analysed from both groundwater monitoring well locations. These were analysed for a range of chemical contaminants, including PAHs, metals and OCPs.

Field Observations and Contamination Assessment

No fill was encountered at either of the two drilling locations. The natural soil encountered generally resembled brown to red silty clays, containing some ironstone gravel and some sand.

No visual or olfactory evidence of contamination was detected within the subsurface profile at either of the two locations.

Laboratory analysis of all soil samples submitted, reported analyte concentrations below the proposed assessment criteria for continued industrial (rail) use.

5.6.7 Sub Area G - Rail Corridor between Ipswich Street and Newcastle Street, including Major Fuel Sidings

Passing through the Fyshwick industrial area, Sub Area G comprises the rail corridor between the Ipswich and Newcastle Street bridges. This Sub Area of the rail corridor has many sidings leased to industrial ^{commercial} premises, some of which are still operational. Sidings to the Shell, BP and Caltex/Ampol fuel depots are still in use, while sidings to the Mobil fuel depot and other industrial premises along the rail corridor are present but appear not to have been utilised for some time. Some of the rail sidings have been completely dismantled.

Soil Sampling Points

Soil sampling was performed from eight dedicated soil boreholes (BH3, 18, 20, 23, 25, 27, 29 and 31) and sixteen groundwater wells were also utilised for the collection of soil samples (GW1, 2, 4, 17, 19, 21, 22, 24, 26, 28, 30, 32, 33, 34, 35, and 36). The locations of the soil sampling points were generally targeted toward the fuel depots due to the possible hydrocarbon impacts associated with these premises.

The locations of these sampling points are shown approximately on Drawings 04, 05, 07 and 08, enclosed in Appendices C and G.

Analytical Program

A total of fifty-three (53) soil samples from the twenty-four (24) dedicated soil bores, and soil/groundwater monitoring bores locations, within the rail corridor, were selected for laboratory analysis. These selected soil samples were analysed for a range of potential chemical contaminants which were identified during the Phase 1 Audit of the area. Generally, 100% (all but one dedicated TPH sample) of the selected samples were analysed for metals, 80% for PAHs, 50% for TPH/BTEX (with one dedicated TPH sample), 40% for OCPs (generally at the surface), 25% for pH and 2 samples (1 location) for OPPs.

Field Observations and Contamination Assessment

Fill materials were encountered at most soil sampling locations, but the depth of filling was generally relatively thin. The deepest fill was 0.95 m thick, at GW32. Fill across the Sub Area generally consisted of gravelly and clayey soil, containing some rail ballast and some coal fragments. Ash was only encountered at GW32, and some undetermined green staining was identified within the fill at BH18. Hydrocarbon odours were only detected within the fill at GW24.

The underlying natural soil generally consists of mottled clay soil, containing some ironstone gravel and ironstone staining. Siltstone was present underlying the clay at all sampling locations at depths ranging from approximately 1.7 m to 3.6 m. The sampling locations were all terminated in siltstone, which was found to extend to a depth of at least 12 m below ground level at GW1.

Hydrocarbon odours were detected within the natural profile outside the Shell depot at sampling locations GW2, BH3, GW4 and GW35. The hydrocarbon odour was generally strongest at a depth of approximately 3 m to 4.5 m. No visible staining of the natural soils was observed accompanying the hydrocarbon odours.

Olfactory evidence of hydrocarbon contamination was also detected outside the Caltex/Ampol depot at BH18, GW19 and BH20. No hydrocarbon odours were detected in the soil at GW21. The odours were typically strongest at depths of 2 m to 2.5 m, although no apparent staining of the soil was observed.

Outside the Mobil depot hydrocarbon odours were detected at BH23 and GW24. Similarly to the Caltex/Ampol depot, the depth of strongest odours was 2 m to 2.5 m, and no visible staining of the soil was observed.

Virtually no visual or olfactory evidence of contamination was detected within the natural soil outside the BP depot. Some possible faint odours were noted at a depth of around 3 m at GW28. No other evidence of contamination was detected.

On the opposite side of the rail corridor directly across from the Caltex/Ampol depot, some faint hydrocarbon odours were also detected at BH29 and GW30 around 3 m below ground level.

Table 5.2 provides a summary of laboratory results for soil samples which reported analyte concentrations in excess of the proposed assessment criteria for continued industrial (rail) use.

Table 5.2 Summary of Analyte Concentrations in Excess of Proposed Assessment Criteria (Sub Area G)

Borehole ID	Depth	Analyte	Concentration
BH2	6.0 m	TPH	7,270 mg/kg
BH3	8.0 m	TPH	6,622 mg/kg
BH32	0.15 m	lead (Pb)	4,733 mg/kg
BH32	0.15 m	zinc (Zn)	53,264 mg/kg
BH32	0.6 m	lead (Pb)	2,203 mg/kg

Elevated total petroleum hydrocarbon (TPH) concentrations were detected above the proposed assessment criteria for continued industrial (rail) use (**5,000 mg/kg**) in two of the samples collected and analysed. These were identified in boreholes BH2 and BH3 and depths of 6 - 8 metres. In borehole BH2, which was completed as a groundwater monitoring bore (GW2), the maximum concentration of TPH coincides with the groundwater table (approximate depth to groundwater 5.7 metres), and observed hydrocarbon odours whilst drilling. Elevated TPH concentrations (below the proposed assessment criteria) were also reported at 4 metres depth (consistent with the odour detected and the elevated PID readings).

Generally, the odours reported during drilling were consistent with elevated TPH concentrations, however, these elevated concentrations in all but two cases, did not exceed the proposed assessment criteria of 5,000 mg/kg.

Elevated levels of heavy metals, particularly lead and zinc were reported at two depth ranges at borehole BH32. The maximum concentration of lead (**4,733 mg/kg**) and of Zinc (**53,264 mg/kg**) were reported at the surface (0 - 0.15 metres) and coincided with a gravelly fill material which contained ballast, ash and cinders. This fill material was only identified at one location.

5.7 Data Validation Report - Soil

All analytical laboratory data and field duplicate data were assessed for validation purposes. The results of internal laboratory Quality Control (QC) procedures for soils are included within the analytical laboratory reports in Appendix F. These include the results of surrogate recoveries and duplicates carried out as part of the laboratory QC program.

The precision of the results for each analyte for the laboratory replicates was determined by calculating the Relative Percentage Difference (RPD) between replicates. This was calculated as follows:

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

The acceptance criteria for laboratory replicates is generally set at an RPD of 20%. This criteria is based on PPK quality assurance (QA) protocols, which were developed with regard to the US EPA regulations. A field duplicate RPD value of <30% is considered acceptable according to the AN protocols.

In order to obtain a measure of overall precision, a relative standard deviation (%RSD) was determined for each soil analyte for the inter-laboratory duplicate analyses conducted. This involved normalising each sample result and the corresponding replicate result and then calculating the standard deviation of the complete set of normalised values for the duplicate samples. This relative standard deviation is calculated as a percentage and is also included in Appendix F.

Based on the inter-laboratory blind duplicate analyses undertaken, the values for the laboratory replicate RPDs and RSDs were within acceptance criteria for the laboratory precision with the exception of two analytes (copper and zinc), where the RPD values were above the specified range. This would be primarily due to the heterogeneous distribution of the analytes within the soil profile, and the relatively minor quantities of analytes detected.

Based on the data quality review of the QA/QC analysis results, the data collected is considered suitable for use in the report and for the conclusions and recommendations made.

6. Groundwater Assessment Program

6.1 Groundwater Assessment Rationale

The groundwater assessment program was based on the scope of works nominated within the project proposal document *Proposal to Conduct Phase 2 Environmental Works - Canberra Railway* (PPK document 27KP/TaylorSP dated 25 May 1998).

The groundwater assessment program comprised of the drilling and construction of twenty-nine (29) permanent groundwater monitoring wells (GW), and the utilisation of three previously existing monitoring wells (PMW) installed by others outside the Mobil fuel depot. Well locations targeted the following areas in order to assess localised groundwater quality:

- areas where potential soil contamination has been identified;
- areas where burial of wastes is suspected;
- adjacent site boundaries of the suspected areas of soil contamination or waste burial.

Table 6.1 details the approximate location and rationale behind the construction of the twenty-nine monitoring wells.

Table 6.1 Groundwater Monitoring Well Locations

Monitoring Well	Location	Well Target/Rationale
GW1,2,4,34,35,36	Rail corridor, Fyshwick industrial area.	Outside Shell fuel depot.
GW5,6,8	Main railyards area.	Around former locomotive refuelling tank.
GW9,10,11,12	Main rail yards area.	General background data in operational part of the railyards area. Possible power station ash fill.
GW13,14	Main rail yards area, adjacent to Robbo's Pet Barn	General background data in rail yards area. Possible deep unidentified filling.
GW16	ARHS site, adjacent to main rail yards area.	Possible hydrocarbon contamination and deep unidentified filling in the ARHS.
GW17,19,21	Rail corridor, Fyshwick industrial area.	Outside Caltex/Ampol fuel depot.
GW22,24	Rail corridor, Fyshwick industrial area.	Outside Mobil fuel depot.
GW26,28	Rail corridor, Fyshwick industrial area.	Outside BP fuel depot.
GW30	Rail corridor, Fyshwick industrial area.	Southern side of rail corridor, opposite Caltex/Ampol fuel depot
GW32	Rail corridor, Fyshwick industrial area.	Outside former cement works.
GW33	Rail corridor, Fyshwick industrial area.	Northern side of rail corridor, opposite Shell fuel depot and north east of BP fuel depot.
GW37	Rail corridor, between Monaro Highway bridge and Jerrabomberra Creek.	General background data.
GW38	Rail corridor, between Ipswich Street and Monaro Highway bridges.	North west of Shell fuel depot.
GW39	Vacant dump site, adjacent to ARHS site.	Probable deep filling of undetermined origin.

The general location of the twenty nine GWs are graphically presented in Drawings 06, 07 and 08 in Appendix G.

6.2 Groundwater Monitoring Well Construction and Development Procedures

All GWs 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.

Well development and purging were conducted in accordance with the guidelines and procedures specified within section A2.12 *Groundwater monitoring bore development* and section A2.13 *Groundwater Monitoring bore purging and sampling* as per 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 I.

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.

Environmental borelogs are contained in Appendix D, and well construction logs are presented in Appendix H.

6.3 Groundwater Well Gauging

Groundwater was encountered beneath the site at depths ranging between 0.53 m below ground level (BGL) and 6.88 m BGL. All GWs were gauged and level surveyed to an arbitrary datum to assess the direction of local groundwater flow beneath the site (with the exception of GW39 which was gauged but not surveyed). Approximate standing groundwater level contours and extrapolated flow direction are graphically shown in Drawings 09, 10 and 11 in Appendix M.

Level surveying and gauging of the wells within the western portion of the site ie. between Wentworth Avenue and Jerrabomberra Creek, identifies a localised groundwater flow direction to the east, north-east. Drawing 09 shows the groundwater levels and interpolated localised groundwater flow direction for the western portion of the site. Level surveying and gauging of the wells within the eastern portion of the site ie. between Newcastle Street and the Monaro Highway, identifies a localised groundwater flow direction to the west. Drawings 10 and 11 show the shows standing groundwater levels and interpolated localised groundwater flow direction and confirms

a localised general east to north easterly direction of groundwater flow beneath the central and eastern portions of the site. Based on these observations, potential sensitive receptors located hydraulically down gradient of the site are considered to include;

- Jerrabomberra Creek and associated wetlands (potential impacts from both the eastern and western portions of site);
- residential allotments, north of Cunningham Street.

The interpolated standing groundwater levels further indicate the potential for migration of contaminated groundwater on to the AN site from adjacent land users including, Shell, Caltex/Ampol, Mobil, BP and the former cement works, located to the east of Newcastle Street.

Based on the field conductivity readings, derived field TDS levels are calculated between 300 mg/L TDS and 2,050 mg/L TDS, corresponding to low to moderate salinities indicating potential beneficial uses of the groundwater including human consumption and domestic irrigation. These calculations of TDS based on field conductivity readings were confirmed by laboratory testing of TDS from selected samples which reported the range of TDS between 149 mg/L and 2,287 mg/L TDS.

No free phase hydrocarbon products were identified in any of the on site wells, however a hydrocarbon sheen was noted at GW 5 (located adjacent to the former refuelling tank within the station area) and obvious hydrocarbon odours were noted at monitoring well GW2 (adjacent to the Shell Depot).

Results of the most recent well gauging, well purging and level surveying are shown in Appendix L.

6.4 Groundwater Sampling Procedures

All groundwater samples were recovered using a stainless steel bailer. Sample collection/labelling/storage and transfer to laboratory were carried out in accordance with Section A2.0 Site Investigation Methodology, per the *Investigation Scope definition Overview and Generic Workplan for Australian National Projects*, prepared by the Australian National Project Consultancy panel in November 1996.

On the completion of field activities, all groundwater samples were checked for labelling consistency against the field sampling record, and packed into chilled and iced eskies prior to shipment to laboratories for analysis. The Sample Transmittal Forms were completed to maintain the Chain of Custody, and were transferred to the laboratory within one week of sample retrieval.

6.5 Groundwater Analytes

Selected groundwater samples were submitted for a range of chemical analyses incorporating general screen parameters characteristic of the groundwater underlying the entire site and sub area specific based on the nature of the groundwater contaminants expected from subarea specific land uses.

The rationale for selection of the various parameter suites for sampling is detailed as follows:

pH

pH is a measure of the relative acidity and/or alkalinity of the groundwater. pH has a major effect upon the fate of particular heavy metals and other chemical constituents within the groundwater.

Total Dissolved Solids (TDS)

Total Dissolved Solids provides a measurement of the dissolved or filterable anionic and cationic components of a groundwater sample. The measurement of TDS provides a ready assessment of the potential beneficial uses of the groundwater resource.

Heavy Metals

The nominated heavy metal screen incorporates arsenic, chromium, copper, cadmium, mercury, nickel, lead and zinc and is identical to the chemical suite analysed during the soil assessment program.

Total Petroleum Hydrocarbons (TPH) and Monoaromatic Hydrocarbons (BTEX)

Based on the widespread storage and use of fuels and lubricating oils products on the majority of AN sites and the potential for subsequent significant environmental impacts, TPH and BTEX analyses are undertaken where evidence of hydrocarbon contamination is known or suspected.

