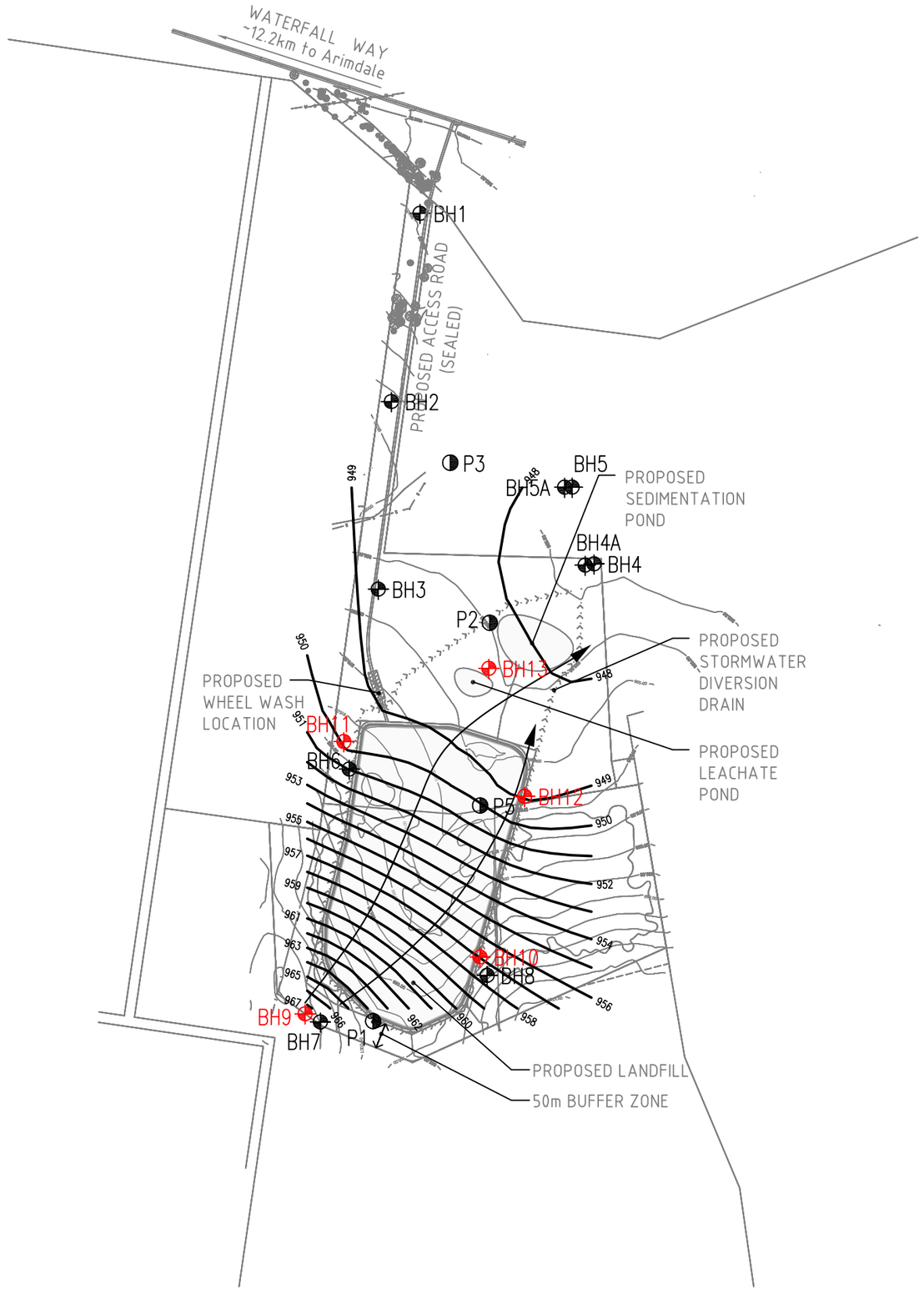
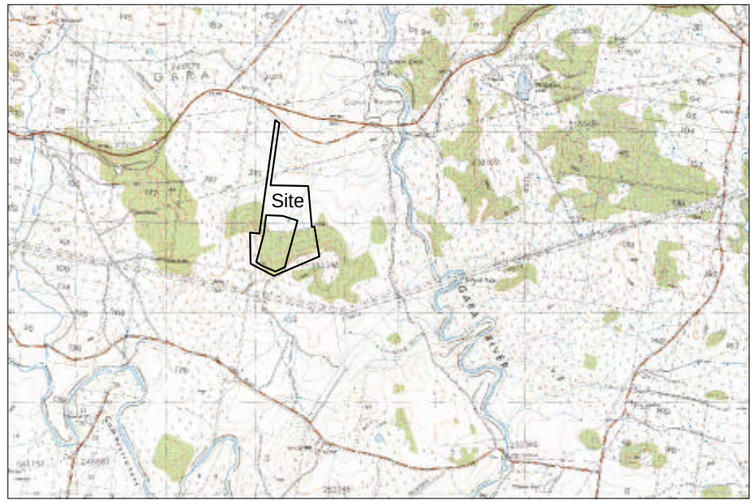
Appendix A

Drawings





Locality Plan
N.T.S.

P4

Legend

- Bore Hole location (April 2007)
- Bore Hole location
- Piezometer Location (EA Systems, 2006)
- Groundwater flow
- Equipotential contour

Note: Drawing adapted by plan supplied by Maunsell Australia Pty Ltd, Drawing No C005

0 100 200 300 400 500

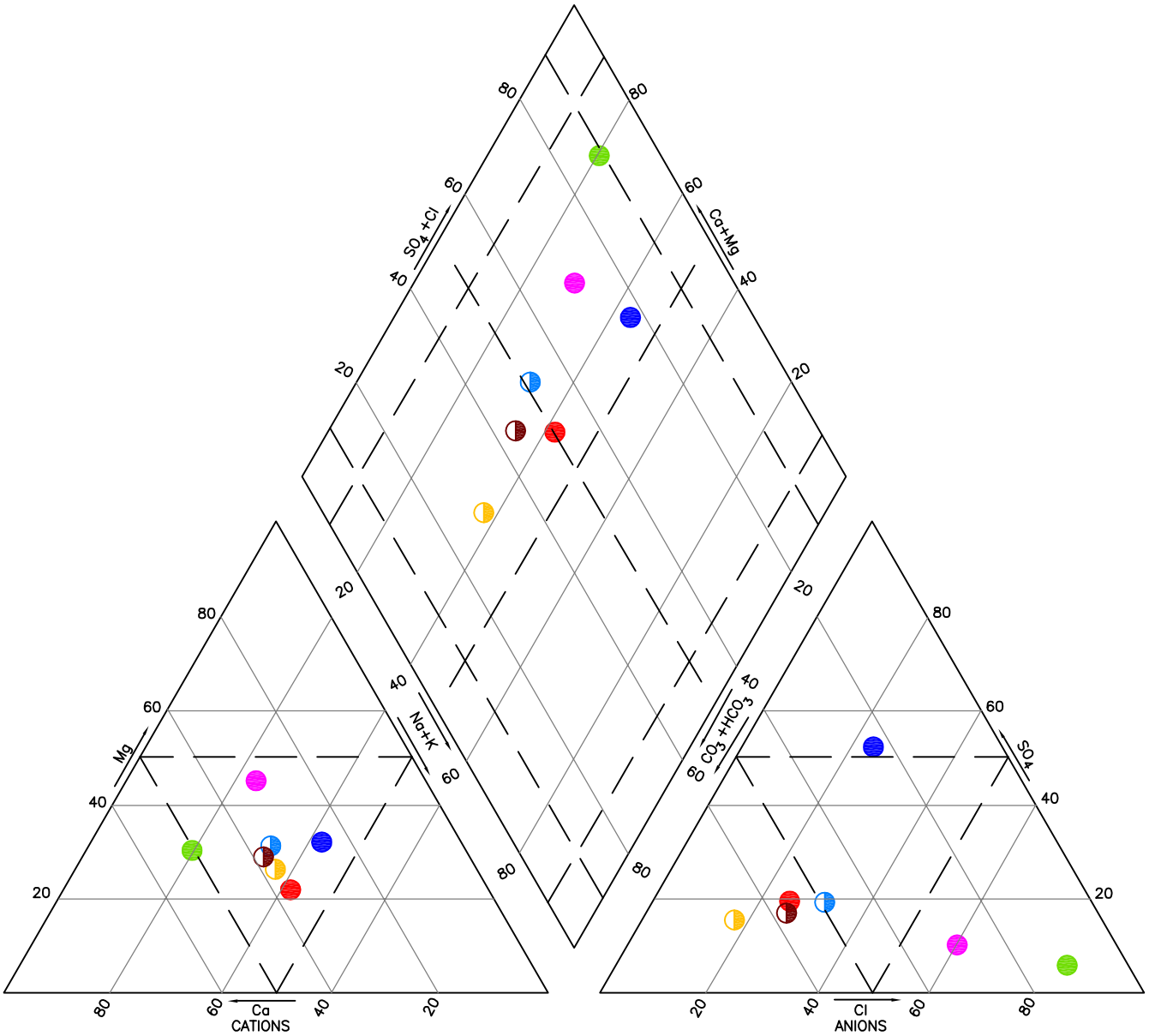
Meters

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

SITE PLAN AND BORE HOLE LOCATION PROPOSED ARMIDALE LAND FILL APRIL 2007

CLIENT	Maunsell Australia Pty Ltd			PROJECT No	5929
DRAWN BY	CW	SCALE	1 : 10000 (A3)	DRAWING No 1	REV 0
APPROVED BY	MA	DATE	29/5/07	OFFICE	NEWCASTLE

CDT-DWG-A3H-001/1



PERCENT OF TOTAL
MILLIEQUIVALENTS PER LITRE

LEGEND

BH4 BH9 BH11 BH13

BH5 BH10 BH12

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GROUNDWATER CHEMISTRY
APRIL 2007
PROPOSED ARMIDALE LANDFILL SITE

CLIENT	Maunsell Australia Pty Ltd						
DRAWN BY	CW	SCALE	As Shown	PROJECT No	5929	OFFICE	Newcastle
APPROVED BY	MA	DATE	29/5/07	DRAWING No	2	Rev	0

CDT-DWG-A4V-001/1

Appendix B

Engineering Logs

Symbol Index Sheet

General Soil Description Sheets

General Rock Description Sheets

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG

BORE No: BH9-LOCATION 1

CLIENT: Maunsell Australia Pty Ltd
PROJECT: Installation of Monitoring Wells
LOCATION: Proposed Landfill, Armidale

PROJECT No: 5929
DATE: 16/4/07
SURFACE LEVEL: Existing
SHEET 1 of 2
METHOD OF ADVANCE: Pneumatic DHH (Down Hole Hammer)

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
None Encountered		0.6		TOPSOIL, Silty/Sandy, rock outcrops and boulders up to 0.5m in diameter and some grass roots
		2.0		Fractured ROCK (MUDSTONE), interspersed with extremely weathered rock lenses
				SANDSTONE, Sandy fragments and fines, dry, yellow/brown
		15.0		ARGILLITE, dry, red/brown, small discrete rock fragments with powdery fines
				Becoming grey with depth, less fines

2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5

LOGGED: CW | CHECKED: MA | DATE: 16/5/07

CRS-TBL-A4V-002/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG

BORE No: BH9-LOCATION 1

CLIENT: Maunsell Australia Pty Ltd
PROJECT: Installation of Monitoring Wells
LOCATION: Proposed Landfill, Armidale

PROJECT No: 5929
DATE: 16/4/07
SURFACE LEVEL: Existing
SHEET 2 of 2
METHOD OF ADVANCE: Pneumatic DHH (Down Hole Hammer)

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
None encountered		27.5 30.0 32.5 35.0 37.5 40.0 42.5 45.0 47.5		ARGILLITE, dry, red/brown, small discrete rock fragments with powdery fines 36–40m Minimal recovery End Bore Hole BH9–Location 1 at 41.0m (no confining pressure in bore)

LOGGED: CW | CHECKED: MA | DATE: 16/5/07

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RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG

BORE No: BH9-LOCATION 2

CLIENT: Maunsell Australia Pty Ltd
PROJECT: Installation of Monitoring Wells
LOCATION: Proposed Landfill, Armidale