Semi Volatile Organic Compounds (SVOCs)

The 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 sample, particularly where current and/or former site usage is varied (ie. storage of various chemicals/fuels and solvents) or unknown.

Volatile Organic Compounds (VOCs)

The 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 sample, particularly where current and/or former site usage is varied (ie. storage of various fuels and solvents) or unknown

Chain of custody documents and analytical request documents are presented in Appendix J.

6.6 Laboratory Used

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

AMDEL Laboratories 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.

Original certified laboratory results and QA/QC reports are presented in Appendix K.

6.7 Groundwater 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.

For the purpose of assessing the groundwater contaminant levels identified during the Phase II Environmental Assessment Program, groundwater quality criteria were selected on the basis of the laboratory reported Total Dissolved Solids (TDS) concentration and the working requirements of the Australian & New Zealand Environmental Conservation Council (ANZECC), where groundwater must be assessed in accordance with the potential beneficial usage/s of the groundwater resource, and the potential to impact upon sensitive receiving water bodies (Marine or freshwater).

Groundwater with a TDS < 1,000 mg/l are classed as potable, while waters with a TDS > 1,000 mg/L are not generally used for drinking (non-potable). Where the quality of the groundwater is potable, then the Australian Drinking Water Standards (Draft 1994/Draft 1995) shall be used to determine water quality with the following.

In addition to human requirements other beneficial uses of the water shall also be taken into consideration. Livestock can tolerate TDS concentrations < 13,000 mg/L while waters of < 5,500 mg/L may be used for irrigation purposes. Therefore where beneficial uses of the groundwater are known to be in these two groups, the Australian Water Quality Guidelines for Fresh and Marine Waters (Livestock (Section 5.2) and Irrigation (Section 5.1) ANZECC, 1992) may be used in assessing water quality.

Groundwater quality in terms of TDS concentrations varies between 149 mg/L and 2,287 mg/L across the site requiring the use of the Australian Drinking Water (AWD) Standards as the proposed preliminary groundwater assessment criteria. Although the quality of the water beneath the site, as assessed by TDS concentrations, may allow for beneficial uses including potable use, it is considered unlikely that current or future on site usage of the groundwater for this purpose will occur. In this case the adoption of the ADW standards may result in an overly cautious preliminary assessment, however in the absence of any clear assessment direction from Environment ACT and the presence of the adjacent Jerrabomberra Creek and Wetlands, it is considered that the

criteria are appropriate for use as initial screening criteria. In addition to the ADW standards, reference will be made to the ANZECC Australian Water Quality Guidelines for Fresh and Marine Waters, (Livestock and Irrigation standards) to further assess groundwater contaminant concentrations adjacent to the Jerrabomberra Creek site boundaries.

In the case of analytes not covered by the nominated guidelines (such as for total petroleum hydrocarbons [TPH]), the Dutch Investigation and Intervention values will be referenced.

6.8 Groundwater 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.

Table 6.2 provides a summary of laboratory results for soil samples which reported analyte concentrations in excess of the proposed preliminary assessment criteria.

Table 6.2 Summary of Analyte Concentrations in Excess of Proposed Assessment Criteria (groundwater)

Groundwater Monitoring Bore	Analyte	Concentration
GW1	mercury	3.1 ug/L
GW2	benzene	901 ug/L
GW2	toluene	906 ug/L
GW4	total petroleum hydrocarbons	95,700 ug/L
GW4	benzene	202 ug/L
GW4	ethylbenzene	528 ug/L
GW4	total xylene	1117 ug/L
GW5	total petroleum hydrocarbons	122,000 ug/L
GW5	benzene	20 ug/L
GW5	arsenic	48 ug/L
GW5	lead	17 ug/L
GW6	lead	36 ug/L
GW8	lead	22 ug/L
GW9	lead	46 ug/L
GW10	lead	68 ug/L
GW10	mercury	2 ug/L
GW11	lead	167 ug/L
GW11	mercury	2 ug/L
GW12	lead	18 ug/L

Groundwater Monitoring Bore	Analyte	Concentration
GW12	mercury	2 ug/L
GW14	lead	11 ug/L
GW16	lead	22 ug/L
GW17	lead	31 ug/L
GW17	mercury	2.2 ug/L
GW19	total petroleum hydrocarbons	296 ug/L
GW19	benzene	6 ug/L
GW19	lead	30 ug/L
GW19	mercury	2.4 ug/L
GW21	lead	20 ug/L
GW21	mercury	2.4 ug/L
GW24	total petroleum hydrocarbons	255,000 ug/L
GW24	benzene	54 ug/L
GW24	total PAHs *	299 ug/L
GW30	lead	37 ug/L
GW35	total petroleum hydrocarbons	31,200 ug/L
GW35	benzene	2,216 ug/L
GW35	toluene	4,312 ug/L
GW35	ethylbenzene	1,633 ug/L
GW35	total xylene	10,152 ug/L
GW35	lead	52 ug/L
GW35	total PAHs *	144 ug/L
GW39	lead	18 ug/L
PMW1	total petroleum hydrocarbons	34,900 ug/L
PMW1	benzene	66 ug/L
PMW1	ethylbenzene	388 ug/L
PMW 1	total PAHs *	105 ug/L
PMW2	total petroleum hydrocarbons	18,700 ug/L
PMW2	total PAHs *	28 ug/L

* no relevant criteria is available for total PAHs in groundwater.

pH

pH values for the groundwater ranged from a low of 6.8 for the sample recovered from GW2 to a high of 7.9 for the sample recovered from GW28. In general, the pH values indicate relatively neutral to slightly alkaline groundwater in the area. All pH values were within the recommended range of 6.5 - 8.5 as nominated by the Australian Drinking Water Guidelines.

Total dissolved Solids

TDS concentrations ranged from a low of 149 mg/L for the sample recovered from PMW2, located adjacent the Mobil refuelling depot, to a high of 2,287 mg/L for the sample recovered from GW16, located adjacent the William Edmunds site.

Heavy Metals

Arsenic

With the exception of the groundwater sample recovered from GW5, all of the remaining groundwater samples recovered reported dissolved phase arsenic concentrations below the health based threshold level of 7 µg/L nominated within the Australian Drinking Water Standards.

The groundwater sample recovered from monitoring well **GW5**, located adjacent to the former refuelling tank, reported an elevated concentration of dissolved phase arsenic of 48 µg/L, in excess of the Australian Drinking water standard of 7 µg/L.

Cadmium

All groundwater samples recovered reported dissolved phase cadmium concentrations below the health based threshold level of 2 µg/L nominated within the Australian Drinking Water Standards.

Chromium (total)

All groundwater samples recovered reported total dissolved phase chromium concentrations below the health based threshold level (50 µg/L for Cr⁶⁺) nominated within the Australian Drinking Water Standards. At present, there are no health based limits established for total chromium, providing the concentration of hexavalent chromium is below 50 µg/L. Although no specific testing for hexavalent chromium was undertaken, the levels for total chromium (maximum 3 µg/L) indicate that the concentration of Cr⁶⁺ would not exceed the criterion.

Copper

All groundwater samples recovered reported dissolved phase copper concentrations below the health based threshold level of 1,000 µg/L nominated within the Australian Drinking Water Standards. The maximum concentration of dissolved phase copper was 34 µg/L in the sample recovered from GW16, located adjacent the William Edmunds site.

Mercury

Elevated levels of dissolved phase mercury, in excess of the health based threshold level of 1 µg/L nominated within the Australian Drinking Water Standards, were detected in ten (10) of the twenty-four (24) groundwater samples recovered from the site. The concentration of dissolved phase mercury ranged from below the laboratory detection limit at several locations up to a high of 3.1 µg/L in the sample recovered from **GW1**, located adjacent to the Shell Depot, near Ipswich Street.

Lead

Elevated levels of dissolved phase lead, in excess of the health based threshold level of **10 µg/L** nominated within the Australian Drinking Water Standards, were detected in sixteen (16) of the twenty-four (24) groundwater samples recovered from the site. The concentration of dissolved phase lead ranged from below the laboratory detection limit at PMW3, located adjacent the Mobil refuelling Depot up to a high of **167 µg/L** in the sample recovered from **GW11**, located adjacent to the Canberra Train Station Building, near Wentworth Avenue.

Zinc

All groundwater samples recovered reported dissolved phase zinc concentrations below the aesthetic based threshold level of **3,000 µg/L** nominated within the Australian Drinking Water Standards. The maximum concentration of dissolved phase zinc was **209 µg/L** in the sample recovered from GW16, located adjacent the William Edmunds site.

Total Petroleum Hydrocarbons

Elevated levels of dissolved phase total petroleum hydrocarbons, in excess of the Dutch Intervention Level of **600 µg/L** ($C_6 - C_{36}$), were detected in six (6) of the twenty-four (24) groundwater samples recovered from the site. The locations where elevated TPH concentrations were identified were GW4, GW35 (adjacent the Shell Depot), GW5, (adjacent the on-site former refuelling tank) GW24, PMW1 and PMW2 (adjacent the Mobil Depot). The concentration of dissolved phase petroleum hydrocarbon products ranged from below the laboratory detection limit at several locations up to a high of **255,000 µg/L** in the sample recovered from **GW24**.

Slightly elevated levels of TPH were also identified in the groundwater sample collected from GW19 (Adjacent the Caltex/Ampol Depot). The concentration of TPH ($C_6 - C_{36}$) was reported as **296 µg/L**, and whilst this value is below the Dutch intervention level, it does suggest the potential for some impaction of the groundwater, not specifically related to the other elevated results obtained (TPH concentrations at adjacent bores [GW17 and GW21] were reported to below the laboratory level of reporting).

The chromatographic distribution of petroleum hydrocarbon fractions identified adjacent to the Shell Depot (GW4, GW35) were predominantly $C_6 - C_{15}$, indicating that the petroleum product resembled a unleaded fuel or motor spirit.

The chromatographic distribution of petroleum hydrocarbon fractions identified adjacent to the on-site former refuelling tank (GW5) were predominantly $C_{10} - C_{28}$, indicating that the petroleum product identified within the groundwater resembled a diesel fuel or light oil product.

The chromatographic distribution of petroleum hydrocarbon fractions identified adjacent to the Mobil Depot (GW24, PMW1 and PNW2) were predominantly $C_{10} - C_{28}$, indicating that the petroleum product identified within the groundwater resembled a diesel fuel or light oil product.

Monoaromatic Hydrocarbons (BTEX)

Elevated levels of dissolved phase benzene, toluene, ethylbenzene and xylenes (BTEX), in excess of their respective health based threshold levels of **1 µg/L, 800 µg/L, 300 µg/L and 600 µg/L**, nominated within the Australian Drinking Water Standards, were detected in seven (7) of the twenty-four (24) groundwater samples recovered from the site. The locations where elevated BTEX concentrations were identified were GW2, GW4, GW35 (adjacent the Shell Depot), GW5 (adjacent the on-site former refuelling tank), GW19 (adjacent the Caltex/Ampol Depot), GW24 and PMW1 (adjacent the Mobil Depot). The concentration of dissolved phase BTEX ranged from below the laboratory detection limit at several locations up to a high of **2,216 µg/L** (benzene), **4,312 µg/L** (toluene), **1,633 µg/L** (ethylbenzene) and **10,152 µg/L** (xylenes) in the sample recovered from **GW35**.

Semi Volatile Organic Compounds (SVOCs)

All groundwater samples recovered reported dissolved phase semi-volatile organic compounds below their respective laboratory detection limits for the individual semi-volatile organic compounds, with the exception of PAH compounds, primarily Naphthalene, Acenaphthene, Fluoranthene, Pyrene, Phenanthrene and Anthracene. Benzo(a)pyrene was not detected above the laboratory detection limits in any of the samples submitted for analysis. The samples which did report dissolved phase PAH compounds were recovered from monitoring wells GW 24, PMW 1 and PMW2, located adjacent to the Mobil Depot and monitoring well GW35 located adjacent to the Shell Depot. In all cases the observed PAH impacts identified within the groundwater samples recovered from monitoring wells adjacent to the Mobil Depot were all associated with identified presence of TPH impacts. No TPH impacts were identified in addition to the PAH compounds reported in monitoring well GW35, located adjacent to the Shell Depot.

Volatile Organic Compounds (VOCs)

All groundwater samples recovered reported dissolved phase volatile organic compounds below their respective laboratory detection limits for the individual volatile organic compounds with the exception of ethylbenzene, n-propylbenzene, Toluene, 1,2,4 trimethylbenzene, 1,3,5 trimethylbenzene, ortho-xylene and meta & para-xylene, all identified in the VOC scan performed on the sample recovered from GW2. Given these compounds are predominantly the mono-aromatic hydrocarbons (BTEX), the results have been discussed above.

6.9 Data Validation Report - Groundwater

All analytical laboratory data and field duplicate data were assessed for validation purposes. The results of internal laboratory quality control (QC) procedures for soils are included within the analytical laboratory reports in Appendix K. These include the results of surrogate recoveries and duplicates carried out as part of the laboratory QC program.

The precision of the results for each analyte for the laboratory replicates was determined by calculating the Relative Percentage Difference (RPD) between replicates. This was calculated as follows:

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

The acceptance criteria for laboratory replicates is generally set at an RPD of 20%. this criteria is based on PPK Quality Assurance (QA) protocols, which were developed with regard to the US EPA regulations. A field duplicate RPD value of < 30% is considered acceptable according to the AN protocols.

In order to obtain a measure of overall precision, a relative standard deviation (%RSD) was determined for each soil analyte for the inter-laboratory duplicate analyses conducted. This involved normalising each sample result and the corresponding replicate result and then calculating the standard deviation of the complete set of normalised values for the duplicate samples. This relative standard deviation is calculated as a percentage and is also included in Appendix K.

Based on the field duplicate analyses undertaken, the values for the laboratory replicate RPDs and RSDs were all within acceptance criteria for the laboratory precision.

Based on the data quality review of the QA/QC analysis results, the data collected is considered suitable for use in the report and for the conclusions and recommendations made.

7. Conclusions

The results and findings of the Phase II investigation program undertaken during June - July 1998 has 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.

Impacts from on site activities

Main Station Area

The predominant soil and groundwater impacts identified within the main station area, are associated with the former locomotive refuelling area, located to the south west of the former goods shed (now Robbo's Pet Barn). 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 two of the groundwater monitoring wells 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 is 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. 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. Due to the extensive area previously used for waste disposal (unknown until the commencement of the investigation program) it is considered that the sampling density adopted for the initial Phase II investigation, is inadequate to allow for detailed characterisation of any potential soil and/or groundwater impacts and in particular for the assessment of any impacts to the adjacent creek and wetlands.

Eastern Rail Corridor (adjacent former Cement Works)

High concentrations of heavy metals, particularly lead and zinc were reported within the upper soil profile within the sampling point, BH 32, 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. The lateral extent of any subsurface ash and cinders surrounding sampling point BH32 was not determined during the initial investigation works.

Analysis of the groundwater samples recovered from the main station and adjacent waste fill area (monitoring wells, GW 5, 6, 8, 10, 11, 12, 13, 14, 16 and 39) 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 (monitoring wells GW 17, 19, 21, 30, 35 and 39) indicating possible widespread occurrences of these analytes, which may not be directly associated with rail activities.

Impacts from suspected off site activities

The predominant soil and groundwater impacts identified within the eastern portion of the rail corridor, are considered to be the result of on site migration of petroleum hydrocarbon products from the Shell, Caltex/Ampol and Mobil fuel depots.

Olfactory evidence of petroleum hydrocarbon impacts within the subsurface soil profiles were reported in four of the six soil and groundwater sampling locations targeted adjacent to the northern boundary of the Shell depot, located adjacent to the Monaro Highway. Absorbed phase TPH concentrations in excess of the nominated threshold criteria were identified in two of the sampling bores at depths between 6m and 8m. Chromatographic analysis of the soil samples identifies the contaminant as a degraded distillate or light oil based product with the presence of a minor lighter more volatile component, possibly a motor spirit. Analysis of the groundwater samples recovered from monitoring wells GW2 and GW4, located to the immediate north - north east of the depot reported elevated concentrations of dissolved phase benzene, toluene, ethylbenzene (GW4 only) and petroleum hydrocarbons (GW 4 only), in excess of the nominated assessment criteria, characteristic of a combined degraded distillate and motor spirit product. No hydrocarbon impacts with the exception of dissolved

phase Napthalene, were reported in the adjacent monitoring wells located to the immediate east of the fuel depot, potentially indicating that the observed impacts may be resulting the north western portion of the Shell Depot. 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.

Olfactory evidence of petroleum hydrocarbon impacts within the subsurface soil profiles were 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 at depths between 2m and 3m. Laboratory analysis of all soil samples submitted for TPH and BTEX analysis, reported concentrations below the nominated assessment criteria. 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. No obvious dissolved phase or absorbed phase impacts were identified adjacent to the southern boundary of the BP Depot. 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. Analysis of the single monitoring well (GW30) located on the southern side of the central rail lines (adjacent to the Caltex/Ampol depot) reported no evidence of any subsurface soil and/or groundwater impacts.

8. Recommendations

In accordance with the proposed continued industrial (rail) use of the site, the results and findings of the Phase II investigation have identified requirements for further assessment works to delineate the specified impacted areas and to allow for the consideration of site specific risk assessment and remediation (if required). The proposed scope of works for subsequent investigations incorporates:

- additional well construction and sampling around the Shell, Mobil and Caltex/Ampol fuel depots, suggest 11-15 wells. It is recommended that INDEC advises these companies of the results and findings of the Phase II program and that these companies are asked to either assess the situation and the impacts to the AN site on their own or to contribute to the continuation of the assessment works relevant to their properties;
- additional well construction and sampling around the former refuelling tank, suggest 3-5 wells;
- additional well construction and sampling within the municipal waste fill area and adjacent to the Jerabomberra creek and wetlands, suggest 11-15 wells;
- additional test pitting to identify the boundaries of the municipal fill area and to assess the type of materials present and determine the nature of any impacts to the underlying natural soil profile. Consideration needs to be given by INDEC (AN) as to which party is responsible for the waste fill area and who will retain the liability for any future impacts. Consideration also needs to be given to the possible future remediation;
- additional well construction and sampling needs to be undertaken across the site in general to determine background concentrations of heavy metals, particularly lead and mercury, suggest 5-7 wells;
- additional soil sampling needs to be undertaken to delineate the extent of impacted fill materials adjacent to the former cement site.

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

9. 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.

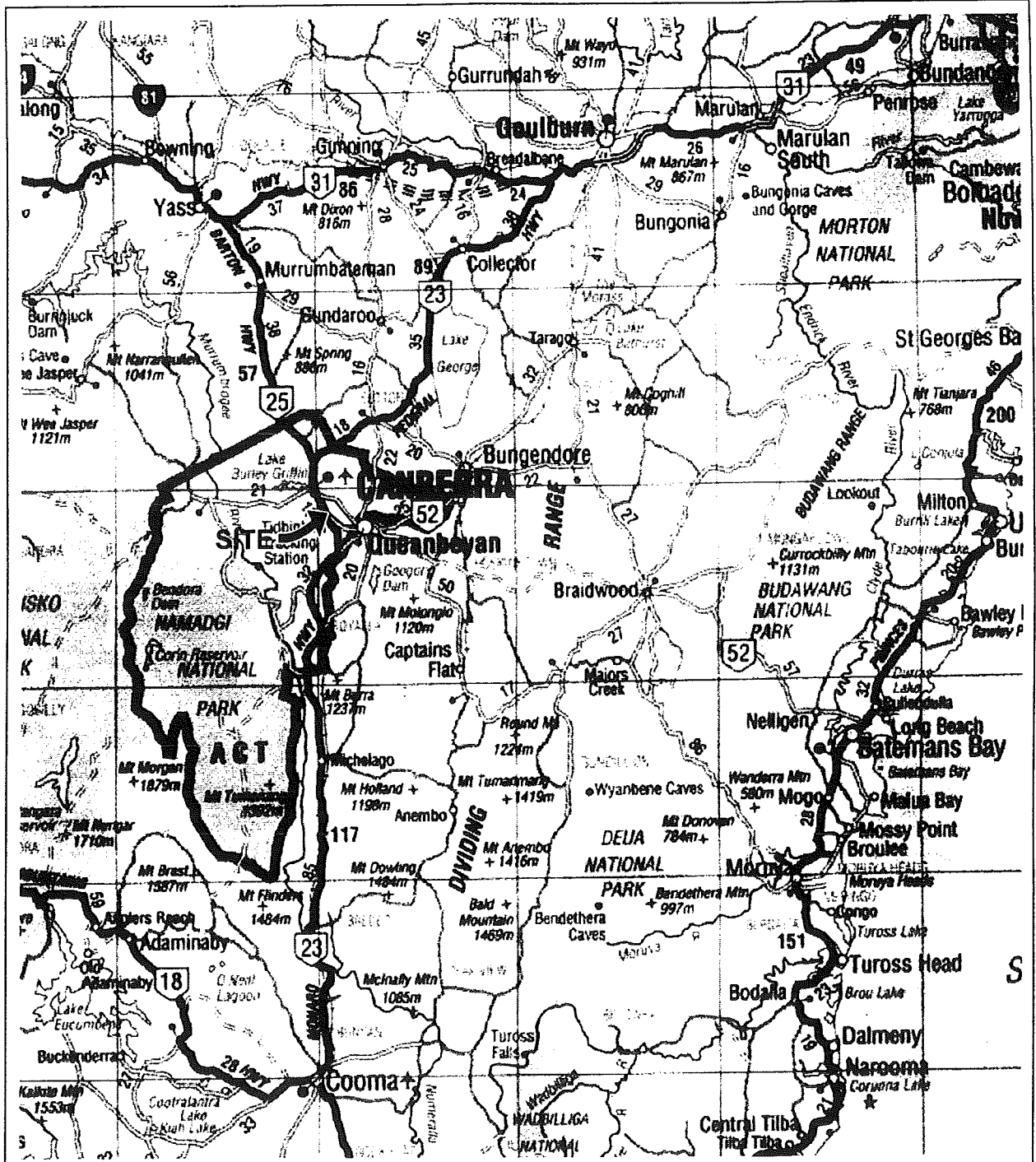
Other Limitations

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



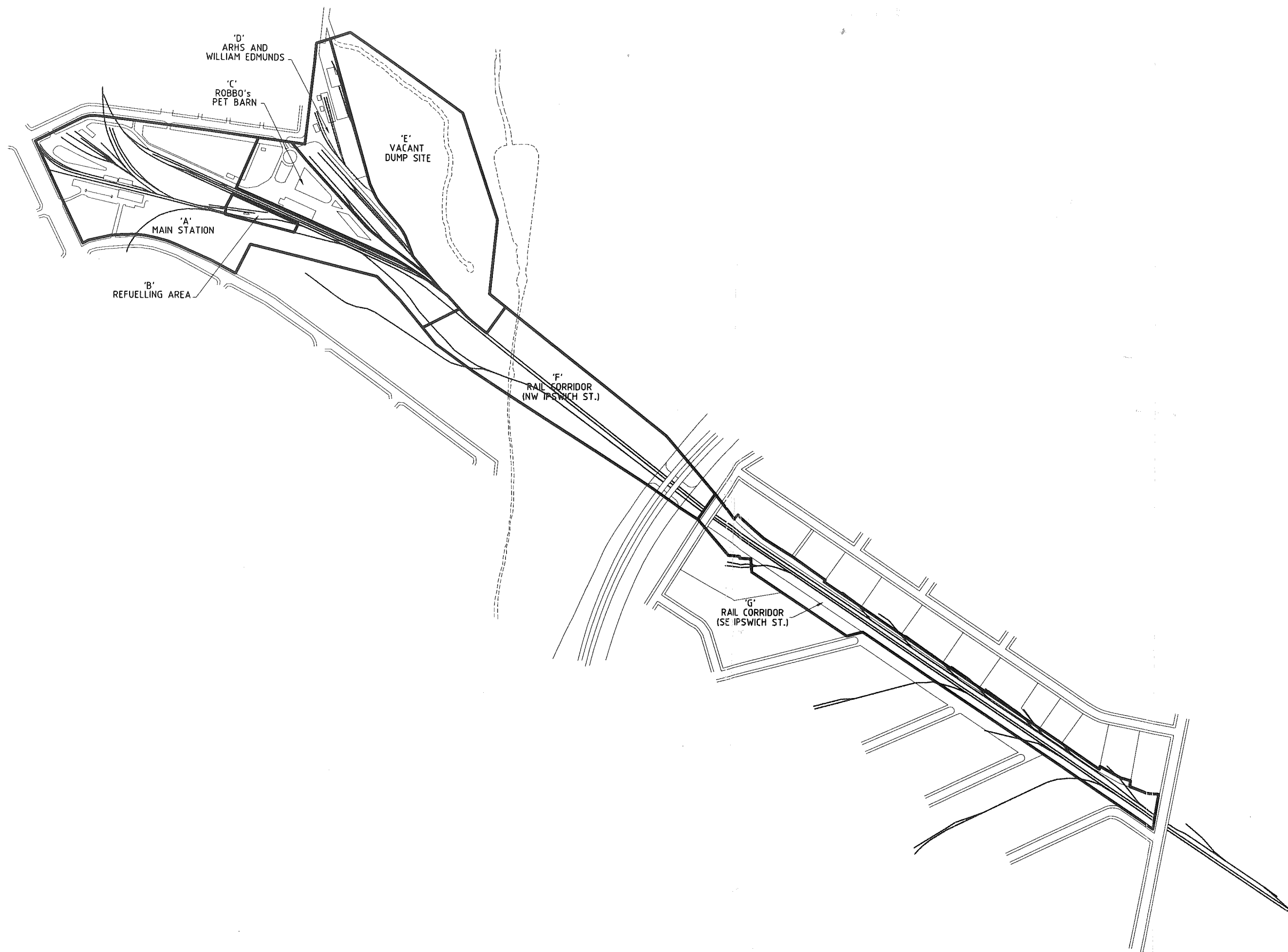
Australian National Phase II Environmental Site Assessments