PROJECT No: 5929
DATE: 16/4/07
SURFACE LEVEL: Existing
SHEET 1 of 2
METHOD OF ADVANCE: Pneumatic DHH (Down Hole Hammer)

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
				Rock outcrops and boulders up to 0.5m in diameter overlying Fractured ROCK (MUDSTONE), with extremely weathered rock and clay, slightly moist, yellow/brown
		2.0		SANDSTONE, Sandy fragments and fines, dry, yellow/brown
		2.5		
		5.0		Becoming darker with depth
		7.5		
		10.0		
None encountered		12.5		
		15.0		
		17.5		
		20.0		
		22.5		Thick clay band 23–24m

LOGGED: CW | CHECKED: MA | DATE: 16/5/07

CRS-TBL-A4V-002/1

RCA AUSTRALIA
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TEST BORE LOG

BORE No: BH9-LOCATION 2

CLIENT: Maunsell Australia Pty Ltd
PROJECT: Installation of Monitoring Wells
LOCATION: Proposed Landfill, Armidale

PROJECT No: 5929
DATE: 16/4/07
SURFACE LEVEL: Existing
SHEET 2 of 2
METHOD OF ADVANCE: Pneumatic DHH (Down Hole Hammer)

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)
				SANDSTONE, Sandy fragments and fines, dry, yellow/brown
		26.0		ARGILLITE, dry, red/brown fines with discrete grey rock fragments
				No recovery >30m
				End Bore Hole BH9–Location 2 at 33.0m (No confining pressure in bore)

27.5
30.0
32.5
None encountered
35.0
37.5
40.0
42.5
45.0
47.5

LOGGED: CW | CHECKED: MA | DATE: 16/5/07

CRS–TBL–A4V–002/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG

BORE No: BH9-LOCATION 3

CLIENT: Maunsell Australia Pty Ltd
PROJECT: Installation of Monitoring Wells
LOCATION: Proposed Landfill, Armidale

PROJECT No: 5929
DATE: 16/4/07
SURFACE LEVEL: 1014.03m, AHD
SHEET 1 of 3
METHOD OF ADVANCE: Pneumatic DHH (Down Hole Hammer)

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
		1.5		Rock outcrops and boulders up to 0.3m in diameter overlying Fractured ROCK (MUDSTONE), with extremely weathered rock and clay, soft to firm clay	Concrete / Backfill
				SANDSTONE, Sandy fragments and fines, dry, yellow/ brown	Bentonite Seal
		20.0		AGILLITE, dry, discreet fragments, red/brown and grey, occasional thin clay bands encountered	Backfill / Backfill

2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5

LOGGED: CW | CHECKED: MA | DATE: 16/5/07

CRS-TBL-A4V-002/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG

BORE No: BH9-LOCATION 3

CLIENT: Maunsell Australia Pty Ltd
PROJECT: Installation of Monitoring Wells
LOCATION: Proposed Landfill, Armidale

PROJECT No: 5929
DATE: 16/4/07
SURFACE LEVEL: 1014.03m AHD
SHEET 2 of 3
METHOD OF ADVANCE: Pneumatic DHH (Down Hole Hammer)

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
		27.5		ARGILLITE, dry, discreet fragments, red/brown and grey, occasional thin clay bands encountered	Backfill / Backfill
		30.0			
		32.5			
		35.0			
		37.5			
		40.0			
		42.5			
		45.0			
		47.5			

LOGGED: CW | CHECKED: MA | DATE: 16/5/07

CRS-TBL-A4V-002/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG

BORE No: BH9-LOCATION 3

CLIENT: Maunsell Australia Pty Ltd
PROJECT: Installation of Monitoring Wells
LOCATION: Proposed Landfill, Armidale

PROJECT No: 5929
DATE: 16/4/07
SURFACE LEVEL: 1014.03m, AHD
SHEET 3 of 3
METHOD OF ADVANCE: Pneumatic DHH (Down Hole Hammer)

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
55.0 ▽				ARGILLITE, dry, discreet fragments, red/brown and grey, occasional thin clay bands encountered Becoming moist	Backfill Bentonite Seal Screened 53.5–59.5m Gravel Gravel
				End Bore Hole BH9–Location 3 at 60.0m	

52.5
55.0
57.5
60.0
62.5
65.0
67.5
70.0
72.5

LOGGED: CW	CHECKED: MA	DATE: 16/5/07

CRS–TBL–A4V–002/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG
BORE No: BH10

CLIENT: Maunsell Australia Pty Ltd
PROJECT: Installation of Monitoring Wells
LOCATION: Proposed Landfill, Armidale

PROJECT No: 5929
DATE: 17/4/07
SURFACE LEVEL: 993.78m, AHD
SHEET 1 of 2
METHOD OF ADVANCE: Pneumatic DHH (Down Hole Hammer)

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
				CLAY, firm to stiff, slightly moist, orange/brown	Backfill
		7.2		SANDSTONE, extremely weathered, Sandy fragments and fines, dry, yellow/brown, becoming less weathered with depth	Bentonite Seal
		16.0		ARGILLLITE, dry, discrete fragments with powdery fines, grey	Backfill
		22.0		ARGILLITE, interbedded layers, dry, yellow/brown and grey	

2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5

LOGGED: CW | CHECKED: MA | DATE: 16/5/07

CRS-TBL-A4V-002/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG
BORE No: BH10

CLIENT: Maunsell Australia Pty Ltd
PROJECT: Installation of Monitoring Wells
LOCATION: Proposed Landfill, Armidale

PROJECT No: 5929
DATE: 17/4/07
SURFACE LEVEL: 977.58m, AHD
SHEET 2 of 2
METHOD OF ADVANCE: Pneumatic DHH (Down Hole Hammer)

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
				ARGILLITE, dry, discreet fragments, red/brown, occasional thin clay bands encountered	Backfill
27.5					
30.0		30.0		ARGILLITE, dry, discreet fragments with powdery fines, grey	
32.5					
35.0					
37.5					
40.0					Bentonite Seal
41.0 ▽					Gravel
42.5					Screened 41.0–47.0m
45.0					Gravel
47.5				End Bore Hole BH10 at 47.0m	Backfill

LOGGED: CW | CHECKED: MA | DATE: 16/5/07

CRS–TBL–A4V–002/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG
BORE No: BHII

CLIENT: Maunsell Australia Pty Ltd
PROJECT: Installation of Monitoring Wells
LOCATION: Proposed Landfill, Armidale

PROJECT No: 5929
DATE: 17/4/07
SURFACE LEVEL: 993.78m, AHD
SHEET 1 of 2
METHOD OF ADVANCE: Pneumatic DHH (Down Hole Hammer)

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
		2.5		CLAY, firm to stiff, slightly moist, orange/brown, interbedded with bands of extremely weathered rock	Bentonite Seal
				SANDSTONE, extremely weathered, dry, Sandy rock fragments with sandy fines, yellow/brown, becoming less weathered with depth	Backfill

2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5

Backfill

LOGGED: CW | CHECKED: MA | DATE: 16/5/07

CRS-TBL-A4V-002/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG
BORE No: BH11

CLIENT: Maunsell Australia Pty Ltd
PROJECT: Installation of Monitoring Wells
LOCATION: Proposed Landfill, Armidale

PROJECT No: 5929
DATE: 17/4/07
SURFACE LEVEL: 977.58m, AHD
SHEET 2 of 2
METHOD OF ADVANCE: Pneumatic DHH (Down Hole Hammer)

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
				SANDSTONE, extremely weathered, dry, Sandy rock fragments with sandy fines, yellow/brown, becoming less weathered with depth	Bentonite Seal; Gravel; Screened 30.0–36.0m; Gravel
				End Bore Hole BH11 at 36.0m	

27.5
30.0
31.0
32.5
35.0
37.5
40.0
42.5
45.0
47.5

LOGGED: CW | CHECKED: MA | DATE: 16/5/07

CRS–TBL–A4V–002/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG
BORE No: BH12

CLIENT: Maunsell Australia Pty Ltd
PROJECT: Installation of Monitoring Wells
LOCATION: Proposed Landfill, Armidale

PROJECT No: 5929
DATE: 18/4/07
SURFACE LEVEL: 969.79m, AHD
SHEET 1 of 2
METHOD OF ADVANCE: Pneumatic DHH (Down Hole Hammer)

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
		2.0		CLAY with occasional rock fragments, firm slightly moist, yellow/brown and grey	Backfil; Bentonite Seal; Backfil
				SANDSTONE, extremely weathered, Sandy fragments with powdery fines, dry, grey/brown, becoming less weathered with depth	

2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5

LOGGED: CW | CHECKED: MA | DATE: 16/5/07

CRS-TBL-A4V-002/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG
BORE No: BH12

CLIENT: Maunsell Australia Pty Ltd
PROJECT: Installation of Monitoring Wells
LOCATION: Proposed Landfill, Armidale

PROJECT No: 5929
DATE: 18/4/07
SURFACE LEVEL: 969.79m, AHD
SHEET 2 of 2
METHOD OF ADVANCE: Pneumatic DHH (Down Hole Hammer)

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
				SANDSTONE, extremely weathered, Sandy fragments with powdery fines, dry, grey/brown, becoming less weathered with depth	Backfill
27.5					
30.0		30.0		ARGILLITE, dry, discrete fragments, hard rock with powdery fines, grey	Bentonite Seal
32.5					Gravel
35.0 35.0 ▽					Screened 34.0–40.0m
37.5					Gravel
40.0				End Bore Hole BH12 at 40.0m	Backfill
42.5					
45.0					
47.5					

LOGGED: CW | CHECKED: MA | DATE: 16/5/07

CRS–TBL–A4V–002/1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

TEST BORE LOG
BORE No: BH13

CLIENT: Maunsell Australia Pty Ltd
PROJECT: Installation of Monitoring Wells
LOCATION: Proposed Landfill, Armidale

PROJECT No: 5929
DATE: 18/4/07
SURFACE LEVEL: 961.7m, AHD
SHEET 1 of 1
METHOD OF ADVANCE: Pneumatic DHH (Down Hole Hammer)

GROUND WATER	SAMPLE TESTING AND DEPTH	DEPTH (m)	STRATA	DESCRIPTION (SOIL TYPE, STRENGTH, MOISTURE, COLOUR, ORIGIN)	BORE CONSTRUCTION
		1.0		CLAY, stiff, dry to slightly moist, red/brown	Backfill; Bentonite Seal; Backfill
		12.0		SANDSTONE, extremely weathered, Sandy fragments with sandy fines, dry, yellow/brown, becoming less weathered with depth	
17.0 ▽				ARGILLITE, dry, discrete fragments with powdery fines, dry, grey	Bentonite Seal; Screened 16.0–22.0m; Gravel; Gravel
		22.0		End Bore Hole BH13 at 22.0m	

LOGGED: CW | CHECKED: MA | DATE: 16/5/07

CRS–TBL–A4V–002/1

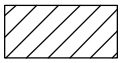
SYMBOLS INDEX SHEET

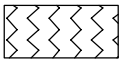
This sheet should be read in conjunction with all test hole log sheets and any idealised geological sections.

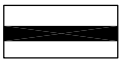
RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

SOIL SYMBOLS

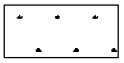
Primary Components


Clay

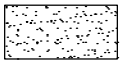

Topsoil

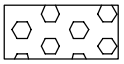

Bitumen

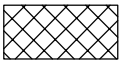

Silt

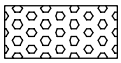

Peat/Organic Soil

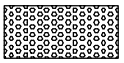

Concrete/ road pavement


Sand

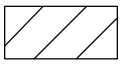

Cobbles/boulders (>60mm in size)

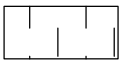

Fill


Gravel

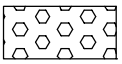

Ironstone gravel, laterite

Secondary Components


Clayey


Silty

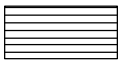

Sandy

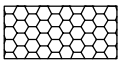

Gravelly

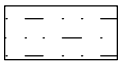
NOTE: Primary soil component shown in capitals and preceded by secondary components. Minor components noted in description. For example Sandy CLAY, with some gravel. The main component is clay with secondary sand and minor gravel. Laboratory classification testing should be undertaken where quantitative soil description is required.