Site Location Map

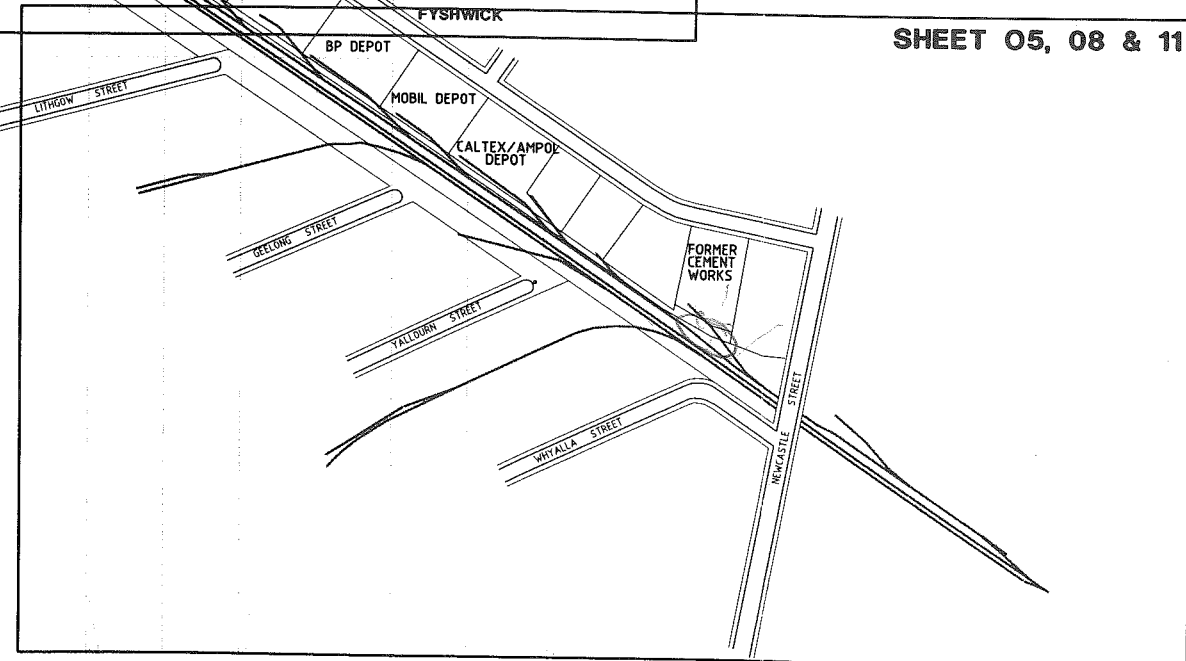
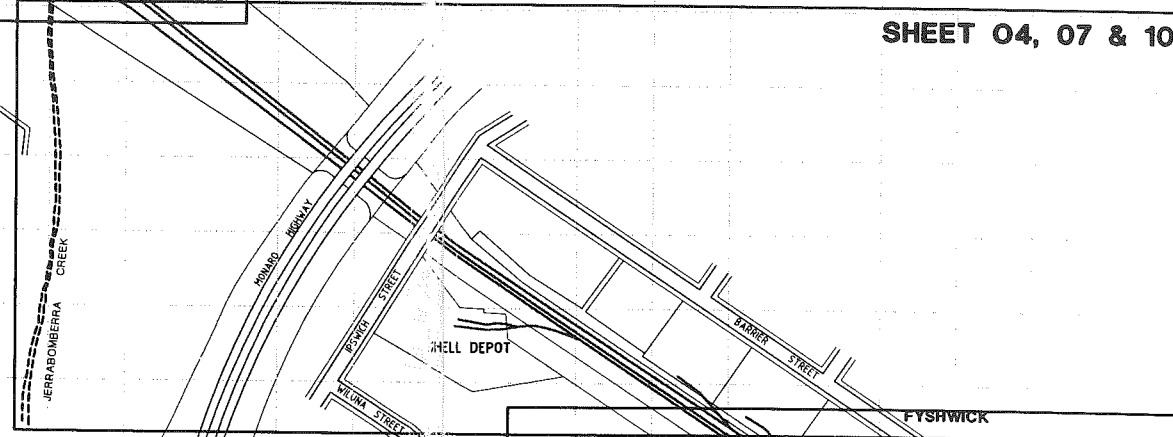
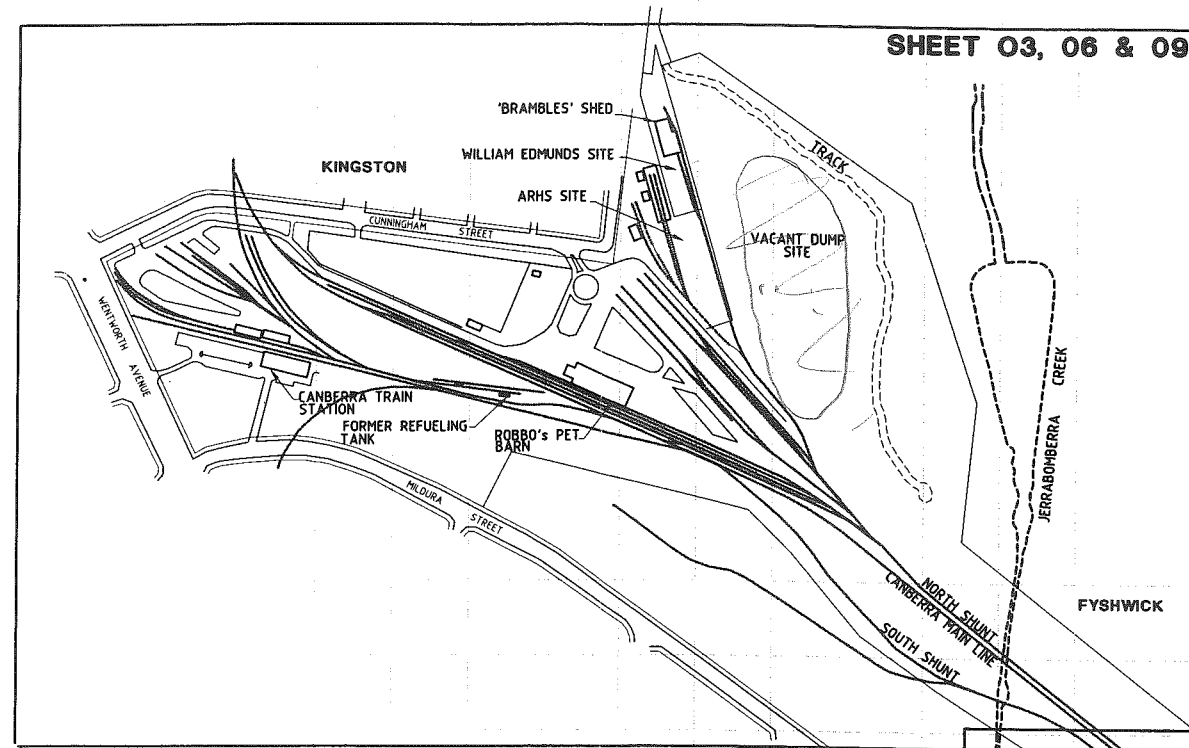
Canberra Railway Yards

Appendix B

Site Plans



										CLIENT INDEC CONSULTING										 PPK Environment & Infrastructure PPK HOUSE 101 PIRIE STREET ADELAIDE SOUTH AUSTRALIA, 5000 TELEPHONE (08) 8405 4300 FAX (08) 8405 4303 Email ppkadel@ozemail.com.au ACN 078 054 798 A NATA Certified Quality Company										PROJECT CANBERRA RAIL YARDS										DESIGNED DATE SCALE A1 1:5000, A3 1:10000									
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CODE DATE DESCRIPTION										BY APPR CODE DATE DESCRIPTION										DRAWN BJB 10.7.98 PROJECT APPROVAL										DRAWING CHECK BJH 10.7.98 CLIENT APPROVAL																			
REVISIONS AND APPROVALS										REVISIONS AND APPROVALS										DRAWING NO 27K140A/01										ISSUE																			



CODE	DATE	DESCRIPTION	BY	APPR	CODE	DATE	DESCRIPTION	BY	APPR
		REVISIONS AND APPROVALS					REVISIONS AND APPROVALS		

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A NATA Certified Quality Company

PROJECT
CANBERRA RAIL YARDS

TITLE
**SITE PLAN - INDEX SHEET
PHASE 2 INVESTIGATION
SHEET 2 OF 11**

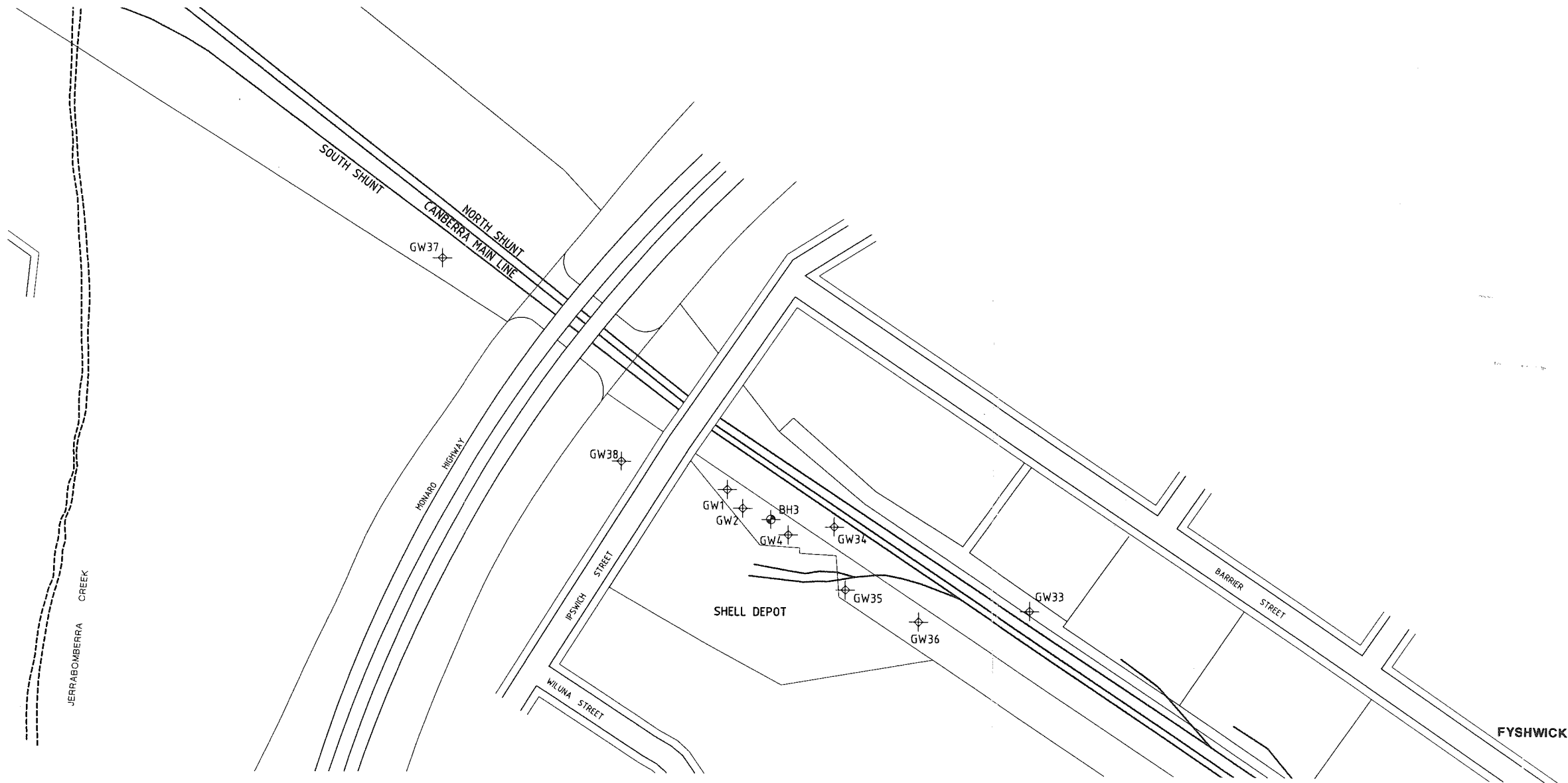
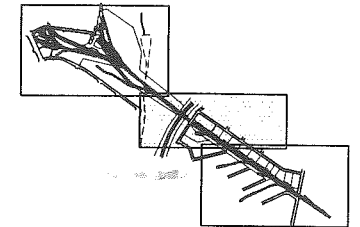
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DESIGN CHECK		A1 1:5000, A3 1:10000
DRAWN		CAD REFERENCE 27K140A
DRAWING CHECK		PROJECT APPROVAL
DRAWING CHECK		CLIENT APPROVAL
DRAWING No		ISSUE
27K140A/02		

Appendix C

Sampling Location Plans (Soil)



PPK Environment & Infrastructure 101 PIRIE STREET ADELAIDE SOUTH AUSTRALIA, 5000 TELEPHONE (08) 8405 4300 FAX (08) 8405 4303 Email ppkadel@ozemail.com.au ACN 079 924 798 A NATA Certified Quality Company	PROJECT CANBERRA RAIL YARDS		DESIGNED DATE	SCALES A1 1:2000, A3 1:4000
	TITLE PHASE 2 INVESTIGATION SOIL SAMPLING LOCATIONS SHEET 3 OF 11		DESIGN CHECK DATE	CAD REFERENCE 27K140A
			DRAWN BJB	PROJECT APPROVAL DATE
			DRAWING CHECK BJH	CLIENT APPROVAL DATE
			DRAWING NO 27K140A/03	ISSUE -



LEGEND

- GW2 DENOTES GROUNDWATER WELL LOCATION
- BH3 DENOTES SOIL BORE LOCATION

				CLIENT				PPK				PROJECT				DESIGNED			
				INDEC CONSULTING				Environment & Infrastructure				CANBERRA RAIL YARDS				DATE			
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												PHASE 2 INVESTIGATION				27K140A			
												SOIL SAMPLING LOCATIONS				PROJECT APPROVAL			
												SHEET 4 OF 11				CLIENT APPROVAL			
																DRAWING No			
																27K140A/04			
																ISSUE			
																-			



CANBERRA NORTH SHUNT
CANBERRA MAIN LINE
CANBERRA SOUTH SHUNT

FYSHWICK

BP DEPOT

MOBIL DEPOT

CALTEX/AMPOL
DEPOT

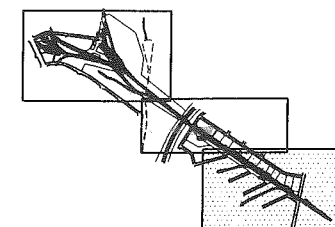
FORMER
CEMENT WORKS

PSM "SR503"
RL 576.549m AHD

GEELONG STREET

YALLOURN STREET

NEWCASTLE STREET



LEGEND

- GW28 DENOTES GROUNDWATER WELL LOCATION
BH25 DENOTES SOIL BORE LOCATION

										CLIENT		 PPK Environment & Infrastructure		PPK Environment & Infrastructure Pty. Ltd.		PROJECT		CANBERRA RAIL YARDS		DESIGNED	DATE	SCALE			
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																DRAWN		BJB		10.7.98		PROJECT APPROVAL			
																DRAWING CHECK		BJH		10.7.98		CLIENT APPROVAL			
																DRAWING NO.						ISSUED			
																						27K140A/05			
CODE	DATE	DESCRIPTION	BY	APPR	CODE	DATE	DESCRIPTION	BY	APPR	CODE	DATE	DESCRIPTION	BY	APPR	CODE	DATE	DESCRIPTION	BY	APPR	CODE	DATE	DESCRIPTION	BY	APPR	

Appendix D

Borehole and Test Pit Logs

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	17/06/98	Time	11:30	Location No	BH 01 (GW1)
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
0-0.2	0-0.15	FILL. Sandy clay, brown, light brown, fine to medium sand, some gravel to 40 mm, fine roots (≤ PL).	0 1	0	
0.2-0.55	0.4-0.5	Sandy CLAY. Dark brown, fine to medium sand, black ironstone mottling (≤ PL).	0	0	
0.55-1.55	0.9-1.0	Sandy Silty CLAY. Mottled orange, light brown, black ironstone mottling, fine to medium sand, some fine ironstone gravel (< PL).	0 0	0 0	
1.55-1.75		Sandy Clayey SILT. Pale grey and pale orange, fine sand, some ironstone gravel to 30 mm (< PL).			
1.75-3.5	1.9-2.0 3.0	SILTSTONE. Orange and dull red.	0 0	2 1	
3.5-5.0	3.5-4.0 4.5-5.0	SILTSTONE. Light purple, weak.	0 0	3 5.5	
5.0-12.0	5.5-6.0 6.5-7.0 7.5-8.0 8.5-9.0 9.5-10.0 10.5-11.0 11.5-12.0	SILTSTONE. Yellow, pale red, becoming brown and more clayey below 10.5 m.	0	5 8 3.5 3 3.5 2.5 2	
		End of Borehole 12.0 m			
Logged by		BJH		Sampled by	
				BJH/MBR	
Field Classification			Comments		
0 ... No obvious contamination			Push tube to 2.0 m		
1 ... Slight visual contamination and/or slight odour			Air drill from 2.0 m to 12.0 m		
2 ... Visual contamination and/or odour			Sometimes background PID vapours up to 10 ppm may be encountered.		
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					

Project	CANBERRA RAIL YARDS		Job Number	27K140A	
Date	17/06/98	Time	13:30	Location No	BH 02 (GW2)
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	0-0.15 0.3-0.4	FILL. Silty Sandy clay, mottled olive brown, some red, some black ironstone staining, some gravel to 30 mm ($\leq$ PL)	0 0	0 0	
0.4-1.2	0.4-0.5	Sandy Silty CLAY. Mottled olive brown and black (ironstone staining) ($\leq$ PL).	0	0	
1.2-3.0	1.2-1.3 1.9-2.1 1.9-2.1D BD1	Silty Gravelly CLAY. Mottled olive green, yellow, red and black ironstone, fine ironstone gravel ($<$ PL)	0	0 0	
3.0-4.5	3.0 4.0	SILTSTONE. Reddish grey over purple. Hydrocarbon odour 4.0-4.5 m	1 2	1 106	
4.5-9.0	5.0 6.0 7-7.5 8-8.5	SILTSTONE/Clayey SILT. Yellow brown, very weak rock.	1 0/1 0 0	28 2 0 0	
End of Borehole 9.0 m					

Logged by	BJH	Sampled by	BJH/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 Push tube to 3m, air drill 3m to 9m.	

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

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	17/06/98	Time	14:45	Location No	BH 03
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
0-0.2	0-0.15	FILL. Silty gravelly clay, mottled brown, olive brown, fine gravel, some fine roots (< PL).	0	0	
0.2-0.5	0.2-0.3	Sandy Silty CLAY. Brown, fine to medium sand, fine roots (< PL).	0	0	
0.5-1.3	0.8-0.9	Silty Sandy CLAY. Orange brown and olive brown, some black ironstone gravel and staining, fine sand.	0	0	
1.3-3.0	2.0	Silty CLAY. Olive green, some orange brown, some gravel fine to 25 mm.	0	3	
3.0-3.5	3.0	Sandy SILT/SILTSTONE. Off white to pale orange, fine sand	0	2	
3.5-5.0	4.0	SILTSTONE. Orange brown, some fine sand, some hydrocarbon odour stronger below 4m.	2	9	
5.0-9.0	5.0	SILTSTONE. Alternating purple and pale yellow, yellow brown, hydrocarbon odour decreasing with depth.	2	46	
	6.0		1	38	
	7.0		0/1	10	
	8.0		0/1	0	
	9.0		0/1	0	
		End of Borehole 9.0 m			
Logged by		BJH	Sampled by		BJH/MBR
Field Classification			Comments		
0 ... No obvious contamination			Push tube to 4m, air drill 4m to 9m		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	17/06/98	Time	15:40	Location No	BH 04 (GW4)
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		
0-0.15	0-0.15	FILL. Silty clay, mottled brown, some fine sand, some fine gravel (> PL).	0	5			
0.15-0.3	0.15-0.3	Sandy Silty CLAY. Brown, fine to medium sand, fine roots (> PL).	0	0			
0.3-0.5	0.4-0.5	Silty Gravelly CLAY. Brown, orange brown, fine gravel.	0	0			
0.5-1.0	0.9-1.0	Silty Gravelly CLAY. Orange brown, mottled green, some ironstone staining, fine ironstone gravel, quartzitic sandstone gravel to 50 mm at 0.9m.	0	4			
1.0-2.8	2.0	Silty Gravelly CLAY. Mottled olive green, black ironstone staining decreasing with depth, fine gravel, some purple siltstone fragments below 2.5 m.	0	2.5			
2.8-8.0	3.0	SILTSTONE. Purple bands at 3m and 6.5 to 7.0 m, hydrocarbon odour strongest 4.0 m to 4.5 m.	1	1.1			
	4.0		2	12			
	4.0D		2				
	BD2		2				
	5.0		2	15			
	6.0		1	31			
	7.0		1	25			
	8.0		0/1	20			
		End of Borehole 8.0 m					
Logged by		BJH		Sampled by		BJH/MBR	
Field Classification				Comments			
0 ... No obvious contamination				Push tube to 3m air drill 3m to 8m.			
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							

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	19/06/98	Time	8:10	Location No	BH 05 (GW5)
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	0-0.05	FILL. Sandy silty clay, brown, fine to medium sand, some rail ballast (≈ PL).	0		
0.05-0.6	0.15-0.3	Silty CLAY. Mottled orange and olive grey, some fine sand (> PL).	0		
0.6-1.1	0.6-0.7	Silty CLAY over Silty Gravelly CLAY. Mottled olive brown, some shale fragments towards base (> PL).	0		
1.1-1.5	1.4-1.5	Gravelly Silty CLAY/Clayey silty GRAVEL. Mottled brown, olive, grey, laminated shale fragments increasing with depth (≈ PL).	0		
1.5-3.0	2.0 3.0	Clayey SHALE over SHALE. Yellow brown, brown, becoming grey at base. Possible hydrocarbon staining below 2.5 m.	0 1		
3.0-4.5	4.0 4.5	SILTSTONE. Grey brown, hydrocarbon odour, probable staining.	2 2		
4.5-7.0	5.0 6.0 7.0	SILTSTONE. Dull red, orange over brown, faint hydrocarbon odour decreasing with depth.	1 0		
		End of Borehole 7.0 m.			
Logged by		BJH	Sampled by		BJH/MBR
Field Classification			Comments		
0 ... No obvious contamination					
1 ... Slight visual contamination and/or slight odour			Push tube to 1.5 m		
2 ... Visual contamination and/or odour			Air to 7.0 m		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	19/06/98	Time	8:40	Location No	BH 06 (GW6)
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		
0-0.3	0-0.15	FILL. Gravelly silty clay, brown, rail ballast, layer of off white gravelly clay at base, some fine to medium sand (≤ PL).	0				
0.3-0.6	0.3-0.4	Silty CLAY. Dark orange brown, some fine sand (≤ PL).	0				
0.6-1.0	0.9-1.0	Silty CLAY. Mottled orange, olive and brown, some shale/siltstone fragments.	0				
1.0-1.8	1.5-1.6	Gravelly Silty CLAY/Clayey silty GRAVEL. Mottled yellow and brown, shale/siltstone fragments.	0				
1.8-5.3	2.0	SILTSTONE. Yellow brown, some clay at top, faint hydrocarbon odour around 4 m.	0				
	3.0		0				
	4.0		1				
	5.0		1				
5.3-7.0	6.0	Silty CLAY. Black, very silty, some fine sand.	0				
	6.0D						
	BD3						
	7.0		0				
		End of Borehole 7.0 m					
Logged by		BJH		Sampled by		BJH/MBR	
Field Classification				Comments			
0 ... No obvious contamination							
1 ... Slight visual contamination and/or slight odour				Push tube to 2.0 m			
2 ... Visual contamination and/or odour				Air to 7.0 m			
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							

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	19/06/98	Time	9:30	Location No	BH 07
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	0-0.15 0.25-0.35 0.6-0.7	FILL. Gravelly silty clay, mottled brown, orange and black, some rail ballast, layer of ash/cinders at 0.3m, some ash at base.	0/1 2 1		
0.7-1.0	0.9-1.0	Silty Sandy CLAY. Orange brown, fine sand, some black ironstone staining.	0		
1.0-1.7		Silty CLAY. Mottled brown, orange brown, yellow, some black ironstone staining, occasional fine quartzitic gravel.			
1.7-4.5	2.0 3.0 4.0	Clayey SHALE/SILTSTONE. Yellow brown and black, black silty clay, occasional sub-rounded quartz gravel, possible faint hydrocarbon odour.	0 0/1 0/1		
4.5-6.0	5.0 6.0	Clayey SILTSTONE. Yellow brown.	0 0		
		End of Borehole 6.0 m			
Logged by		BJH		Sampled by	
				BJH/MBR	
Field Classification			Comments		
0 ... No obvious contamination					
1 ... Slight visual contamination and/or slight odour			Push tube to 1.5 m		
2 ... Visual contamination and/or odour			Air to 6.0 m		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	19/06/98	Time	10:15	Location No	BH 08 (GW8)
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	0-0.1	FILL. Clayey silty sand, dark brown, occasional fine cinders/slag fragments.	1		
0.1-0.4	0.3-0.4	Sandy Clayey SILT. Brown, yellow brown, fine to medium sand, some fine roots.	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.			
1.2-1.8	1.2-1.3	Gravelly Silty CLAY. Mottled brown, yellow, red, siltstone fragments fine to coarse, very silty (waxy).	0		
1.8-2.5	2.0	Clayey Silty GRAVEL. Brown, light brown, siltstone fragments, considerable clay.	0		
2.5-7.0	3.0	Silty CLAY. Brown, some gravel.	0		
	4.0		0		
	5.0		0		
	6.0		0		
	7.0		0		
		End of Borehole 7.0 m			
Logged by		BJH		Sampled by	
				BJH/MBR	
Field Classification			Comments		
0 ... No obvious contamination					
1 ... Slight visual contamination and/or slight odour			Push tube to 1.5 m		
2 ... Visual contamination and/or odour			Air to 7.0 m		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	19/06/98	Time	11:00	Location No	BH 09 (GW9)
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
0-0.5	0-0.15	FILL. Silty gravelly clay, mottled brown, red, yellow, some rail ballast, some ash/coal.	1		
	0.4-0.5		1/2		
0.5-0.7	0.55-0.65	Silty SAND. Brown, fine to medium.	0		
0.7-1.1		Silty Sandy CLAY. Red brown, fine sand.			
1.1-1.5	1.4-1.5	Silty CLAY. Mottled brown, grey, red, very silty, some siltstone fragments towards base.	0		
1.5-2.5	2.0	Clayey SILTSTONE. Yellow brown and grey.	0		
2.5-8.5	3.0	SILTSTONE. Grey, yellow brown, some clay, some brown layers.	0		
	4.0		0		
	5.0		0		
	6.0		0		
	7.0		0		
	8.0		0		
		End of Borehole 8.5 m			

Logged by	BJH	Sampled by	BJH/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 Push tube to 1.5 m air to 8.5 m
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Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	10/06/98	Time	11:45	Location No	BH 10 (GW10)
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	0-0.15 0.55-0.65	FILL. Alternating layers of silty clay and ballast/ash/coal, black and brown, red brown	2 2				
0.7-0.9	0.75-0.85	Silty Sandy CLAY. Brown, fine sand.	0				
0.9-1.8	1.4-1.5	Silty CLAY/Silty Gravelly CLAY. Mottled yellow brown, orange brown.	0				
1.8-3.8	2.0 3.0	SILTSTONE. Light brown to pale grey, some clay near top.	0 0				
3.8-4.5	4.0	SILTSTONE. Light grey, strong.	0				
		End of Borehole 4.5 m Terminated due to high resistance					
Logged by		BJH		Sampled by		BJH/MBR	
Field Classification				Comments			
0 ... No obvious contamination							
1 ... Slight visual contamination and/or slight odour				Push tube to 1.5 m			
2 ... Visual contamination and/or odour				Air drill 1.5 m to 4.5 m			
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							

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	19/06/98	Time	12:20	Location No	BH 11 (GW11)
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		
0-0.35	0-0.15	FILL. Sandy silty clay, mottled black, brown, ash, some fine coal fragments.	2				
0.35-0.6	0.4-0.5	FILL. Silty sandy clay, dark orange brown, some grey mottling (≥ PL).	0				
0.6-0.8	0.6-0.7	Silty Sandy CLAY. Brown, dark brown fine sand, some fine roots (> PL).	0				
0.8-1.0		Silty CLAY. Brown, some fine sand (> PL).					
1.0-1.7	1.3-1.4	Silty CLAY. Mottled orange brown, olive, some fine sand (≥ PL).	0				
1.7-3.5	2.0 3.0	Clayey SILTSTONE. Yellow brown, some grey, some fine to medium sand.	0 0				
3.5-5.0	4.0 5.0	SILTSTONE. Grey, strong (similar to dolomite).	0 0				
		End of Borehole 5.0 m					
Logged by		BJH		Sampled by		BJH/MBR	
Field Classification				Comments			
0 ... No obvious contamination							
1 ... Slight visual contamination and/or slight odour				Push tube 1.5 m			
2 ... Visual contamination and/or odour				Air to 5.0 m			
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							

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	19/06/98	Time	13:25	Location No	BH 12 (GW12)
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	0-0.1	FILL. Silty sand, dark brown, fine to medium, fine roots.	0		
0.1-0.3	0.1-0.3	FILL. Clayey sandy gravel, mottled brown, black, yellow, coal and cinders fine to 30 mm.	2		
0.3-0.55	0.3-0.45	Clayey Sandy SILT. Dark brown, fine to medium sand, occasional fine ironstone gravel (possible disturbed natural).	0		
0.55-0.7		Silty Sandy CLAY. Brown, fine sand.			
0.7-1.1	0.7-0.8	Gravelly Silty CLAY. Mottled brown, red, yellow, siltstone fragments fine to 30 mm.	0		
1.1-2.7	2.0	Silty GRAVEL/Gravelly SILT (weathered Siltstone). Yellow brown, some fine to medium sand.	0		
2.7-7.0	3.0	SILTSTONE. Light grey and yellow brown, becoming brown at base, some clay.	0		
	3.0D				
	BD4				
	4.0		0		
	5.0		0		
	6.0		0		
	7.0		0		
		End of Borehole 7.0 m			
Logged by		BJH		Sampled by	
				BJH/MBR	
Field Classification			Comments		
0 ... No obvious contamination					
1 ... Slight visual contamination and/or slight odour			Push tube to 1.5 m		
2 ... Visual contamination and/or odour			Air to 7.0 m		
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					