ROCK SYMBOLS

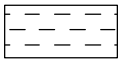
Sedimentary

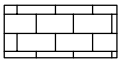

Claystone

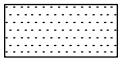

Conglomerate


Siltstone

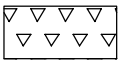

Coal

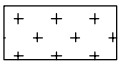

Shale/Laminite


Limestone

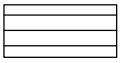

Sandstone

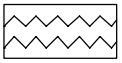
Igneous


Volcanic (fine grained–basalt)


Plutonic (coarse grained–granite)

Metamorphic


Low grade (slate, schist)


High grade (gneiss, quartzite)

SYMBOLS

Testing and Sampling

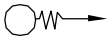
D	Disturbed sample
B	Bulk sample
U50	Undisturbed tube sample (50mm diameter)
SPT	Standard penetration test
N	SPT blows per 300mm
R	SPT refusal
PP	Pocket penetrometer value (kPa)
Sv	Shear vane, peak undrained shear strength (kPa)
○	Point load test (axial)
●	Point load test (diametrical)
PID	Photoionisation detector reading (ppm) (note: comments regarding odour are based on olfactory evidence)

Groundwater


Groundwater level at time of measurement


Water outflow (loss)


Water inflow (make)


Seepage

Groundwater levels unless otherwise indicated refer to the level of free water encountered in the bores or test holes at the time of measurement. The actual groundwater level may differ depending on material permeability, climate, tides etc.

Well Construction


Screened interval


Filter zone


Hole collapse


Bentonite seal


Lockable cover

GENERAL SOIL DESCRIPTION SHEET

This sheet should be read in conjunction with all test hole log sheets and any idealised geological sections.

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SOIL DESCRIPTION

Descriptive Terms

Cohesive	–	Soils that exhibit cohesion or bonding between particles (ie clay, silt).
Granular	–	Soils that have little cohesion or bonding between particles (ie sand, gravel).
Dry	–	Looks and feels dry. Dry cohesive soils are hard, friable or powdery and dry granular soils are cohesionless and free running.
Moist	–	Soil feels cool and looks dark in colour. Moist cohesive soils can be moulded and moist granular soils tend to cohere.
Wet	–	Free water present.
Cemented	–	Secondary bonding between soil particles. Weakly cemented soils are easily broken up by hand.

SOIL GRAIN SIZE

CLAY	SILT	SAND			GRAVEL			COBBLES	BOULDERS
		Fine	Medium	Coarse	Fine	Medium	Coarse		
0.002mm	0.06mm	0.2mm	0.6mm	2mm	6mm	20mm	60mm	200mm	

SOIL STRENGTH

Consistency of Cohesive Soils[1]

Term	Pocket Penetrometer Value (kPa)	Field Guide
Very soft	<25	Surface Penetrated by fist
Soft	25-50	Easily penetrated by thumb
Firm	50-100	Penetrated by thumb with effort
Stiff	100-200	Indented by thumb
Very stiff	200-400	Surface only marked by thumbnail
Hard	>400	

Density of Granular Soils[2]

Term	Density Index (%)
Very loose	<15
Loose	15-35
Medium dense	35-65
Dense	65-85
Very dense	85-100

NOTE: 1. Consistency can be assessed based on insitu testing or laboratory testing on undisturbed samples. Undrained shear strengths can be estimated from field pocket penetrometer values by dividing by 2. Quantification of undrained shear strength should be based on insitu or laboratory testing.

2. Density can only be assessed on the basis of insitu testing

SOIL ORIGIN

Weathered in Place Soils

Residual soil	–	Rock completely broken down to soil, no rock structure visible.
Extremely weathered material	–	Rock predominantly broken down to soil with some relict rock structure present.

Transported Soils

Alluvial soil	–	Deposited by streams and rivers.
Slopewash soils	–	Deposited on slopes by gravity and sheet flow.
Aeolian soils	–	Deposited by wind.
Lacustrine soils	–	Deposited in lakes.
Marine soils	–	Deposited in bays, beaches and estuaries.
Slide debris	–	Deposited by mass movement (colluvium).
Fill	–	Deposited by man.

GENERAL ROCK DESCRIPTION SHEET

This sheet should be read in conjunction with all test hole log sheets and any idealised geological sections.

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The following rock description is intended for the geotechnical logging of diamond drill core and is also applicable for the mapping of natural exposures and cuttings.

In most rocks the presence of defects and the effects of weathering have a significant influence on the engineering behaviour of the rock mass.

The term **rock substance** refers to the description of material characteristics such as rock type, grain size, colour, strength and weathering.

The term **rock mass** refers to the properties of the overall rock mass/body and involves description of defects (discontinuities or fractures in the rock substance such as joints, faults bedding partings etc), weathering and structure.

ROCK SUBSTANCE – DESCRIPTIVE TERMS

Rock name : Simple rock names are used rather than precise geological classifications.

$I_s(50)$: Point load strength index.

Grain size/ type : The grains of a rock can be described in terms of size (mm) and shape on the basis of appropriate terms used in the General Soil Description Sheet. Where identified, individual minerals should be described.

Strength : Strength is estimated on the basis of tactile appraisal and confirmed by point load strength testing where shown. The rock strength description refers to the strength of the rock material and not to the strength of the rock mass which may be considerably weaker due to the effect of rock defects. Unconfined compressive strength testing should be undertaken where rock strengths need to be quantified.

Term	Symbol	$I_s(50)$ MPa	Field Guide (The core refers to 150mm long x 50mm dia. sample)
Extremely Low	EL	<0.03	Soil strength property description appropriate
Very Low	VL	0.03-0.1	May be crumbled in the hand. Sandstone is 'sugary' and friable.
Low	L	0.1-0.3	The core may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.
Medium	M	0.3-1.0	The core may be broken by hand with considerable difficulty. Readily scored with knife
High	H	1.0-3.0	The core cannot be broken by unaided hands, can be slightly scratched or scored with knife.
Very High	VH	3.0-10.0	The core may be broken with hand held hammer. Cannot be scratched with knife.
Extremely High	EH	>10.0	The core is difficult to break with hand held hammer. Rings when struck with hammer.

*I_s (50) = Point load strength index

Weathering :

Term	Symbol	Definition
Extremely Weathered	EW	The rock exhibits soil-like properties though the texture of the original rock is still evident.
Highly Weathered	HW	Limonite staining or colour change affects the whole of the rock mass. Signs of chemical or physical decomposition is evident throughout the whole of the rock mass.
Moderately Weathered	MW	Staining extends throughout the whole of the rock mass and the original colour is no longer recognisable.
Slightly Weathered	SW	Partial staining or decolouration of the rock mass, usually by limonite, has taken place.
Fresh	F	Rock mass unaffected by weathering.

The assignment of rock weathering terms is subjective and is used for identification purposes only

GENERAL ROCK DESCRIPTION SHEET

This sheet should be read in conjunction with all test hole log sheets and any idealised geological sections.

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ROCK MASS – DESCRIPTIVE TERMS

Defects : **Defects** are fractures in the rock mass and include joints, faults, shear planes, cleavages and bedding partings. Description of defects is important as defects generally control the overall engineering behaviour of the rock mass.

Defect spacing refers to the degree of fracturing or spacing of all natural fractures. Artificial fractures induced by drilling, boxing or transport of rock core are not included in the defect spacing log. The delineation of artificial fractures is subjective.

Defect Description

Type	:	Parting	(along rock layering/bedding)
		Joint	(across rock layering/bedding)
		Shear	(zone or seam of rock movement resulting in crushing/fracturing)
		Clayey seam	(infilled or extremely weathered layer)
		Vein	(secondary mineralisation along a fracture)
Shape	:	Planar	
		Curved	
		Undulose/Stepped	
		Irregular	
Roughness	:	Rough	
		Smooth	
		Striated	(slickenside, indicative of shear movement)
Infill	:	Clean	(defect surfaces clean)
		Stained	(surfaces stained by limonite (iron–oxide) or similar)
		Veneer	(thin surface coating $\leq$1mm thick)
		Coating	(surface coating 1mm–5mm thick)
		Seam	(5mm–100mm thick)
		Zone	(>100mm thick)

Orientation of defects is described relative to the horizontal.

Dip = the maximum angle of a defect plane relative to the horizontal surface

Strike = orientation relative to magnetic north of the line of intersection of a defect plane and the horizontal surface

Structure : Structure refers to larger scale rock mass features such as bedding, folding, lineation and flow banding etc. Where no structure is discernible the term massive is used.
In sedimentary rocks the following terms can be used to describe the spacing of bedding/stratification.

Term	Spacing of Bedding (mm)
Laminated	<20
Thinly bedded	20–200
Medium bedded	200–600
Thickly bedded	600–2000
Very thickly bedded	>2000

Appendix C

Results Summary Table

Sample ID	PQL	95% Fresh [A]	BH4	BH5	BH9	BH10	BH11	BH12	BH13
Date			20/04/2007	20/04/2007	18/04/2007	19/04/2007	19/04/2007	19/04/2007	19/04/2007
Sample Purpose			Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Sample Appearance			Mod turbid	Mod turbid	Clear	Clear	Slt Turbid	Clear	Slt turbid
Sample collected by			CW	CW	CW	CW	CW	CW	CW
Physical Parameters									
Field pH			7.61	7.76	7.63	7.63	7.71	7.54	7.71
pH (pH units)	0.01	6.5 - 9.0	6.77	7.51	6.82	6.79	6.84	6.74	6.74
Alkalinity									
Hydroxide Alkalinity as CaCO3	1000		<1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	1000		<1	<1	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	1000		577	826	219	274	388	547	458
Total Alkalinity as CaCO3	1000		577	826	219	274	388	547	458
Dissolved Major Anions									
Sulphate	1000		149	1480	56	66	104	87	101
Disolved Major Cations									
Calcium	1000		135	335	58	339	89	114	114
Magnesium	1000		52	254	68	118	49	43	44
Sodium	1000		178	655	75	149	103	131	122
Potassium	1000		1	5	8	4	<1	1	1
Fluoride									
Fluoride	100		0.3	0.3	0.6	0.1	0.2	0.2	0.2
Chloride									
Chloride	1000		141	489	260	928	116	76.6	120
NOx									
Nitrite	10		0.033	0.026	0.005	0.005	0.005	0.005	0.014
Nitrate as N	10	700	0.149	0.005	0.833	4.36	0.311	0.112	0.158
Nitrite + Nitrate as N	10		0.182	0.031	0.838	4.365	0.316	0.117	0.172
Ionic Balance									
Total Anions (meq/L)	10		18.6	61.1	12.9	33	13.2	14.9	14.6
Total Cations (meq/L)	10		18.8	66.2	12	33.3	13	15	14.6
Ionic Balance (%)	10		0.53	3.94	3.63	0.42	0.88	0.3	0.05
Heavy Metals									
Iron	50	*300*	1.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese	1	1900	1.4	0.594	0.35	0.018	0.047	0.042	0.068
Non Metallic Inorganics									
Ammonia as N	10	900	0.158	0.543	0.175	0.417	0.111	0.131	0.108
Total Organic Carbon									
TOC	1000		6	37	3	4	3	4	5
Phenols									
Total Phenols	50	320	<0.050	0.085	<0.050	<0.050	<0.050	<0.050	<0.050
Fumigants									
2.2-Dichloropropane	5		<5	<5	<5	<5	<5	<5	<5
1.2-Dichloropropane	5	*900*	<5	<5	<5	<5	<5	<5	<5
cis-1.3-Dichloropropylene	5		<5	<5	<5	<5	<5	<5	<5
trans-1.3-Dichloropropylene	5		<5	<5	<5	<5	<5	<5	<5
1.2-Dibromoethane (EDB)	5		<5	<5	<5	<5	<5	<5	<5
Halogenated Aliphatic Compounds									
Dichlorodifluoromethane	50		<50	<50	<50	<50	<50	<50	<50
Chloromethane	50		<50	<50	<50	<50	<50	<50	<50
Vinyl chloride	50		<50	<50	<50	<50	<50	<50	<50
Bromomethane	50		<50	<50	<50	<50	<50	<50	<50
Chloroethane	50		<50	<50	<50	<50	<50	<50	<50
Trichlorofluoromethane	50		<50	<50	<50	<50	<50	<50	<50
1.1-Dichloroethene	5		<5	<5	<5	<5	<5	<5	<5
Iodomethane	5		<5	<5	<5	<5	<5	<5	<5
trans-1.2-Dichloroethene	5		<5	<5	<5	<5	<5	<5	<5
1.1-Dichloroethane	5	*90*	<5	<5	<5	<5	<5	<5	<5
cis-1.2-Dichloroethene	5		<5	<5	<5	<5	<5	<5	<5
1.1.1-Trichloroethane	5	*270*	<5	<5	<5	<5	<5	<5	<5
1.1-Dichloropropylene	5		<5	<5	<5	<5	<5	<5	<5
Carbon Tetrachloride	5	*240*	<5	<5	<5	<5	<5	<5	<5
1.2-Dichloroethane	5	*1900*	<5	<5	<5	<5	<5	<5	<5
Trichloroethene	5		<5	<5	<5	<5	<5	<5	<5
Dibromomethane	5		<5	<5	<5	<5	<5	<5	<5
1.1.2-Trichloroethane	5	6500	<5	<5	<5	<5	<5	<5	<5
1.3-Dichloropropane	5	*0.1*	<5	<5	<5	<5	<5	<5	<5
Tetrachloroethene	5		<5	<5	<5	<5	<5	<5	<5
1.1.1.2-Tetrachloroethane	5		<5	<5	<5	<5	<5	<5	<5
trans-1.4-Dichloro-2-butene	5		<5	<5	<5	<5	<5	<5	<5
cis-1.4-Dichloro-2-butene	5		<5	<5	<5	<5	<5	<5	<5
1.1.2.2-Tetrachloroethane	5	*400*	<5	<5	<5	<5	<5	<5	<5
1.2.3-Trichloropropane	5		<5	<5	<5	<5	<5	<5	<5
Pentachloroethane	5	*80*	<5	<5	<5	<5	<5	<5	<5
1.2-Dibromo-3-chloropropane	5		<5	<5	<5	<5	<5	<5	<5
Hexachlorobutadiene	5		<5	<5	<5	<5	<5	<5	<5
Halogenated Aromatic Compounds									
Chlorobenzene	5		<5	<5	<5	<5	<5	<5	<5
Bromobenzene	5		<5	<5	<5	<5	<5	<5	<5
2-Chlorotoluene	5		<5	<5	<5	<5	<5	<5	<5
4-Chlorotoluene	5		<5	<5	<5	<5	<5	<5	<5
1.3-Dichlorobenzene	5	260	<5	<5	<5	<5	<5	<5	<5
1.4-Dichlorobenzene	5	60	<5	<5	<5	<5	<5	<5	<5
1.2-Dichlorobenzene	5	160	<5	<5	<5	<5	<5	<5	<5
1.2.4-Trichlorobenzene	5	170	<5	<5	<5	<5	<5	<5	<5
1.2.3-Trichlorobenzene	5	10	<5	<5	<5	<5	<5	<5	<5
Trihalomethanes									
Chloroform	5	*370*	<5	<5	6	<5	6	<5	<5
Bromodichloromethane	5		<5	<5	<5	<5	<5	<5	<5
Dibromochloromethane	5		<5	<5	<5	<5	<5	<5	<5
Bromoform	5		<5	<5	<5	<5	<5	<5	<5

All results in µg/L
PQL = Practical Quantitation Limit.
[A] ANZECC 2000 95% Protection Level for Fresh Water
Guidelines in *italics* are low level reliability guidelines
Total Phenolics guideline based on Phenol
Results shown in **BOLD** are in excess of the primary acceptance criteria: 95% Fresh

Appendix D

Laboratory Certificates of Analysis

ALS Environmental

CERTIFICATE OF ANALYSIS

Client	: ROBERT CARR & ASSOCIATES P/L	Laboratory	: Environmental Division Sydney	Page	: 1 of 9
Contact	: MR CRAIG WELLINGS	Contact	: Victor Kedicioglu	Work Order	: ES0705218
Address	: P O BOX 175 CARRINGTON NSW AUSTRALIA 2294	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164		
E-mail	: craigw@rca.com.au	E-mail	: Victor.Kedicioglu@alsenviro.com		
Telephone	: 49029200	Telephone	: 61-2-8784 8555		
Facsimile	: 49029299	Facsimile	: 61-2-8784 8500		
Project	: 5929	Quote number	: SY/099/06	Date received	: 23 Apr 2007
Order number	: - Not provided -			Date issued	: 1 May 2007
C-O-C number	: 202536			No. of samples	- Received : 7
Site	: - Not provided -				Analysed : 7

ALSE - Excellence in Analytical Testing

NATA Accredited Laboratory 825

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Position	Department
Ankit Joshi		Inorganics - NATA 825 (10911 - Sydney)
Celine Conceicao	Spectroscopist	Inorganics - NATA 825 (10911 - Sydney)
Ken Reid	Manager	Newcastle - NATA 825 (1656 - Newcastle)
Rassem Ayoubi	Senior Organic Chemist	Organics - NATA 825 (10911 - Sydney)

ALS Environmental

Comments

This report for the ALSE reference ES0705218 supersedes any previous reports with this reference. Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- **Analytical Results for Samples Submitted**
- **Surrogate Recovery Data**

The analytical procedures used by ALS Environmental have been developed from established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insuffient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits). Where LOR of reported result differ from standard LOR, this may be due to high moisture, reduced sample amount or matrix interference. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number, LOR = Limit of Reporting. * Indicates failed Surrogate Recoveries.

Specific comments for Work Order **ES0705218**

It has been noted that NO2 is greater than NOX (sample ID BH5), however this difference is within the limits of experimental variation.

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: BH9 Sample Matrix Type / Description: WATER Sample Date / Time: 18 Apr 2007 15:00 Laboratory Sample ID: ES0705218-001	BH10 WATER 19 Apr 2007 15:00 ES0705218-002	BH11 WATER 19 Apr 2007 15:00 ES0705218-003	BH12 WATER 19 Apr 2007 15:00 ES0705218-004	BH13 WATER 19 Apr 2007 15:00 ES0705218-005
EA005: pH								
pH Value		0.01	pH Unit	6.82	6.79	6.84	6.74	6.74
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	219	274	388	547	458
Total Alkalinity as CaCO3		1	mg/L	219	274	388	547	458
ED040F: Dissolved Major Anions								
Sulphate as SO4 2-	14808-79-8	1	mg/L	56	66	104	87	101
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1.0	mg/L	260	928	116	76.6	120
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	58	339	89	114	114
Magnesium	7439-95-4	1	mg/L	68	118	49	43	44
Sodium	7440-23-5	1	mg/L	75	149	103	131	122
Potassium	7440-09-7	1	mg/L	8	4	<1	1	1
EG020F: Dissolved Metals by ICP-MS								
Manganese	7439-96-5	0.001	mg/L	0.350	0.018	0.047	0.042	0.068
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.6	0.1	0.2	0.2	0.2
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.010	mg/L	0.175	0.417	0.111	0.131	0.108
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N		0.010	mg/L	<0.010	<0.010	<0.010	<0.010	0.014
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.010	mg/L	0.833	4.36	0.311	0.112	0.158
EK059G: NOX as N by Discrete Analyser								
Nitrite + Nitrate as N		0.010	mg/L	0.833	4.36	0.311	0.112	0.172
EN055: Ionic Balance								
Total Anions		0.01	meq/L	12.9	33.0	13.2	14.9	14.6
Total Cations		0.01	meq/L	12.0	33.3	13.0	15.0	14.6
Ionic Balance		0.01	%	3.63	0.42	0.88	0.30	0.05
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon		1	mg/L	3	4	3	4	5
EP035G: Total Phenol by Discrete Analyser								
Phenols (Total)		0.050	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050

ALS Environmental

Analytical Results

				Client Sample ID :	BH9	BH10	BH11	BH12	BH13
				Sample Matrix Type / Description :	WATER	WATER	WATER	WATER	WATER
				Sample Date / Time :	18 Apr 2007 15:00	19 Apr 2007 15:00	19 Apr 2007 15:00	19 Apr 2007 15:00	19 Apr 2007 15:00
				Laboratory Sample ID :					
Analyte	*CAS number*	*LOR*	*Units*		ES0705218-001	ES0705218-002	ES0705218-003	ES0705218-004	ES0705218-005
EP074D: Fumigants									
2.2-Dichloropropane	594-20-7	5	µg/L		<5	<5	<5	<5	<5
1.2-Dichloropropane	78-87-5	5	µg/L		<5	<5	<5	<5	<5
cis-1.3-Dichloropropylene	10061-01-5	5	µg/L		<5	<5	<5	<5	<5
trans-1.3-Dichloropropylene	10061-02-6	5	µg/L		<5	<5	<5	<5	<5
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L		<5	<5	<5	<5	<5
EP074E: Halogenated Aliphatic Compounds									
Dichlorodifluoromethane	75-71-8	50	µg/L		<50	<50	<50	<50	<50
Chloromethane	74-87-3	50	µg/L		<50	<50	<50	<50	<50
Vinyl chloride	75-01-4	50	µg/L		<50	<50	<50	<50	<50
Bromomethane	74-83-9	50	µg/L		<50	<50	<50	<50	<50
Chloroethane	75-00-3	50	µg/L		<50	<50	<50	<50	<50
Trichlorofluoromethane	75-69-4	50	µg/L		<50	<50	<50	<50	<50
1.1-Dichloroethene	75-35-4	5	µg/L		<5	<5	<5	<5	<5
Iodomethane	74-88-4	5	µg/L		<5	<5	<5	<5	<5
trans-1.2-Dichloroethene	156-60-5	5	µg/L		<5	<5	<5	<5	<5
1.1-Dichloroethane	75-34-3	5	µg/L		<5	<5	<5	<5	<5
cis-1.2-Dichloroethene	156-59-2	5	µg/L		<5	<5	<5	<5	<5
1.1.1-Trichloroethane	71-55-6	5	µg/L		<5	<5	<5	<5	<5
1.1-Dichloropropylene	563-58-6	5	µg/L		<5	<5	<5	<5	<5
Carbon Tetrachloride	56-23-5	5	µg/L		<5	<5	<5	<5	<5
1.2-Dichloroethane	107-06-2	5	µg/L		<5	<5	<5	<5	<5
Trichloroethene	79-01-6	5	µg/L		<5	<5	<5	<5	<5
Dibromomethane	74-95-3	5	µg/L		<5	<5	<5	<5	<5
1.1.2-Trichloroethane	79-00-5	5	µg/L		<5	<5	<5	<5	<5
1.3-Dichloropropane	142-28-9	5	µg/L		<5	<5	<5	<5	<5
Tetrachloroethene	127-18-4	5	µg/L		<5	<5	<5	<5	<5
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L		<5	<5	<5	<5	<5
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L		<5	<5	<5	<5	<5
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L		<5	<5	<5	<5	<5
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L		<5	<5	<5	<5	<5
1.2.3-Trichloropropane	96-18-4	5	µg/L		<5	<5	<5	<5	<5
Pentachloroethane	76-01-7	5	µg/L		<5	<5	<5	<5	<5
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L		<5	<5	<5	<5	<5
Hexachlorobutadiene	87-68-3	5	µg/L		<5	<5	<5	<5	<5
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	5	µg/L		<5	<5	<5	<5	<5
Bromobenzene	108-86-1	5	µg/L		<5	<5	<5	<5	<5

ALS Environmental

Analytical Results

	Client Sample ID :	BH9	BH10	BH11	BH12	BH13
	Sample Matrix Type / Description :	WATER	WATER	WATER	WATER	WATER
	Sample Date / Time :	18 Apr 2007 15:00	19 Apr 2007 15:00	19 Apr 2007 15:00	19 Apr 2007 15:00	19 Apr 2007 15:00
	Laboratory Sample ID :	ES0705218-001	ES0705218-002	ES0705218-003	ES0705218-004	ES0705218-005

Analyte	CAS number	LOR	Units					
EP074F: Halogenated Aromatic Compounds								
2-Chlorotoluene	95-49-8	5	µg/L	<5	<5	<5	<5	<5
4-Chlorotoluene	106-43-4	5	µg/L	<5	<5	<5	<5	<5
1.3-Dichlorobenzene	541-73-1	5	µg/L	<5	<5	<5	<5	<5
1.4-Dichlorobenzene	106-46-7	5	µg/L	<5	<5	<5	<5	<5
1.2-Dichlorobenzene	95-50-1	5	µg/L	<5	<5	<5	<5	<5
1.2.4-Trichlorobenzene	120-82-1	5	µg/L	<5	<5	<5	<5	<5
1.2.3-Trichlorobenzene	87-61-6	5	µg/L	<5	<5	<5	<5	<5
EP074G: Trihalomethanes								
Chloroform	67-66-3	5	µg/L	6	<5	6	<5	<5
Bromodichloromethane	75-27-4	5	µg/L	<5	<5	<5	<5	<5
Dibromochloromethane	124-48-1	5	µg/L	<5	<5	<5	<5	<5
Bromoform	75-25-2	5	µg/L	<5	<5	<5	<5	<5
EP074S: VOC Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	106	118	115	112	111
Toluene-D8	2037-26-5	0.1	%	97.3	107	102	101	98.7
4-Bromofluorobenzene	460-00-4	0.1	%	97.6	101	102	101	98.0