Project	CANBERRA RAIL YARDS		Job Number	27K140A	
Date	19/06/98	Time	14:25	Location No	BH 13 (GW13)
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		
0-0.15	0-0.15	Silty Sandy CLAY. Dark brown, fine to medium sand, fine roots (possible fill) (> PL).	0				
0.15-0.8	0.15-0.3	Silty CLAY. Mottled red, olive brown and yellow, some fine ironstone gravel, some fine sand. (> PL).	0				
0.8-1.3	0.8-0.9	Sandy Silty CLAY. Yellow brown, fine to medium sand, some fine gravel (> PL).	0				
1.3-3.1	2.0 3.0	Silty CLAY. Mottled grey and yellow brown, occasional fine ironstone gravel (> PL).	0 0				
3.1-4.8	4.0	Silty CLAY. Grey, some fine sand (> PL).	0				
4.8-5.0	5.0	Sandy CLAY. Grey and light orange, coarse sand, some fine quartzitic gravel.	0				
		End of Borehole 5.0 m					
Logged by		BJH		Sampled by		BJH/MBR	
Field Classification				Comments			
0 ... No obvious contamination				Push tube to 1.5 m Air to 5.0 m			
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							

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	19/06/98	Time	15:05	Location No	BH 14 (GW14)
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		
0-0.15	0-0.15	FILL. Silty sand, brown, fine to medium grained, some fine roots.	0				
0.15-0.35	0.15-0.3	FILL. Silty gravelly clay, mottled grey, brown, orange, gravel fine to 20 mm, some ash.	0/1				
0.35-0.65	0.4-0.5	Silty CLAY/Clayey SILT. Orange brown, some fine to medium sand (< PL).	0				
0.65-1.2	1.0-1.1	Silty Sandy CLAY. Mottled pale brown and orange, some fine to medium sand, some fine gravel.	0				
1.2-2.5	2.0	Silty CLAY. Mottled olive brown, brown, some black ironstone staining, some fine sand.	0				
2.5-7.0	3.0 4.0 5.0 6.0 7.0	Silty Gravelly CLAY. Light orange brown, brown, siltstone fragments, very wet at base.	0 0 0 0 0				
		End of Borehole 7.0 m					
Logged by		BJH		Sampled by		BJH/MBR	
Field Classification				Comments			
0 ... No obvious contamination				Push tube to 1.5 m			
1 ... Slight visual contamination and/or slight odour				Air to 7.0 m			
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							

Project	CANBERRA RAIL YARDS		Job Number	27K140A	
Date	19/06/98	Time	15:40	Location No	BH 15
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	0-0.15 0.4-0.5	FILL. Gravelly silty clay, dark brown, orange, black mottling, gravel and coal fragments fine to 60 mm.	1/2 1		
0.7-5.0	1.5 2.0 3.0 4.0 5.0	FILL. Ash, clay, metal, coal and timber fragments, black, brown, no strong odour, some gravel to 30 mm.	2/3 2/3 2/3 2/3 2/3		
5.0-6.5	6.0	Silty CLAY. Mottled brown, grey, faint odour, some fine sand.	1		
		End of Borehole 6.5 m			

Logged by	BJH	Sampled by	BJH/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 Push tube to 1.5 m (67% recovery) Air to 6.5 m	
PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301			

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	19/06/98	Time	16:25	Location No	BH 16 (GW16)
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
0-0.15	0-0.15	FILL. Sandy silt, brown, fine to medium sand, some fine gravel or coal, fine roots.	0/1		
0.15-0.75	0.4-0.5	FILL. Silty gravelly clay, mottled brown, yellow, red, mixed gravel fine to 50 mm.	1		
0.75-1.7	0.8-0.9 1.4-1.5	Silty CLAY. Mottled red, brown and yellow, some black ironstone staining, some fine siltstone and ironstone gravel (possible fill).	0		
1.7-7.0	2.0 3.0 4.0 5.0 6.0 7.0	SILTSTONE. Yellow brown, some brown, grey brown clay above 3.0 m.	0 0 0 0 0 0		
		End of Borehole 7.0 m			
Logged by		BJH		Sampled by	
		BJH/MBR			
Field Classification			Comments		
0 ... No obvious contamination			Push tube to 1.5 m		
1 ... Slight visual contamination and/or slight odour			air to 7.0 m		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	20/06/98	Time	9:05	Location No	BH 17 (GW17)
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	0-0.1	FILL. Sandy gravel, grey brown, gravel fine to coarse, sand fine to coarse	0/1		
0.05-0.5	0.4-0.5	FILL. Silty clay, mottled grey brown, red, olive, some black, some fine gravel, some fine sand.	0/1		
0.5-0.65		FILL. Silty clay, mottled light grey, some ironstone staining, some fine to medium sand, possible disturbed natural.	0		
0.65-1.15	0.9-1.0	Silty Sandy CLAY. Mottled light brown, yellow, orange, some ironstone staining, gravelly below 1.0 m (fine sub angular to sub rounded gravel).	0		
1.15-1.9	2.0	Silty CLAY. Mottled orange brown, olive, some fine sand.	0		
1.9-5.5	3.0 4.0 5.0	Clayey SILTSTONE. Yellow brown.	0 0 0		
		End of Borehole 5.5 m			
Logged by		BJH		Sampled by	
				BJH/MBR	
Field Classification			Comments		
0 ... No obvious contamination					
1 ... Slight visual contamination and/or slight odour			Push tube to 1.5 m		
2 ... Visual contamination and/or odour			Air drill 1.5 m to 5.5 m		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	20/06/98	Time	9:45	Location No	BH 18
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		
0-0.15	0-0.15	FILL. Sandy gravel, brown, grey brown, rail ballast, fine to coarse sand, fine roots, some green staining.	2				
0.15-0.35		Silty Sandy CLAY. Brown, light brown, fine to medium sand, some fine roots.	0				
0.35-0.65	0.35-0.45	Silty Sandy CLAY. Light brown, yellow brown, fine sand, some fine gravel.	0				
0.65-1.7	0.9-1.0	Sandy Silty CLAY. Mottled orange, yellow, light grey, fine to medium sand, some fine gravel.	0				
1.7-3.5	2.0 3.0	SILTSTONE/Clayey SILTSTONE. Grey, becoming gravelly below 3.0 m, noticeable hydrocarbon odour, strongest from 2.0 to 3.0 m.	1/2 2				
3.5-5.0	4.0 5.0	Clayey SILTSTONE. Orange brown, faint hydrocarbon odour at top.	0/1 0				
		End of Borehole 5.0 m					
Logged by		BJH		Sampled by		BJH/MBR	
Field Classification				Comments			
0 ... No obvious contamination				Push tube to 1.5 m			
1 ... Slight visual contamination and/or slight odour				Air 1.5 m to 5.0 m			
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							

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	20/06/98	Time	10:10	Location No	BH 19 (GW19)
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
0-0.15	0-0.15	FILL. Silty sandy clay, brown, fine to medium sand, some fine coal fragments, fine roots.	1		
0.15-0.35		Silty sandy CLAY. Brown, fine to medium sand.	0		
0.35-0.95	0.4-0.5	Silty sandy CLAY. Mottled orange and brown, fine sand, some sub rounded gravel towards base.	0		
0.95-1.8	1.0-1.1	Silty CLAY. Mottled dark brown, yellow, some orange, some siltstone fragments fine to coarse.	0		
1.8-5.5	2.0 3.0 4.0 5.0	Clayey SILTSTONE. Pale orange to yellow brown, noticeable hydrocarbon odour 2-2.5 m, becoming fainter with depth.	2 1 0 0		
		End of Borehole 5.5 m			
Logged by		BJH		Sampled by	
				BJH/MBR	
Field Classification			Comments		
0 ... No obvious contamination			Push tube to 1.5 m Air to 5.5 m		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	20/06/98	Time	10:30	Location No	BH 20
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		
0-0.15	0-0.15	FILL. Sandy silty clay, brown, layer of medium to coarse sand at base, some fine coal and gravel.	0/1				
0.15-0.5	0.4-0.5	Silty sandy CLAY. Brown, light brown, fine to medium sand, very silty, some orange and black ironstone staining towards base.	0				
0.5-1.0		Sandy silty CLAY. Orange over dark orange, some black ironstone staining, gravelly towards base.	0				
1.0-1.7	1.2-1.3	Silty CLAY. Mottled grey brown, yellow some black ironstone, some siltstone fragments.	0				
1.7-2.5	2.0	Clayey SILTSTONE. Yellow brown, hydrocarbon odour.	2				
2.5-5.5	3.0 4.0 5.0	SILTSTONE/Clayey SILTSTONE. Orange, faint hydrocarbon odour at top, becoming fainter.	1/2 0 0				
		End of Borehole 5.5 m					
Logged by		BJH		Sampled by		BJH/MBR	
Field Classification				Comments			
0 ... No obvious contamination				Push tube to 1.5 m			
1 ... Slight visual contamination and/or slight odour				Air to 5.5 m			
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							

Project	CANBERRA RAIL YARDS		Job Number	27K140A	
Date	20/06/98	Time	10:50	Location No	BH 21 (GW21)
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
0-0.2	0-0.15	FILL. Silty gravelly clay, brown, orange, yellow, coal and gravel fine to 30 mm, fine roots.	1		
0.2-0.5	0.4-0.5	Sandy Clayey SILT. Brown, fine to medium sand.	0		
0.5-1.1	1.0-1.1	Silty Sandy CLAY. Mottled grey brown, orange, some yellow, fine to medium sand, some fine gravel.	0		
1.1-1.7		Silty Sandy CLAY. Reddish brown, some grey, fine to medium sand, some fine quartzitic gravel, some siltstone fragments.	0		
1.7-5.5	2.0 3.0 4.0 5.0	Clayey SILTSTONE. Orange.	0 0 0 0		
		End of Borehole 5.5 m			
Logged by		BJH		Sampled by	
				BJH/MBR	
Field Classification			Comments		
0 ... No obvious contamination			Push tube to 1.5 m Air to 5.5 m		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	20/06/98	Time	11:20	Location No	BH 22 (GW22)
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
0-0.6	0-0.15 0.3-0.4	FILL. Silty gravelly clay, dark grey brown, light brown, some orange, ballast, some fine coal fragments.	1 2		
0.6-1.2	0.7-0.8	Silty Sandy CLAY. Light brown, fine to medium sand, becoming gravelly, some ironstone staining below 1.0 m.	0		
1.2-2.0	2.0	Silty CLAY. Red and grey, some gravel to 30 mm.	0		
2.0-2.7		Clayey SILT. Yellow brown (extremely weathered siltstone).	0		
2.7-5.5	3.0 4.0 5.0	SILTSTONE/Clayey SILTSTONE. Red.	0 0 0		
		End of Borehole 5.5 m			
Logged by		BJH		Sampled by	
		BJH/MBR			
Field Classification			Comments		
0 ... No obvious contamination			Push tube to 1.5 m		
1 ... Slight visual contamination and/or slight odour			Air to 5.5 m		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	20/06/98	Time	11:55	Location No	BH 23
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
0-0.15	0-0.15	FILL. Silty gravelly clay, light brown, ballast, some fine gravel, fine to medium sand.	0/1		
0.15-0.85	0.4-0.5	Silty CLAY. Light brown, orange and ironstone mottling, some fine sand.	0		
0.85-2.0	1.5 2.0	Silty CLAY. Mottled brown grey, some red, some fine gravel, faint hydrocarbon odour towards base.	0 1		
2.0-2.5	2.5	Silty CLAY. Yellow brown, strong hydrocarbon odour (no hydrocarbon staining).	3		
2.5-5.5	3.0 4.0 5.0	Clayey SILTSTONE. Brown to yellow brown, faint hydrocarbon odour at top.	1 0 0		
		End of Borehole 5.5 m			
Logged by		BJH		Sampled by	
		BJH/MBR			
Field Classification			Comments		
0 ... No obvious contamination			Push tube to 1.0 m Air to 5.5 m		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	20/06/98	Time	12:50	Location No	BH 24 (GW24)
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		
0-0.6	0-0.15 0.5-0.6	FILL. Gravelly silty clay, mottled brown, grey, yellow, hydrocarbon/kero odour towards base, ballast, gravel fine to coarse.	1 2/3				
0.6-0.8		Silty CLAY. Mottled grey, brown, ironstone mottling, some fine ironstone gravel, faint hydrocarbon/kero odour.	1				
0.8-1.1	0.9-1.0	Silty CLAY. Grey brown, some fine sand.	0/1				
1.1-1.8	1.5-1.6	Silty CLAY. Mottled orange brown, grey, brown, ironstone staining, hydrocarbon odour.	1/2				
1.8-3.0	2.0 3.0	Clayey SILTSTONE. Greyish yellow brown, hydrocarbon odour decreasing with depth.	3 1/2				
3.0-5.5	4.0 5.0	SILTSTONE. Orange, faint hydrocarbon odour.	0/1 0				
		End of Borehole 5.5 m					
Logged by		BJH		Sampled by		BJH/MBR	
Field Classification				Comments			
0 ... No obvious contamination				Push tube to 1.5 m Air to 5.5 m			
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							

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	20/06/98	Time	13:20	Location No	BH 25
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		
0-0.2	0-0.15	FILL. Sandy gravelly silt, brown, fine to medium sand, gravel fine to 20 mm.	0				
0.2-0.5	0.3-0.4	Silty CLAY. Dark orange brown, some fine quartzitic gravel, some fine ironstone gravel.	0				
0.5-1.0	0.6-0.7	Silty CLAY. Brown, some fine sand.	0				
1.0-1.3		Silty CLAY. Mottled orange and olive brown.	0				
1.3-3.0	1.4-1.5	Silty CLAY. Mottled grey and olive green.	0				
	2.0		0				
	3.0		0				
3.0-5.5	4.0	Clayey SILTSTONE. Light red.	0				
	5.0		0				
		End of Borehole 5.5 m					
Logged by		BJH		Sampled by		BJH/MBR	
Field Classification				Comments			
0 ... No obvious contamination				Push tube to 1.5 m Air to 5.5 m			
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							