ALS Environmental

Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID: BH4 Sample Matrix Type / Description: WATER Sample Date / Time: 20 Apr 2007 15:00 Laboratory Sample ID: ES0705218-006	Client Sample ID: BH5 Sample Matrix Type / Description: WATER Sample Date / Time: 20 Apr 2007 15:00 Laboratory Sample ID: ES0705218-007			
EA005: pH								
pH Value		0.01	pH Unit	6.77	7.51			
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1			
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1			
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	577	826			
Total Alkalinity as CaCO3		1	mg/L	577	826			
ED040F: Dissolved Major Anions								
Sulphate as SO4 2-	14808-79-8	1	mg/L	149	1480			
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1.0	mg/L	141	489			
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	135	335			
Magnesium	7439-95-4	1	mg/L	52	254			
Sodium	7440-23-5	1	mg/L	178	655			
Potassium	7440-09-7	1	mg/L	1	5			
EG020F: Dissolved Metals by ICP-MS								
Manganese	7439-96-5	0.001	mg/L	1.40	0.594			
Iron	7439-89-6	0.05	mg/L	1.30	<0.05			
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.3	0.3			
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.010	mg/L	0.158	0.543			
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N		0.010	mg/L	0.033	0.026			
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.010	mg/L	0.149	<0.010			
EK059G: NOX as N by Discrete Analyser								
Nitrite + Nitrate as N		0.010	mg/L	0.182	<0.010			
EN055: Ionic Balance								
Total Anions		0.01	meq/L	18.6	61.1			
Total Cations		0.01	meq/L	18.8	66.2			
Ionic Balance		0.01	%	0.53	3.94			
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon		1	mg/L	6	37			
EP035G: Total Phenol by Discrete Analyser								
Phenols (Total)		0.050	mg/L	<0.050	0.085			

ALS Environmental

Analytical Results

				Client Sample ID :	BH4	BH5			
				Sample Matrix Type / Description :	WATER	WATER			
				Sample Date / Time :	20 Apr 2007 15:00	20 Apr 2007 15:00			
				Laboratory Sample ID :					
Analyte	*CAS number*	*LOR*	*Units*		ES0705218-006	ES0705218-007			
EP074D: Fumigants									
2.2-Dichloropropane	594-20-7	5	µg/L		<5	<5			
1.2-Dichloropropane	78-87-5	5	µg/L		<5	<5			
cis-1.3-Dichloropropylene	10061-01-5	5	µg/L		<5	<5			
trans-1.3-Dichloropropylene	10061-02-6	5	µg/L		<5	<5			
1.2-Dibromoethane (EDB)	106-93-4	5	µg/L		<5	<5			
EP074E: Halogenated Aliphatic Compounds									
Dichlorodifluoromethane	75-71-8	50	µg/L		<50	<50			
Chloromethane	74-87-3	50	µg/L		<50	<50			
Vinyl chloride	75-01-4	50	µg/L		<50	<50			
Bromomethane	74-83-9	50	µg/L		<50	<50			
Chloroethane	75-00-3	50	µg/L		<50	<50			
Trichlorofluoromethane	75-69-4	50	µg/L		<50	<50			
1.1-Dichloroethene	75-35-4	5	µg/L		<5	<5			
Iodomethane	74-88-4	5	µg/L		<5	<5			
trans-1.2-Dichloroethene	156-60-5	5	µg/L		<5	<5			
1.1-Dichloroethane	75-34-3	5	µg/L		<5	<5			
cis-1.2-Dichloroethene	156-59-2	5	µg/L		<5	<5			
1.1.1-Trichloroethane	71-55-6	5	µg/L		<5	<5			
1.1-Dichloropropylene	563-58-6	5	µg/L		<5	<5			
Carbon Tetrachloride	56-23-5	5	µg/L		<5	<5			
1.2-Dichloroethane	107-06-2	5	µg/L		<5	<5			
Trichloroethene	79-01-6	5	µg/L		<5	<5			
Dibromomethane	74-95-3	5	µg/L		<5	<5			
1.1.2-Trichloroethane	79-00-5	5	µg/L		<5	<5			
1.3-Dichloropropane	142-28-9	5	µg/L		<5	<5			
Tetrachloroethene	127-18-4	5	µg/L		<5	<5			
1.1.1.2-Tetrachloroethane	630-20-6	5	µg/L		<5	<5			
trans-1.4-Dichloro-2-butene	110-57-6	5	µg/L		<5	<5			
cis-1.4-Dichloro-2-butene	1476-11-5	5	µg/L		<5	<5			
1.1.2.2-Tetrachloroethane	79-34-5	5	µg/L		<5	<5			
1.2.3-Trichloropropane	96-18-4	5	µg/L		<5	<5			
Pentachloroethane	76-01-7	5	µg/L		<5	<5			
1.2-Dibromo-3-chloropropane	96-12-8	5	µg/L		<5	<5			
Hexachlorobutadiene	87-68-3	5	µg/L		<5	<5			
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	5	µg/L		<5	<5			
Bromobenzene	108-86-1	5	µg/L		<5	<5			

ALS Environmental

Analytical Results

				Client Sample ID :	BH4	BH5			
				Sample Matrix Type / Description :	WATER	WATER			
				Sample Date / Time :	20 Apr 2007 15:00	20 Apr 2007 15:00			
				Laboratory Sample ID :					
Analyte	*CAS number*	*LOR*	*Units*		ES0705218-006	ES0705218-007			
EP074F: Halogenated Aromatic Compounds									
2-Chlorotoluene	95-49-8	5	µg/L		<5	<5			
4-Chlorotoluene	106-43-4	5	µg/L		<5	<5			
1.3-Dichlorobenzene	541-73-1	5	µg/L		<5	<5			
1.4-Dichlorobenzene	106-46-7	5	µg/L		<5	<5			
1.2-Dichlorobenzene	95-50-1	5	µg/L		<5	<5			
1.2.4-Trichlorobenzene	120-82-1	5	µg/L		<5	<5			
1.2.3-Trichlorobenzene	87-61-6	5	µg/L		<5	<5			
EP074G: Trihalomethanes									
Chloroform	67-66-3	5	µg/L		<5	<5			
Bromodichloromethane	75-27-4	5	µg/L		<5	<5			
Dibromochloromethane	124-48-1	5	µg/L		<5	<5			
Bromoform	75-25-2	5	µg/L		<5	<5			
EP074S: VOC Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		113	117			
Toluene-D8	2037-26-5	0.1	%		104	106			
4-Bromofluorobenzene	460-00-4	0.1	%		102	110			

ALS Environmental

Surrogate Control Limits

Matrix Type: WATER - Surrogate Control Limits

Surrogate Control Limits

Method name	*Analyte name*	*Lower Limit*	*Upper Limit*
EP074: Volatile Organic Compounds			
EP074S: VOC Surrogates	1,2-Dichloroethane-D4	80	120
	Toluene-D8	88	110
	4-Bromofluorobenzene	86	115

ALS Environmental

QUALITY CONTROL REPORT

Client	:	**ROBERT CARR & ASSOCIATES P/L**	**Laboratory**	: Environmental Division Sydney	**Page**	:	1 of 14
Contact	:	MR CRAIG WELLINGS	**Contact**	: Victor Kedicioglu			
Address	:	P O BOX 175 CARRINGTON NSW AUSTRALIA 2294	**Address**	: 277-289 Woodpark Road Smithfield NSW Australia 2164	**Work order**	:	**ES0705218**
					Amendment No.	:	
Project	:	5929	**Quote number**	: SY/099/06	**Date received**	:	23 Apr 2007
Order number	:	- Not provided -			**Date issued**	:	1 May 2007
C-O-C number	:	202536					
Site	:	- Not provided -					
E-mail	:	craigw@rca.com.au	**E-mail**	: Victor.Kedicioglu@alsenviro.com	**No. of samples**		
Telephone	:	49029200	**Telephone**	: 61-2-8784 8555	**Received**	:	7
Facsimile	:	49029299	**Facsimile**	: 61-2-8784 8500	**Analysed**	:	7

This final report for the ALSE work order reference ES0705218 supersedes any previous reports with this reference.
Results apply to the samples as submitted. All pages of this report have been checked and approved for release.
This report contains the following information:

- Laboratory Duplicates (DUP); Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Samples (LCS); Recovery and Acceptance Limits
- Matrix Spikes (MS); Recovery and Acceptance Limits

Work order specific comments
It has been noted that NO2 is greater than NOX (sample ID BH5), however this difference is within the limits of experimental variation.

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This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Department
Ankit Joshi	Inorganics - NATA 825 (10911 - Sydney)
Celine Conceicao	Inorganics - NATA 825 (10911 - Sydney)
Ken Reid	Newcastle - NATA 825 (1656 - Newcastle)
Rassem Ayoubi	Organics - NATA 825 (10911 - Sydney)

Quality Control Report - Laboratory Duplicates (DUP)

The quality control term **Laboratory Duplicate** refers to an intralaboratory split sample randomly selected from the sample batch. Laboratory duplicates provide information on method precision and sample heterogeneity.
- Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations:* ***LOR*** = *Limit of Reporting,* ***RPD*** = *Relative Percent Difference.*
* Indicates failed QC. The permitted ranges for the RPD of Laboratory Duplicates (relative percent deviation) are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting:- Result < 10 times LOR, no limit - Result between 10 and 20 times LOR, 0% - 50% - Result > 20 times LOR, 0% - 20%

Matrix Type: WATER

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EA005: pH						
EA005: pH - (QC Lot: 399141)				pH Unit	pH Unit	%
ES0705218-007	BH5	pH Value	0.01 pH Unit	7.51	7.52	0.1
ES0705359-001	Anonymous	pH Value	0.01 pH Unit	7.66	7.61	0.6
ED037P: Alkalinity by PC Titrator						
ED037P: Alkalinity by PC Titrator - (QC Lot: 399579)				mg/L	mg/L	%
ES0705152-001	Anonymous	Hydroxide Alkalinity as CaCO3	1 mg/L	<1	<1	0.0
		Carbonate Alkalinity as CaCO3	1 mg/L	<1	<1	0.0
		Bicarbonate Alkalinity as CaCO3	1 mg/L	353	353	0.0
		Total Alkalinity as CaCO3	1 mg/L	353	353	0.0
ES0705174-008	Anonymous	Hydroxide Alkalinity as CaCO3	1 mg/L	<1	<1	0.0
		Carbonate Alkalinity as CaCO3	1 mg/L	<1	<1	0.0
		Bicarbonate Alkalinity as CaCO3	1 mg/L	20	20	0.0
		Total Alkalinity as CaCO3	1 mg/L	20	20	0.0
ED037P: Alkalinity by PC Titrator - (QC Lot: 399581)				mg/L	mg/L	%
ES0705218-007	BH5	Hydroxide Alkalinity as CaCO3	1 mg/L	<1	<1	0.0
		Carbonate Alkalinity as CaCO3	1 mg/L	<1	<1	0.0
		Bicarbonate Alkalinity as CaCO3	1 mg/L	826	821	0.6
		Total Alkalinity as CaCO3	1 mg/L	826	821	0.6
ED040F: Dissolved Major Anions						
ED040F: Dissolved Major Anions - (QC Lot: 396735)				mg/L	mg/L	%
ES0705187-001	Anonymous	Sulphate as SO4 2-	1 mg/L	39	39	0.0
ES0705218-005	BH13	Sulphate as SO4 2-	1 mg/L	101	101	0.0
ED045G: Chloride Discrete analyser						
ED045G: Chloride Discrete analyser - (QC Lot: 397082)				mg/L	mg/L	%
ES0705217-001	Anonymous	Chloride	1.0 mg/L	31.4	31.1	1.0
ES0705218-007	BH5	Chloride	1.0 mg/L	489	485	0.7

Matrix Type: WATER

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
ED093F: Dissolved Major Cations						
ED093F: Dissolved Major Cations - (QC Lot: 396734)				mg/L	mg/L	%
ES0705187-001	Anonymous	Calcium	1 mg/L	10	10	0.0
		Magnesium	1 mg/L	8	8	0.0
		Sodium	1 mg/L	38	38	0.0
		Potassium	1 mg/L	4	4	0.0
ES0705218-005	BH13	Calcium	1 mg/L	114	114	0.0
		Magnesium	1 mg/L	44	44	0.0
		Sodium	1 mg/L	122	124	1.6
		Potassium	1 mg/L	1	1	0.0
EG020F: Dissolved Metals by ICP-MS						
EG020F: Dissolved Metals by ICP-MS - (QC Lot: 397312)				mg/L	mg/L	%
EP0701582-001	Anonymous	Manganese	0.001 mg/L	0.144	0.151	4.5
		Iron	0.05 mg/L	2.77	2.88	3.7
ES0705221-002	Anonymous	Manganese	0.001 mg/L	1.23	1.17	5.2
		Iron	0.05 mg/L	0.81	0.73	10.1
EK040P: Fluoride by PC Titrator						
EK040P: Fluoride by PC Titrator - (QC Lot: 399580)				mg/L	mg/L	%
ES0705152-001	Anonymous	Fluoride	0.1 mg/L	<0.1	<0.1	0.0
ES0705218-007	BH5	Fluoride	0.1 mg/L	0.3	0.6	65.2
EK055G: Ammonia as N by Discrete Analyser						
EK055G: Ammonia as N by Discrete Analyser - (QC Lot: 397085)				mg/L	mg/L	%
ES0705217-001	Anonymous	Ammonia as N	0.010 mg/L	11.7	11.8	1.1
ES0705218-007	BH5	Ammonia as N	0.010 mg/L	0.543	0.597	9.5
EK057G: Nitrite as N by Discrete Analyser						
EK057G: Nitrite as N by Discrete Analyser - (QC Lot: 396879)				mg/L	mg/L	%
ES0705218-001	BH9	Nitrite as N	0.010 mg/L	<0.010	<0.010	0.0
ES0705221-003	Anonymous	Nitrite as N	0.010 mg/L	<0.010	<0.010	0.0
EK059G: NOX as N by Discrete Analyser						
EK059G: NOX as N by Discrete Analyser - (QC Lot: 397089)				mg/L	mg/L	%
ES0705218-001	BH9	Nitrite + Nitrate as N	0.010 mg/L	0.833	0.850	2.0

Matrix Type: WATER

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EK059G: NOX as N by Discrete Analyser - continued						
EK059G: NOX as N by Discrete Analyser - (QC Lot: 397089) - continued				mg/L	mg/L	%
ES0705221-003	Anonymous	Nitrite + Nitrate as N	0.010 mg/L	<0.010	<0.010	0.0
EP005: Total Organic Carbon (TOC)						
EP005: Total Organic Carbon (TOC) - (QC Lot: 399506)				mg/L	mg/L	%
ES0705195-004	Anonymous	Total Organic Carbon	1 mg/L	20	20	0.0
ES0705219-002	Anonymous	Total Organic Carbon	1 mg/L	2	2	0.0
EP035G: Total Phenol by Discrete Analyser						
EP035G: Total Phenol by Discrete Analyser - (QC Lot: 398067)				mg/L	mg/L	%
ES0705130-001	Anonymous	Phenols (Total)	0.050 mg/L	<0.050	<0.050	0.0
ES0705218-006	BH4	Phenols (Total)	0.050 mg/L	<0.050	<0.050	0.0
EP074D: Fumigants						
EP074D: Fumigants - (QC Lot: 397425)				µg/L	µg/L	%
ES0705218-001	BH9	2,2-Dichloropropane	5 µg/L	<5	<5	0.0
		1,2-Dichloropropane	5 µg/L	<5	<5	0.0
		cis-1,3-Dichloropropylene	5 µg/L	<5	<5	0.0
		trans-1,3-Dichloropropylene	5 µg/L	<5	<5	0.0
		1,2-Dibromoethane (EDB)	5 µg/L	<5	<5	0.0
EP074E: Halogenated Aliphatic Compounds						
EP074E: Halogenated Aliphatic Compounds - (QC Lot: 397425)				µg/L	µg/L	%
ES0705218-001	BH9	Dichlorodifluoromethane	50 µg/L	<50	<50	0.0
		Chloromethane	50 µg/L	<50	<50	0.0
		Vinyl chloride	50 µg/L	<50	<50	0.0
		Bromomethane	50 µg/L	<50	<50	0.0
		Chloroethane	50 µg/L	<50	<50	0.0
		Trichlorofluoromethane	50 µg/L	<50	<50	0.0
		1,1-Dichloroethene	5 µg/L	<5	<5	0.0
		Iodomethane	5 µg/L	<5	<5	0.0
		trans-1,2-Dichloroethene	5 µg/L	<5	<5	0.0
		1,1-Dichloroethane	5 µg/L	<5	<5	0.0
		cis-1,2-Dichloroethene	5 µg/L	<5	<5	0.0

Matrix Type: WATER

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	Client Sample ID	Analyte name	LOR	Original Result	Duplicate Result	RPD
EP074E: Halogenated Aliphatic Compounds - continued						
EP074E: Halogenated Aliphatic Compounds - (QC Lot: 397425) - continued				µg/L	µg/L	%
ES0705218-001	BH9	1,1,1-Trichloroethane	5 µg/L	<5	<5	0.0
		1,1-Dichloropropylene	5 µg/L	<5	<5	0.0
		Carbon Tetrachloride	5 µg/L	<5	<5	0.0
		1,2-Dichloroethane	5 µg/L	<5	<5	0.0
		Trichloroethene	5 µg/L	<5	<5	0.0
		Dibromomethane	5 µg/L	<5	<5	0.0
		1,1,2-Trichloroethane	5 µg/L	<5	<5	0.0
		1,3-Dichloropropane	5 µg/L	<5	<5	0.0
		Tetrachloroethene	5 µg/L	<5	<5	0.0
		1,1,1,2-Tetrachloroethane	5 µg/L	<5	<5	0.0
		trans-1,4-Dichloro-2-butene	5 µg/L	<5	<5	0.0
		cis-1,4-Dichloro-2-butene	5 µg/L	<5	<5	0.0
		1,1,2,2-Tetrachloroethane	5 µg/L	<5	<5	0.0
		1,2,3-Trichloropropane	5 µg/L	<5	<5	0.0
		Pentachloroethane	5 µg/L	<5	<5	0.0
		1,2-Dibromo-3-chloropropane	5 µg/L	<5	<5	0.0
		Hexachlorobutadiene	5 µg/L	<5	<5	0.0
EP074F: Halogenated Aromatic Compounds						
EP074F: Halogenated Aromatic Compounds - (QC Lot: 397425)				µg/L	µg/L	%
ES0705218-001	BH9	Chlorobenzene	5 µg/L	<5	<5	0.0
		Bromobenzene	5 µg/L	<5	<5	0.0
		2-Chlorotoluene	5 µg/L	<5	<5	0.0
		4-Chlorotoluene	5 µg/L	<5	<5	0.0
		1,3-Dichlorobenzene	5 µg/L	<5	<5	0.0
		1,4-Dichlorobenzene	5 µg/L	<5	<5	0.0
		1,2-Dichlorobenzene	5 µg/L	<5	<5	0.0
		1,2,4-Trichlorobenzene	5 µg/L	<5	<5	0.0
		1,2,3-Trichlorobenzene	5 µg/L	<5	<5	0.0
EP074G: Trihalomethanes						

Matrix Type: WATER

Laboratory Duplicates (DUP) Report

Laboratory Sample ID	*Client Sample ID*	*Analyte name*	*LOR*	*Original Result*	*Duplicate Result*	*RPD*
EP074G: Trihalomethanes - continued						
EP074G: Trihalomethanes - (QC Lot: 397425)				µg/L	µg/L	%
ES0705218-001	BH9	Chloroform	5 µg/L	6	7	16.4
		Bromodichloromethane	5 µg/L	<5	<5	0.0
		Dibromochloromethane	5 µg/L	<5	<5	0.0
		Bromoform	5 µg/L	<5	<5	0.0

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Quality Control Report - Method Blank (MB) and Laboratory Control Samples (LCS)

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC type is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a known, interference free matrix spiked with target analytes or certified reference material. The purpose of this QC type is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of actual laboratory data. Flagged outliers on control limits for inorganics tests may be within the NEPM specified data quality objective of recoveries in the range of 70 to 130%. Where this occurs, no corrective action is taken. Abbreviations: LOR = Limit of reporting.

Matrix Type: WATER

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

		Method blank result	Actual Results		Recovery Limits	
			Spike concentration	Spike Recovery	Dynamic Recovery Limits	
Analyte name	LOR			LCS	Low	High
ED037P: Alkalinity by PC Titrator						
ED037P: Alkalinity by PC Titrator - (QC Lot: 399579)		mg/L	mg/L	%	%	%
Total Alkalinity as CaCO3	1 mg/L	----	200	99.5	80.2	108
ED037P: Alkalinity by PC Titrator - (QC Lot: 399581)		mg/L	mg/L	%	%	%
Total Alkalinity as CaCO3	1 mg/L	----	200	99.5	80.2	108
ED040F: Dissolved Major Anions						
ED040F: Dissolved Major Anions - (QC Lot: 396735)		mg/L	mg/L	%	%	%
Sulphate as SO4 2-	1 mg/L	----	150	97.4	82.9	114
	1 mg/L	<1	1	----	----	----
ED045G: Chloride Discrete analyser						
ED045G: Chloride Discrete analyser - (QC Lot: 397082)		mg/L	mg/L	%	%	%
Chloride	1 mg/L	----	50	103	83.7	124
	1 mg/L	----	250	101	83.7	124
	1.0 mg/L	<1.0	----	----	----	----
ED093F: Dissolved Major Cations						
ED093F: Dissolved Major Cations - (QC Lot: 396734)		mg/L	mg/L	%	%	%
Calcium	1 mg/L	----	50	99.6	82.9	121
	1 mg/L	<1	----	----	----	----
Magnesium	1 mg/L	<1	----	----	----	----
	1 mg/L	----	50	95.9	82.7	114
Potassium	1 mg/L	<1	----	----	----	----
	1 mg/L	----	50	96.8	84.3	118
Sodium	1 mg/L	----	50	100	77.4	113
	1 mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS						

Matrix Type: WATER

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

Analyte name	LOR	Method blank result	Actual Results: Spike concentration	Actual Results: Spike Recovery LCS	Recovery Limits: Dynamic Recovery Limits Low	Recovery Limits: Dynamic Recovery Limits High
EG020F: Dissolved Metals by ICP-MS - continued						
EG020F: Dissolved Metals by ICP-MS - (QC Lot: 397312)		mg/L	mg/L	%	%	%
Iron	0.05 mg/L	<0.05	----	----	----	----
	0.05 mg/L	----	0.5	98.2	70	130
Manganese	0.001 mg/L	----	0.1	97.8	70	130
	0.001 mg/L	<0.001	----	----	----	----
EK040P: Fluoride by PC Titrator						
EK040P: Fluoride by PC Titrator - (QC Lot: 399580)		mg/L	mg/L	%	%	%
Fluoride	0.1 mg/L	----	5.0	98.2	64.8	115
	0.1 mg/L	<0.1	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser						
EK055G: Ammonia as N by Discrete Analyser - (QC Lot: 397085)		mg/L	mg/L	%	%	%
Ammonia as N	0.01 mg/L	----	1.00	89.8	75.6	128
	0.010 mg/L	<0.010	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser						
EK057G: Nitrite as N by Discrete Analyser - (QC Lot: 396879)		mg/L	mg/L	%	%	%
Nitrite as N	0.01 mg/L	----	0.96	108	66.6	131
	0.010 mg/L	<0.010	----	----	----	----
EK059G: NOX as N by Discrete Analyser						
EK059G: NOX as N by Discrete Analyser - (QC Lot: 397089)		mg/L	mg/L	%	%	%
Nitrite + Nitrate as N	0.010 mg/L	<0.010	----	----	----	----
	0.01 mg/L	----	0.96	99.2	76.9	122
EP005: Total Organic Carbon (TOC)						
EP005: Total Organic Carbon (TOC) - (QC Lot: 399506)		mg/L	mg/L	%	%	%
Total Organic Carbon	1 mg/L	<1	----	----	----	----
	1 mg/L	----	10	92.6	86.9	125
EP035G: Total Phenol by Discrete Analyser						
EP035G: Total Phenol by Discrete Analyser - (QC Lot: 398067)		mg/L	mg/L	%	%	%
Phenols (Total)	0.05 mg/L	----	0.50	96.2	65.6	118
	0.050 mg/L	<0.050	----	----	----	----