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	20/06/98	Time	14:50	Location No	BH 26 (GW26)
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	0-0.1	FILL. Silty sandy clay, brown, orange brown, fine sand (disturbed natural).	0				
0.1-3.6	0.4-0.5	Silty CLAY. Mottled olive brown, some fine sand, occasional gravelly lenses.	0				
	1.0-1.1		0				
	2.0		0				
	3.0		0				
3.6-5.5	4.0	Clayey SILTSTONE. Yellow brown over orange and yellow brown.	0				
	5.0		0				
		End of Borehole 5.5 m					
Logged by		BJH		Sampled by		BJH/MBR	
Field Classification				Comments			
0 ... No obvious contamination							
1 ... Slight visual contamination and/or slight odour				Push tube to 1.5 m			
2 ... Visual contamination and/or odour				Air to 5.5 m			
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							

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	20/06/98	Time	14:20	Location No	BH 27
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		
0-0.2	0-0.15	FILL. Silty sandy clay, brown, fine to medium sand, some fine gravel (disturbed natural).	0				
0.2-0.7	0.4-0.5	Sandy Silty CLAY. Orange and yellow brown, fine to medium sand.	0				
0.7-3.6	1.5	Silty CLAY. Mottled brown, grey, yellow brown, some ironstone staining, some fine gravel.	0				
	2.0		0				
	3.0		0				
3.6-5.5	4.0	Clayey SILTSTONE. Red.	0				
	5.0		0				
		End of Borehole 5.5 m					
Logged by		BJH		Sampled by		BJH/MBR	
Field Classification				Comments			
0 ... No obvious contamination				Push tube to 1.5 m Air to 5.5 m			
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							

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	20/06/98	Time	13:55	Location No	BH 28 (GW28)
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
0-0.2	0-0.15	FILL. Silty clay, mottled brown, grey, some fine sand, some fine gravel.	0		
0.2-0.9	0.5-0.6	Silty Sandy CLAY. Brown, light brown over orange and olive green, fine to medium sand.	0		
0.9-1.4	1.2-1.3	Silty CLAY. Mottled brown, grey and orange, some ironstone staining, some fine gravel towards base.	0		
1.4-3.2	2.0 3.0	Silty CLAY. Olive brown, some fine sand, possible faint hydrocarbon odour.	0 0/1		
3.2-5.5	4.0 5.0	Clayey SILTSTONE. Red.	0 0		
		End of Borehole 5.5 m			
Logged by		BJH		Sampled by	
		BJH/MBR			
Field Classification			Comments		
0 ... No obvious contamination			Push tube to 1.5 m Air to 5.5 m		
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					

Project	CANBERRA RAIL YARDS		Job Number	27K140A	
Date	21/06/98	Time	9:10	Location No	BH 29
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
0-0.15	0-0.15	FILL. Sandy gravelly clay, dark grey, fine to coarse sand, fine gravel, some fine coal fragments.	1/2		
0.15-0.6	0.4-0.5	FILL. Sandy silty clay, mottled brown, light brown, grey, fine to coarse sand, some fine gravel and coal fragments.	0/1		
0.6-0.75	0.9-1.0	Silty sandy CLAY/clayey sandy SILT. Brown, fine to medium sand.	0		
0.75-1.3		Silty CLAY. Red, some fine sand.	0		
1.3-3.3	2.0 3.0	Silty CLAY. Mottled brown, orange, grey, some black ironstone staining, some fine ironstone gravel, faint hydrocarbon odour below 2.5 m.	0 0/1		
3.3-5.5	3.5 4.0 5.0	Clayey SILT/weathered SILTSTONE. Light brown, faint hydrocarbon odour near top	1 0 0		
		End of Borehole 5.5 m			
Logged by		BJH	Sampled by		BJH/MBR
Field Classification			Comments		
0 ... No obvious contamination					
1 ... Slight visual contamination and/or slight odour			Push tube to 1.5 m		
2 ... Visual contamination and/or odour			Air to 5.5 m		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	21/06/98	Time	9:35	Location No	BH 30 (GW30)
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		
0-0.2	0-0.15	FILL. Sandy clayey gravel, black, ballast and coal fine to coarse, fine to coarse sand.	2				
0.2-0.4	0.25-0.4	FILL. Silty clay, mottled orange brown and light brown, some fine gravel.	0/1				
0.4-0.75		Silty sandy CLAY. Light brown, fine to medium sand.	0				
0.75-1.8	0.8-0.9 2.0	Silty Sandy CLAY. Mottled brown, orange, some black ironstone staining, fine sand.	0				
1.8-2.5		Silty CLAY. Mottled grey, brown.	0				
2.5-5.5	3.0 4.0 5.0	Clayey SILT/Clayey SILTSTONE. Yellow brown, faint hydrocarbon odour around 3.5 m	0/1 0/1 0				
		End of Borehole 5.5 m					
Logged by		BJH		Sampled by		BJH/MBR	
Field Classification				Comments			
0 ... No obvious contamination				Push tube to 1.5 m Air to 5.5 m			
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							

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	21/06/98	Time	10:20	Location No	BH 31
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	0-0.1	FILL. Sandy clayey gravel, grey, ballast and fine gravel, fine to coarse sand.	1		
0.1-0.5	0.4-0.5	FILL. Silty sandy clay, mottled brown, grey, orange, fine to medium sand, some gravel to 25 mm.	0		
0.5-1.3	0.9-1.0	Silty Sandy CLAY. Mottled brown, orange, fine to medium sand, some black ironstone staining, some fine ironstone gravel.	0		
1.3-3.2	2.0 3.0	Silty CLAY. Mottled grey brown, some red.	0 0		
3.2-5.5	4.0 5.0	Clayey SILT/weathered SILTSTONE. Light brown to yellow brown.	0 0		
		End of Borehole 5.5 m			
Logged by		BJH		Sampled by	
		BJH			
Field Classification			Comments		
0 ... No obvious contamination			Push tube to 1.5 m		
1 ... Slight visual contamination and/or slight odour			Air to 5.5 m		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	21/06/98	Time	11:00	Location No	BH 32 (GW32)
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
0-0.95	0-0.15 0.5-0.6	FILL. Sandy clayey gravel, grey, brown, black, gravel, ballast, ash, brick fragments fine to coarse, fine to coarse sand.	2 1/2		
0.95-2.0	1.5 2.0	Silty CLAY. Brown, light brown.	0 0		
2.0-6.0	3.0 4.0 5.0 6.0	Clayey SILTSTONE. Brown, light brown.	0 0 0 0		
		End of Borehole 6.0 m			
Logged by		BJH		Sampled by	
		BJH			
Field Classification			Comments		
0 ... No obvious contamination			Push tube to 1.0 m		
1 ... Slight visual contamination and/or slight odour			Air to 6.0 m		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	21/06/98	Time	11:35	Location No	BH 33 (GW33)
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	0-0.1	FILL. Sandy silty clay, mottled brown, grey, fine to coarse sand, some fine gravel.	0		
0.1-1.0	0.4-0.5	FILL. Silty sandy clay, red brown, mottled yellow, fine to coarse sand.	0		
1.0-1.5	1.5	Silty CLAY. Brown, light grey, some fine sand.	0		
1.5-4.0	2.0 3.0 4.0	Clayey SILT. Light grey to light brown.	0 0 0		
4.0-5.5	5.0	Clayey SILT/SILTSTONE. Yellow brown to light brown.	0		
		End of Borehole 5.5 m			
Logged by		BJH		Sampled by	
		BJH			
Field Classification			Comments		
0 ... No obvious contamination			Push tube to 1.0 m		
1 ... Slight visual contamination and/or slight odour			air to 5.5 m		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	22/06/98	Time	9:50	Location No	BH 34 (GW34)
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	0-0.05	FILL. Silty clay, dark brown, fine gravel.	0				
0.05-0.7	0.05-0.7	Sandy Silty CLAY. Orange brown, fine to medium sand.	0				
0.7-1.2	0.7-1.2	Silty CLAY. Light brown, small gravel chips.	0 0				
1.2-2.6	2.0	Silty Gravelly CLAY. Olive brown, mottled orange, ironstone stained.	0				
2.6-5.5	3.0 4.0 5.0	SILTSTONE. Orange, yellow, consistent to depth, no hydrocarbon odour.	0				
		End of Borehole 5.5 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							

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	22/06/98	Time	10:30	Location No	BH 35 (GW35)
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	0-0.05	FILL. Silty Clay. Dark brown/red, medium to large gravel (ballast).	0		
0.05-0.6		Silty CLAY. Dark reddish brown, fine roots.	0		
0.6-1.1	0.6-1.1	Silty CLAY. Brown, small gravel chips.	0		
1.1-1.8	1.1-1.8	Silty CLAY. Brown, orange mottling, medium gravel chips.			
1.8-5.5	2.0 3.0 4.0 5.0	SILTSTONE. Purple, white, turning purple yellow at depth, hydrocarbon odour slight at 2.0 m, hydrocarbon odour strong at 3.0 m, hydrocarbon odour until ≈ 4.0 m.	1 2 2		
		End of Borehole 5.5 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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	22/06/98	Time		Location No	BH 36 (GW36)
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
0-0.2	0-0.2	FILL. Silty Clay, reddish brown, small gravel chips, fine root systems.	0		
0.2-0.51	0.2-0.51	Silty CLAY. Red brown, orange, yellow mottling turning yellow, medium stone chips, roots.	0		
0.51-0.7	0.51-0.7	Silty CLAY. Yellow, dry.	0		
0.7-1.9		Silty CLAY. Olive brown.	0		
1.9-2.5	2.0	Silty CLAY. Light brown, olive, medium gravel.	0		
2.5-5.5	3.0 4.0 5.0	SILTSTONE. Yellow purple, turning to yellow at depth (≈ 4.5).	0		
		End of Borehole 5.5 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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	22/06/98	Time	13:00	Location No	BH 37 (GW37)
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
0-0.40	0-0.4	Silty CLAY. Dark brown/black, small gravel, very moist.	0		
0.4-1.5	0.4-1.5	Silty CLAY. Dark grey/black, very moist, small stones.	0		
1.5-3.0	2.0 3.0	Silty Clayey SAND. Olive grey, turning lighter brown at depth, fine gravel, sand ≈ 50%.	0		
3.0-4.0	4.0	Sandy Silty CLAY. Light brown, very wet, fine to medium sand ≈ 80%.	0		
		End of Borehole 4.0 m			
Logged by		MBR		Sampled by	
		MBR			
Field Classification			Comments		
0 ... No obvious contamination			Standpipe in creek channel		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	22/06/98	Time	14:30	Location No	BH 38 (GW38)
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		
0-0.25	0-0.25	Silty CLAY. Red/brown, small gravel chips, orange mottling, small root systems.	0				
0.25-0.85	0.25-0.85	Silty CLAY. Orange/yellow mottling, small roots system.	0				
0.85-2.6	0.85-1.5 2.0	Silty CLAY. Orange/brown, yellow mottling, ironstone staining, small gravel and ironstone chips.	0				
2.6-5.5	3.0 4.0 5.0	Silty CLAY. Brown/red, ironstone chips, small gravel.	0				
		End of Borehole 5.5 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							

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time	8:00	Location No	BH 39 (GW39)
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	0-0.05	FILL. Silty clay, brown, large gravel, roots.	0		
0.05-0.10	0.05-0.10	FILL. Silty clay, orange, small gravel chips.	0		
0.1-0.7	0.1-0.7	FILL. Silty clay, dark grey, large gravel.	1		
0.7-6.0	1.0 2.0 3.0 4.0 5.0 6.0	FILL. Silty clay, grey, landfill waste, metal bits, large gravels.	1		
6.0-9.0	7.0 8.0 9.0	Sandy SILT. Light brown, 70% sand slurry.	0		
		End of Borehole 9.0 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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time		Location No	BH 40
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	0-0.05	FILL. Loamy clay, dark brown, root systems.	0		
0.05-0.38	0.05-0.38	FILL. Loamy clay, dark brown, small gravel, root systems.	0		
0.38-0.62	0.38-0.62	CLAY. Orange brown, dark orange mottling.	0		
0.62-1.0	0.62-1.0	CLAY. Olive brown, orange mottling, some ironstone chips, small gravel.	0		
End of Borehole 1.0 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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Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time		Location No	BH 41
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
0-0.15	0-0.15	Loamy CLAY. Dark brown, light brown mottling, small ironstone chips and root system.	0		
0.15-0.41	0.15-0.41	Silty CLAY. Orange red, small to medium ironstone chips.	0		
0.41-1.00	0.41-1.00	Silty CLAY. Orange red, yellow mottling, small ironstone chips.	0		
End of Borehole 1.0 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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time		Location No	BH 42
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	0-0.05	FILL. Loamy clay, dark brown, light brown mottling, root system.	0		
0.05-0.28	0.05-0.28	SILTY CLAY. Light brown, some ironstone chips, roots.	0		
0.28-0.71	0.28-0.71	CLAY. Dark red, small ironstone chips.	0		
0.71-1.00	0.71-1.00	CLAY. Olive brown, yellow orange mottling, small ironstone chips.	0		
		End of Borehole 1.0 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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time		Location No	BH 43
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
0-0.15	0-0.15	FILL. Clay, ballast and ash.	2		
0.15-0.57	0.15-0.57	Silty CLAY. Dark red, yellow mottling, small ironstone chips.	0		
0.57-0.77	0.57-0.77	Silty CLAY. Orange brown, yellow mottling, ironstone stained with small chips.	0		
		End of Borehole 0.77 m Terminated Due to High Resistance			