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Matrix Type: WATER

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

Analyte name	LOR	Method blank result	Actual Results		Recovery Limits	
			Spike concentration	Spike Recovery	Dynamic Recovery Limits	
				LCS	Low	High
EP074D: Fumigants						
EP074D: Fumigants - (QC Lot: 397425)		µg/L	µg/L	%	%	%
1,2-Dibromoethane (EDB)	5 µg/L	----	10	100	79.1	123
	5 µg/L	<5	----	----	----	----
1,2-Dichloropropane	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	103	80.7	119
2,2-Dichloropropane	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	99.3	72.7	124
cis-1,3-Dichloropropylene	5 µg/L	----	20	103	80.4	119
	5 µg/L	<5	----	----	----	----
trans-1,3-Dichloropropylene	5 µg/L	----	20	98.7	79.3	120
	5 µg/L	<5	----	----	----	----
EP074E: Halogenated Aliphatic Compounds						
EP074E: Halogenated Aliphatic Compounds - (QC Lot: 397425)		µg/L	µg/L	%	%	%
1,1,1,2-Tetrachloroethane	5 µg/L	----	10	106	78.9	121
	5 µg/L	<5	----	----	----	----
1,1,1-Trichloroethane	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	102	75.8	124
1,1,2,2-Tetrachloroethane	5 µg/L	----	10	105	77.8	126
	5 µg/L	<5	----	----	----	----
1,1,2-Trichloroethane	5 µg/L	----	10	101	79.6	122
	5 µg/L	<5	----	----	----	----
1,1-Dichloroethane	5 µg/L	----	10	102	79.3	121
	5 µg/L	<5	----	----	----	----
1,1-Dichloroethene	5 µg/L	----	10	98.5	72.5	128
	5 µg/L	<5	----	----	----	----
1,1-Dichloropropylene	5 µg/L	----	10	104	77.8	121
	5 µg/L	<5	----	----	----	----
1,2,3-Trichloropropane	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	96.9	74.1	128
1,2-Dibromo-3-chloropropane	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	103	66.4	136

Matrix Type: WATER

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

Analyte name	LOR	Method blank result	Actual Results		Recovery Limits	
			Spike concentration	Spike Recovery	Dynamic Recovery Limits	
				LCS	Low	High
EP074E: Halogenated Aliphatic Compounds - continued						
EP074E: Halogenated Aliphatic Compounds - (QC Lot: 397425) - continued		µg/L	µg/L	%	%	%
1,2-Dichloroethane	5 µg/L	----	10	104	75.5	126
	5 µg/L	<5	----	----	----	----
1,3-Dichloropropane	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	104	79.9	122
Bromomethane	50 µg/L	<50	----	----	----	----
	50 µg/L	----	100	106	68.9	131
Carbon Tetrachloride	5 µg/L	----	10	105	73.8	126
	5 µg/L	<5	----	----	----	----
Chloroethane	50 µg/L	----	100	101	73.9	126
	50 µg/L	<50	----	----	----	----
Chloromethane	50 µg/L	----	100	94.9	67.4	130
	50 µg/L	<50	----	----	----	----
cis-1,2-Dichloroethene	5 µg/L	----	10	105	79.5	121
	5 µg/L	<5	----	----	----	----
cis-1,4-Dichloro-2-butene	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	103	70.6	128
Dibromomethane	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	103	76.1	126
Dichlorodifluoromethane	50 µg/L	<50	----	----	----	----
	50 µg/L	----	100	91.6	60.6	138
Hexachlorobutadiene	5 µg/L	----	10	112	67.2	129
	5 µg/L	<5	----	----	----	----
Iodomethane	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	113	70.2	128
Pentachloroethane	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	109	71.8	126
Tetrachloroethene	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	100	75	124
trans-1,2-Dichloroethene	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	103	77.4	122

Matrix Type: WATER

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

Analyte name	LOR	Method blank result	Actual Results: Spike concentration	Actual Results: Spike Recovery LCS	Recovery Limits: Dynamic Recovery Limits Low	Recovery Limits: Dynamic Recovery Limits High
EP074E: Halogenated Aliphatic Compounds - continued						
EP074E: Halogenated Aliphatic Compounds - (QC Lot: 397425) - continued		µg/L	µg/L	%	%	%
trans-1,4-Dichloro-2-butene	5 µg/L	----	10	90.8	61.4	136
	5 µg/L	<5	----	----	----	----
Trichloroethene	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	106	76.7	123
Trichlorofluoromethane	50 µg/L	----	100	103	71.6	128
	50 µg/L	<50	----	----	----	----
Vinyl chloride	50 µg/L	<50	----	----	----	----
	50 µg/L	----	100	99.7	69.4	129
EP074F: Halogenated Aromatic Compounds						
EP074F: Halogenated Aromatic Compounds - (QC Lot: 397425)		µg/L	µg/L	%	%	%
1,2,3-Trichlorobenzene	5 µg/L	----	10	108	68.6	128
	5 µg/L	<5	----	----	----	----
1,2,4-Trichlorobenzene	5 µg/L	----	10	102	67.8	129
	5 µg/L	<5	----	----	----	----
1,2-Dichlorobenzene	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	105	82.3	116
1,3-Dichlorobenzene	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	103	78.9	120
1,4-Dichlorobenzene	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	103	79.9	119
2-Chlorotoluene	5 µg/L	----	10	102	78.2	120
	5 µg/L	<5	----	----	----	----
4-Chlorotoluene	5 µg/L	----	10	104	79	119
	5 µg/L	<5	----	----	----	----
Bromobenzene	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	95.6	79.3	119
Chlorobenzene	5 µg/L	----	10	102	80.8	119
	5 µg/L	<5	----	----	----	----
EP074G: Trihalomethanes						

Matrix Type: WATER

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

Analyte name	LOR	Method blank result	Actual Results		Recovery Limits	
			Spike concentration	Spike Recovery	Dynamic Recovery Limits	
				LCS	Low	High
EP074G: Trihalomethanes - continued						
EP074G: Trihalomethanes - (QC Lot: 397425)		µg/L	µg/L	%	%	%
Bromodichloromethane	5 µg/L	----	10	107	76.9	123
	5 µg/L	<5	----	----	----	----
Bromoform	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	108	73.5	126
Chloroform	5 µg/L	----	10	100	78.2	122
	5 µg/L	<5	----	----	----	----
Dibromochloromethane	5 µg/L	<5	----	----	----	----
	5 µg/L	----	10	107	78.5	124

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Quality Control Report - Matrix Spikes (MS)

The quality control term **Matrix Spike (MS)** refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC type is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQO's). 'Ideal' recovery ranges stated may be waived in the event of sample matrix interferences. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations: **LOR** = Limit of Reporting, **RPD** = Relative Percent Difference.*

* Indicates failed QC

Matrix Type: WATER

Matrix Spike (MS) Report

					Actual Results		Recovery Limits	
					Sample Result	Spike Recovery	Static Limits	
Analyte name	Laboratory Sample ID	Client Sample ID	LOR	Spike Concentration		MS	Low	High
ED045G: Chloride Discrete analyser								
ED045G: Chloride Discrete analyser - (QC Lot: 397082)				mg/L	mg/L	%	%	%
Chloride	ES0705217-001	Anonymous	1 mg/L	250	31.4	104	70	130
EG020F: Dissolved Metals by ICP-MS								
EG020F: Dissolved Metals by ICP-MS - (QC Lot: 397312)				mg/L	mg/L	%	%	%
Manganese	EP0701582-001	Anonymous	0.001 mg/L	0.2	0.144	89.8	70	130
EK040P: Fluoride by PC Titrator								
EK040P: Fluoride by PC Titrator - (QC Lot: 399580)				mg/L	mg/L	%	%	%
Fluoride	ES0705218-002	BH10	0.1 mg/L	5.0	0.1	99.0	70	130
EK055G: Ammonia as N by Discrete Analyser								
EK055G: Ammonia as N by Discrete Analyser - (QC Lot: 397085)				mg/L	mg/L	%	%	%
Ammonia as N	ES0705217-001	Anonymous	0.01 mg/L	1.00	11.7	* Not Determined	70	130
EK057G: Nitrite as N by Discrete Analyser								
EK057G: Nitrite as N by Discrete Analyser - (QC Lot: 396879)				mg/L	mg/L	%	%	%
Nitrite as N	ES0705218-001	BH9	0.01 mg/L	0.60	<0.010	106	70	130
EK059G: NOX as N by Discrete Analyser								
EK059G: NOX as N by Discrete Analyser - (QC Lot: 397089)				mg/L	mg/L	%	%	%
Nitrite + Nitrate as N	ES0705218-001	BH9	0.01 mg/L	0.60	0.833	74.5	70	130
EP005: Total Organic Carbon (TOC)								
EP005: Total Organic Carbon (TOC) - (QC Lot: 399506)				mg/L	mg/L	%	%	%
Total Organic Carbon	ES0705207-001	Anonymous	1 mg/L	100	5	110	70	130
EP035G: Total Phenol by Discrete Analyser								
EP035G: Total Phenol by Discrete Analyser - (QC Lot: 398067)				mg/L	mg/L	%	%	%
Phenols (Total)	ES0705130-001	Anonymous	0.05 mg/L	0.42	<0.050	98.1	70	130

Matrix Type: WATER

Matrix Spike (MS) Report

					Actual Results		*Recovery Limits*	
					Sample Result	*Spike Recovery*	*Static Limits*	
Analyte name	*Laboratory Sample ID*	*Client Sample ID*	*LOR*	*Spike Concentration*		*MS*	*Low*	*High*
EP074E: Halogenated Aliphatic Compounds								
EP074E: Halogenated Aliphatic Compounds - (QC Lot: 397425)				µg/L	µg/L	%	%	%
1,1-Dichloroethene	ES0705218-001	BH9	5 µg/L	25	<5	131	70	130
Trichloroethene			5 µg/L	25	<5	120	70	130
EP074F: Halogenated Aromatic Compounds								
EP074F: Halogenated Aromatic Compounds - (QC Lot: 397425)				µg/L	µg/L	%	%	%
Chlorobenzene	ES0705218-001	BH9	5 µg/L	25	<5	113	70	130

AUSTRALIAN LABORATORY SERVICES PTY LTD ABN 84 009 936 029
277-289 Woodpark Road Smithfield NSW 2164 Australia
Telephone: 61-2-8784 8555 Facsimile: 61-2-8784 8500 http://www.alsenviro.com/

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive report

Client Details

Client	:	ROBERT CARR & ASSOCIATES P/L
Contact	:	MR CRAIG WELLINGS
Address	:	P O BOX 175 CARRINGTON NSW AUSTRALIA 2294
Project	:	5929
Order number	:	- Not provided -
C-O-C Number	:	202536
Site	:	- Not provided -
Sampler	:	CRAIG WELLINGS
E-mail	:	craigw@rca.com.au
Telephone	:	49029200
Facsimile	:	49029299

Laboratory Details

Laboratory	:	Environmental Division Sydney
Manager	:	Victor Kedicioglu
Address	:	277-289 Woodpark Road Smithfield NSW Australia 2164
Quote number	:	----
Work order	:	ES0705218
E-mail	:	Victor.Kedicioglu@alsenviro.com
Telephone	:	61-2-8784 8555
Facsimile	:	61-2-8784 8500

Dates

Date Samples Received	:	23 Apr 2007	SRA Issue Date	:	24 Apr 2007
Scheduled Reporting Date	:	1 May 2007	Client Requested Date	:	1 May 2007

Delivery Details

Mode of Delivery	:	Carrier.	Temperature		: CHILLED - Ice bricks present
No. of coolers/boxes	:	2 HARD	No. of samples	- Received	7
Security Seal	:	Intact.		- Analysed	7

Comments

- **Samples received in appropriately pretreated and preserved containers.**
- **pH analysis should be conducted within 6 hours of sampling.**
- **Breaches in recommended extraction / analysis holding times may occur. Please contact ALSE for further information (Nanthini Coilparampil).**
- **NO3 should be analysed within 48 hours of sampling.**

- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Nanthini Coilparampil
- Analytical work for this work order will be conducted at ALSE Sydney.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.
- When the sampling time is not supplied on the COC documentation, ALSE defaults the sampling time to that of the COC 'relinquishment' time (if supplied). If this also is not supplied, ALSE defaults the sampling time to the 'time of receipt at Laboratory'.