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			

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time		Location No	BH 44
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
0-0.15	0-0.15	CLAY. Yellow red, orange mottling, large gravel, ironstone chips.	0		
0.15-0.48	0.15-0.48	Silty CLAY. Yellow orange, red mottling, small gravel.	0		
0.48-0.80	0.48-0.80	Silty CLAY. Olive brown, dark brown, orange mottling, small amount of light grey mottling.	0		
0.80-1.00	0.80-1.00	SILTSTONE. Fractured, olive silty clay inserts, some ironstone staining.	0		
		End of Borehole 1.0 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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time		Location No	BH 45
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
0-0.31	0-0.31	FILL. Ash, cinder, large gravel.	2		
0.31-0.54	0.31-0.54	Silty CLAY. Red brown, ironstone chips, large gravel.	0		
		End of Borehole 0.54 m Terminated Due to High Resistance			
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time		Location No	BH 46
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
0-0.21	0-0.21	FILL. Loamy clay, dark brown, medium and large gravel.	0		
0.21-0.70	0.21-0.70	Silty CLAY. Dark orange brown, light yellow mottling, ironstone chips.	0		
0.70-1.00	0.70-1.00	Silty CLAY. Dark brown orange and yellow mottling, ironstone staining and chips.	0		
		End of Borehole 1.0 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					

Project	CANBERRA RAIL YARDS		Job Number	27K140A	
Date	24/06/98	Time		Location No	BH 47
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
0-0.10	0-0.10	FILL. Loamy clay, dark brown, some ash, medium gravel.	1		
0.10-0.31	0.10-0.31	Silty CLAY. Yellow/brown, some gravel, large and small gravel chips.	0		
0.31-1.00	0.31-1.00	Silty CLAY. Olive/yellow, brown mottling, small gravel chips.	0		
		End of Borehole 1.0 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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time		Location No	BH 48
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
0-0.15	0-0.15	FILL. Clay, dark black, ash, medium gravel, root system.	2		
0.15-0.40	0.15-0.40	FILL. Clay, large gravel chips and ironstone chips.	0		
		End of Borehole 0.4 m Terminated Due to High Resistance			
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	22/06/98	Time	10.20	Location No	TP 101
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
0-3.6	0-0.15 1.0 3.0 3.5	FILL. Gravelly sandy clay, brown, yellow brown, gravel fine to coarse, brick fragments, whole bricks, scrap metal, some bitumen, fine to coarse sand, some glass fragments, some pieces of plastic.	1 1 1 1		
3.6-4.0	3.7	Sandy Silty CLAY. Grey, fine to medium sand, some organic/marine odour (> PL).	1		
4.0-4.5	4.5	Silty Sandy CLAY. Mottled orange brown and grey, fine sand (≈PL).	0		
		End of Test Pit 4.5 m			
Logged by		BJH		Sampled by	
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	22/06/98	Time	11.05	Location No	TP 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
0-2.3/3.7*	0.15 0.4 1.2 2.6	FILL. Building rubble brown, some sandy clay, bricks, scrap metal, pieces of timber, some burnt timber/ashes, old shoes, beer bottles, pieces of plastic, wire, paper bags, fragments of tartan wool, some slate fragments, lens of burnt foliage at 2.5-2.7 m, copy of Sydney Telegraph (August 2, 1964) from around 2-2.5 m, old car filters, broken piece of asbestos pipe, concrete slab fragments.	0 2 1 3		
2.3/3.7*-4.5	3.7 4.5	Silty CLAY. Grey, some fine sand, faint colour at top (especially under burnt foliage area) becoming mottled orange towards base.	0/1 0		
		End of Test Pit 4.5 m			

Logged by	BJH	Sampled by	BJH
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 * Top of natural 2.3 m on western side sloping to 3.7 m on eastern side.	
PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301			

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	22/06/98	Time	11.55	Location No	TP 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
0-1.1	0-0.15 1.0	FILL. Sandy clay over building rubble, yellow brown, brown, off-white, grey brown, gravel fine to coarse, brick fragments, timber fragments, clay tiles, broken concrete pipe.	0 0/1		
1.1-3.7	1.3 2.7	FILL. Rubbish including burnt foliage, broken plastic flower pots, scrap metal, scrap fabric/material, timber fragments old tin bucket, paper, plastic, some odour becoming stronger with depth, newspapers from 1964, 65 at approx 2.5 m depth, glass bottles, old clothing, some grey clay and sand soil mixed in.	2/3 2/3		
3.7-4.7	3.7 4.7	Silty CLAY. Mottled grey, some orange mottling towards base, some fine sand. 			

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	22/06/98	Time	13.15	Location No	TP 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
0-0.9	0-0.15	FILL. Sandy clayey gravel, yellow brown, brown gravel fine to coarse, sand fine to coarse, some cobbles/boulders.	0		
0.9-2.2	1.0	FILL. Gravelly sandy clay, red, brown, gravel fine to coarse, sand fine to coarse, occasional fine coal fragments.	0/1		
2.2-3.4	2.6	FILL. Rubbish, some clay, black, some coal, glass fragments, brick fragments, timber, burnt timber/foilage, scrap metal, bottles, scrap fabric/material.	2/3		
3.4-4.6	3.6	Silty CLAY. Grey, some fine to medium sand, some orange mottling towards base.	0		
		End of Test Pit 4.6 m			

Logged by	BJH	Sampled by	BJH
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 Located in depression groundwater flowing into base of pit (rapidly).	
PPK Environment & Infrastructure Pty Ltd, 101 Pirie Street, Adelaide SA 5000. Tel: 8405 4300 Fax: 8405 4301			

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	22/06/98	Time	14.00	Location No	TP 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
0-0.6	0-0.15	FILL. Sandy gravelly clay, brown, orange brown, fine to coarse sand, fine to coarse gravel.	0		
0.6-4.1	1.0	FILL. Rubbish, grey sand, scrap metal, ash, pieces of asbestos cement roof sheeting, glass bottles, plastic fragments, milk cartons, brick fragments, timber fragments, burnt paper, large concrete lumps, car wheel, strong odour below 2.5 m (ash), disturbed natural soil below 3.5 m, bed springs.	2		
	2.9		2/3		
	3.8		2/3		
4.1-4.8	4.4	Silty CLAY. Mottled grey, some fine to medium sand.	0		
		End of Test Pit 4.8 m			

Logged by	BJH	Sampled by	BJH
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			

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	22/06/98	Time	14.50	Location No	TP 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		
0-0.6	0-0.15	FILL. Clayey sand gravel, red over yellow brown, gravel fine to coarse, cobbles, fine to coarse sand, fine roots.	0				
0.6-3.9	1.0 3.1	FILL. Rubbish, some grey sand, refrigerators, bottles, scrap metal, asbestos cement sheeting fragments, concrete fragments, timber fragments, some ash, burnt timber, occasional green flecks, fishing net, some odour (ash).	3 2				
3.9-4.8	4.2 4.8	Silty CLAY. Mottled grey, fine to medium sand, gravel lens below 4.5 m.	0 0				
End of Test Pit 4.8 m							
Logged by		BJH		Sampled by		BJH	
Field Classification				Comments			
0 ... No obvious contamination				Groundwater rapid into hole at base (gravel layer).			
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							

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	22/06/98	Time	15.40	Location No	TP 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
0-0.6	0-0.15	FILL. Clayey sandy gravel, brown, yellow brown, some ash/coal, gravel fine to coarse, sand fine to coarse.	1		
0.6-4.0	1.0 3.4	FILL. Rubbish, grey sand and yellow gravel, concrete fragments, plastic, clothing, scrap metal, large concrete fragments, car tyres, car parts, one household oil heating tank. Rubbish appears to have been burnt just above natural.	2 2		
4.0-5.1	4.3 5.1	Silty CLAY. Grey, black at surface, some odour at top, faint orange colour at bottom. <			

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time	8.05	Location No	TP 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
0-0.4	0-0.5	FILL. Layered sandy clay and gravelly sand, orange brown, light grey, brown, gravel fine to coarse, sand fine to coarse.	0/1		
0.4-2.0	1.0	FILL. Sandy gravelly clay and rubbish, orange brown to grey brown, fine to coarse sand, fine to coarse gravel, bricks, plastic bottles, concrete block, scrap metal, some ash, demolished concrete street lighting poles.	2		
2.0-2.9	2.5 2.9	Sandy gravelly CLAY. Mottled light orange and yellow, fine to medium sand, gravel fine to 30 mm.	0/1 0		
		End of Test Pit 2.9 m			
Logged by		BJH		Sampled by	
		BJH			
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time	8.50	Location No	TP 109
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	0-0.15	FILL. Sandy gravelly clay, grey brown, dark orange, fine to coarse sand, fine to coarse gravel, fine roots.	0		
0.7-1.1		FILL. Building rubble and yellow brown clayey sand, bricks, concrete.	0/1		
1.1-3.2	1.2 2.7	FILL. Rubbish, large amount of ash, noticeable odour, scrap metal, wire, car parts, newspapers, timber fragments, bottles, steel pipes.	3 3		
3.2-3.8	3.5 3.8	Silty Sandy CLAY. Mottled grey, green, fine to medium sand, orange mottling below 3.5 m.	0 0		
		End of Test Pit 3.8 m			
Logged by		BJH		Sampled by	
		BJH			
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time	9.30	Location No	TP 110
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	0-0.15	FILL. Sandy gravelly clay, brown orange brown, fine to coarse sand, gravel fine to coarse, some broken glass, some fine ash.	1		
0.7-3.5	1.3 2.6 3.2	FILL. Rubbish and orange brown sand, grey sand and clay, scrap metal, bricks, lots of ash, timber fragments, bottles, broken glass, faint odour.	2/3 2 3		
3.5-4.5	3.9 4.5	Silty CLAY. Mottled grey, green, some fine to medium sand, some orange mottling towards base.	0 0		
End of Test Pit 4.5 m					
Logged by		BJH		Sampled by	
		BJH			
Field Classification			Comments		
0 ... No obvious contamination			Possible slow groundwater inflow at base (possible perched water).		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time	11.20	Location No	TP 111
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
0-1.5	0-0.15 1.3	FILL. Sandy gravelly clay, brown, yellow brown, grey, fine to coarse sand, fine to coarse gravel.	0 0/1		
1.5-3.6	1.8 3.6	FILL. Rubbish and sandy clay, grey, black, yellow brown, scrap metal, timber fragments, concrete fragments, pieces of fibre cement sheeting, wire, plastic, some odour, fabric/material, car tyre.	2/3 2/3		
		End of Test Pit 3.6+ m			
Logged by		BJH		Sampled by	
		BJH			
Field Classification			Comments		
0 ... No obvious contamination			Groundwater intercepted at 2.7 m in rubbish fill.		
1 ... Slight visual contamination and/or slight odour			Natural soil not encountered due to groundwater.		
2 ... Visual contamination and/or odour			Depth of pit ≥3.6 m (depth uncertain due to groundwater).		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time	11.50	Location No	TP 112
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
0-0.15	0-0.15	FILL. Silty sandy clay, dark grey brown, fine to medium sand, fine roots.	0		
0.15-1.1	0.9	FILL. Sandy gravelly clay, yellow brown, orange, layer at grey ash at 0.9 m.	1/2		
1.1-1.6	1.5	Silty Sandy CLAY. Mottled yellow brown, grey, orange, fine to medium sand.	0		
1.6-2.7	2.7	Sandy Silty CLAY. Mottled grey, red, brown, fine to medium sand.	0		
		End of Test Pit 2.7 m			
Logged by		BJH	Sampled by		BJH
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time	14.00	Location No	TP 113
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
0-0.15	0-0.15	FILL. Silty sandy clay, dark grey brown, fine to medium sand, fine roots.	0		
0.15-0.25		FILL. Silty clay, brown to dark orange brown, some fine to medium sand, some gravel to 30 mm.			
0.25-1.5	0.5	Silty CLAY. Mottled yellow brown, orange and grey, some fine sand.	0		
		End of Test Pit 1.5 m			
Logged by		BJH		Sampled by	
		BJH			
Field Classification			Comments		
0 ... No obvious contamination			Broken gravity sewer pipe in pit.		
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time	16.05	Location No	TP 114
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	0-0.1	FILL. Clayey gravelly sand, dark grey to black, fine to coarse, coal fine to 40 mm.	2		
0.1-0.2		FILL. Silty sandy clay, orange to red brown, fine sand.			
0.2-0.6	0.5	FILL. Sandy clayey gravel, grey, ash and coal fine to coarse, fine to coarse sand, some timber fragments.	2		
0.6-0.75		FILL. Sandy silty clay, dull reddish brown, some fine ash/coal (disturbed natural).	0/1		
0.75-1.3	0.8	Silty Sandy CLAY. Yellow brown orange, some black ironstone, fine to medium sand.	0		
1.3-1.5	1.4	Clayey SILSTONE. Light grey, orange mottling, extremely weathered, highly fractured.	0		
		End of Test Pit 1.5 m			
Logged by		BJH	Sampled by		BJH
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	24/06/98	Time	16.30	Location No	TP 115
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
0-0.3	0-0.15	FILL. Sandy gravel, black, grey, ash and coal fine to 60 mm, fine to coarse sand.	2/3		
0.3-0.85	0.4-0.6	FILL. Clayey sandy gravel, dull red over mottled yellow, orange and grey, gravel fine to coarse, cobbles, boulders to 300 mm, fine to coarse sand, some perched water.	0/1		
0.85-1.25	1.0	Silty Sandy CLAY. Red brown, fine sand.	0		
1.25-1.8		Silty Sandy CLAY. Mottled grey, yellow brown, orange, some ironstone to 20 mm.	0		
		End of Test Pit 1.8 m			
Logged by		BJH		Sampled by	
		BJH			
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					

Project	CANBERRA RAIL YARDS			Job Number	27K140A
Date	25/06/98	Time	8.20	Location No	TP 116
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
0-0.65	0-0.15 0.5	FILL. Sandy clayey gravel, black, grey, some bands of orange brown clay, ash and coal fine to 40 mm some gravel, fine to coarse sand.	2/3 3		
0.65-1.15	1.0	Silty Sandy CLAY. Grey, some red mottling, fine sand.	0		
1.15-1.7	1.5	Silty CLAY. Mottled yellow brown and grey, becoming greyer with depth.	0		
End of Test Pit 1.7 m					
Logged by		BJH		Sampled by	
Field Classification		Comments			
0 ... No obvious contamination		Old stormwater pipe in pit.			
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					