Client	: ROBERT CARR & ASSOCIATES P/L	**Work Order**	: ES0705218
Project	: 5929	**ALS Quote Reference**	: ----

ALS Environmental

Summary of Sample(s) / Container(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as moisture and preparation tasks, that form an implicit part of that package.

ALS Sample ID.	Client Sample ID - Sample Date	**Requested Analysis**									
		EA005: pH - WATER pH	**ED037P - WATER** Total Alkalinity as CaCO3 (PC)	**ED040F - WATER** Dissolved Major Anions	**ED045G - WATER** Chloride by Discrete Analyser	**ED093F - WATER** Dissolved Major Cations	**EG020A-F - WATER** Dissolved Metals by ICPMS - Suite A	**EK040-P - WATER** Fluoride(PC)	**EK055G - WATER** Ammonia as N By Discrete Analyser	**EK058G - WATER** Nitrate as N by Discrete Analyser	**EN055 - DA - WATER** Ionic Balance (DA)
ES0705218-001	**BH9 - 18 Apr 2007**	●	●	●	●	●	●	●	●	●	●
ES0705218-002	**BH10 - 19 Apr 2007**	●	●	●	●	●	●	●	●	●	●
ES0705218-003	**BH11 - 19 Apr 2007**	●	●	●	●	●	●	●	●	●	●
ES0705218-004	**BH12 - 19 Apr 2007**	●	●	●	●	●	●	●	●	●	●
ES0705218-005	**BH13 - 19 Apr 2007**	●	●	●	●	●	●	●	●	●	●
ES0705218-006	**BH4 - 20 Apr 2007**	●	●	●	●	●	●	●	●	●	●
ES0705218-007	**BH5 - 20 Apr 2007**	●	●	●	●	●	●	●	●	●	●
	Total(s) :	7	7	7	7	7	7	7	7	7	7

Client	: ROBERT CARR & ASSOCIATES P/L	**Work Order**	: ES0705218
Project	: 5929	**ALS Quote Reference**	: ----

ALS Sample ID.	Client Sample ID - Sample Date	**Requested Analysis**									
		EP005 - WATER Total Organic Carbon (TOC)	**EP035G - WATER** Total Phenol by Discrete Analyser	**EP074DEFG - WATER** VOC - Fumigants, Hal Aliphatics, Hal Aromatics, THM							
ES0705218-001	**BH9 - 18 Apr 2007**	●	●	●							
ES0705218-002	**BH10 - 19 Apr 2007**	●	●	●							
ES0705218-003	**BH11 - 19 Apr 2007**	●	●	●							
ES0705218-004	**BH12 - 19 Apr 2007**	●	●	●							
ES0705218-005	**BH13 - 19 Apr 2007**	●	●	●							
ES0705218-006	**BH4 - 20 Apr 2007**	●	●	●							
ES0705218-007	**BH5 - 20 Apr 2007**	●	●	●							
	Total(s) :	7	7	7							

Client	: ROBERT CARR & ASSOCIATES P/L	**Work Order**	: ES0705218
Project	: 5929	**ALS Quote Reference**	: ----

ALS Environmental

Requested Reports

- **MR CRAIG WELLINGS**
  - A4 - AU Certificate of Analysis - NEPM format — Email — craigw@rca.com.au
  - A4 - AU Quality Control Report - NEPM format — Email — craigw@rca.com.au
  - A4 - AU Interpretive Quality Control Report - NEPM format — Email — craigw@rca.com.au
  - EDI Format - ENMRG — Email — craigw@rca.com.au
  - Default - Chain of Custody — Email — craigw@rca.com.au
  - A4 - AU Sample Receipt Notification - Comprehensive format — Email — craigw@rca.com.au
- **MS DANIELLE WHITE**
  - A4 - AU Certificate of Analysis - NEPM format — Email — daniellew@rca.com.au
  - A4 - AU Quality Control Report - NEPM format — Email — daniellew@rca.com.au
  - A4 - AU Interpretive Quality Control Report - NEPM format — Email — daniellew@rca.com.au
  - EDI Format - ENMRG — Email — daniellew@rca.com.au
  - Default - Chain of Custody — Email — daniellew@rca.com.au
  - A4 - AU Sample Receipt Notification - Comprehensive format — Email — daniellew@rca.com.au
  - A4 - AU Tax Invoice — Email — daniellew@rca.com.au

Sample Container(s) / Preservation Non-Compliance Log

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exist.**

CHAIN OF CUSTODY DOCUMENTATION

202536

ALS Laboratory Group

CLIENT: RCA AUSTRALIA	SAMPLER: CRAIG WELLINGS
ADDRESS / OFFICE: PO BOX 175 CARRINGTON 2294	MOBILE: 0412672805
PROJECT MANAGER (PM): CRAIG WELLINGS	PHONE 49029212
PROJECT ID: 5929	EMAIL REPORT TO: craigw@rca-com.au
SITE: P.O. NO.:	EMAIL INVOICE TO: (if different to report) same
RESULTS REQUIRED (Date): QUOTE NO.:	ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract suite prices)

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

Notes: e.g. Highly contaminated samples
e.g. "High PAHs expected".
Extra volume for QC or trace LORs etc.

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION		pH	Total Alkalinity	Dissolved Major Anions	Dissolved Major Cations	Ion Balance	Chloride	Fluoride	Nitrate	Ammonia	Dissolved Metals *	TOC	Total Phenolics	VHCs	
ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles														
1	BH9	W	18/4/07				x	x	x	x	x	x	x	x	x	x	x	x	x	* Fe, Mg, Mn
2	BH10	"	19/4/07				x	x	x	x	x	x	x	x	x	x	x	x	x	
3	BH11	"	"				x	x	x	x	x	x	x	x	x	x	x	x	x	Note: all TOC samples
4	BH12	"	"				x	x	x	x	x	x	x	x	x	x	x	x	x	field filtered (0.45µm)
5	BH13	"	"				x	x	x	x	x	x	x	x	x	x	x	x	x	
6	BH4	"	20/4/07				x	x	x	x	x	x	x	x	x	x	x	x	x	
7	BH5	"	"				x	x	x	x	x	x	x	x	x	x	x	x	x	

Environmental Division
Sydney
Work Order
ES0705218

Telephone : 61-2-8784 8555

RELINQUISHED BY:		RECEIVED BY		
Name: CRAIG WELLINGS	Date: 23/4/07	Name: Hayley Northington	Date: 23/4/07	Co
Of: RCA AUSTRALIA	Time:	Of: ALS Newcastle	Time: 11:00	
Name: Hayley Northington	Date: 23/4/07	Name: JESSIE	Date: 24-4-07	Transport Co:
Of: ALS Newcastle	Time: 4pm	Of: ALS Syd	Time: 8:30 am	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserveed Plastic; AG = Amber Glass Unpreserved; V = VOA Vial HCl Preserved; VS = VOA Vial Sulphuric Preserved; SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Laboratory Group

WHITE - LAB COPY
YELLOW - CUSTOMER COPY
PINK - BOOK COPY

Appendix E

Field Permeability Test Results

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PIEZOMETER TEST

CLIENT:	Maunsell Australia Pty Ltd	**DATE:**	21/05/2007
PROJECT:	Groundwater Assessment	**RCA ref:**	5929
LOCATION:	Proposed Landfill - Armidale	**CLIENT REF:**	

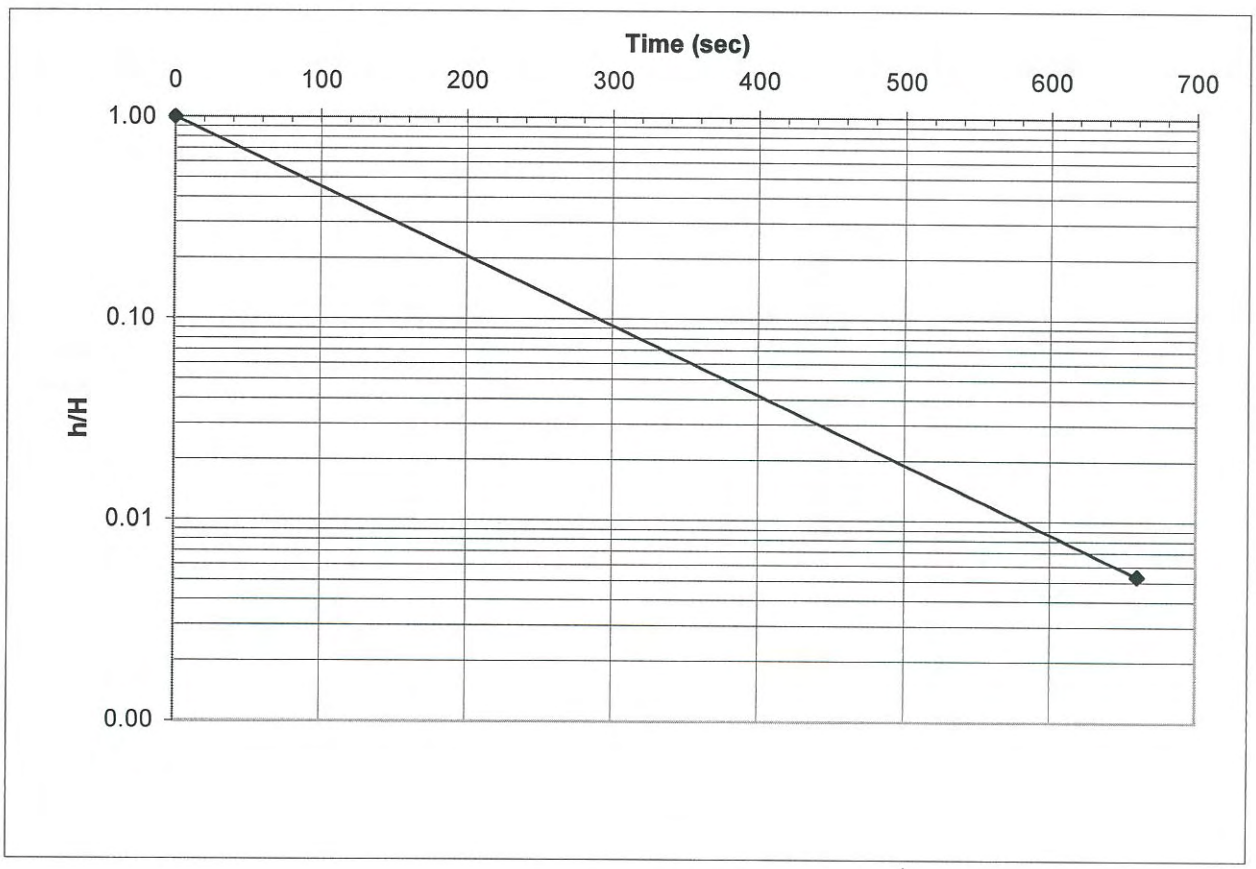
BORE DETAILS

Bore No.	BH11
Piezometer length (L)	6 m
Piezometer radius (r)	0.025 m
Bore radius (R)	0.075 m
Depth of piezometer	36 m
Static water level	28.02 m
Lag time T_o (37% recovery)	60 sec

Results

Time (sec)	Depth to water (m)	Change in level (m)	h/H
Static	28.02		
0	22.39	-5.63	1.00
660	27.99	-0.03	0.01

TEST METHOD: Falling head



Based on Hvorslev method

$$K = \frac{r^2 \ln(L/R)}{2LT_o}$$

Calculated Permeability **3.8E-06 m / sec**

RCA Australia	**Tested by: CW**	**Date: 17/4/07**
Office:	**Checked by: MA**	**Date: 22/5/07**

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PIEZOMETER TEST

CLIENT:	Maunsell Australia Pty Ltd	**DATE:**	21/05/2007
PROJECT:	Groundwater Assessment	**RCA ref:**	5929
LOCATION:	Proposed Landfill - Armidale	**CLIENT REF:**	

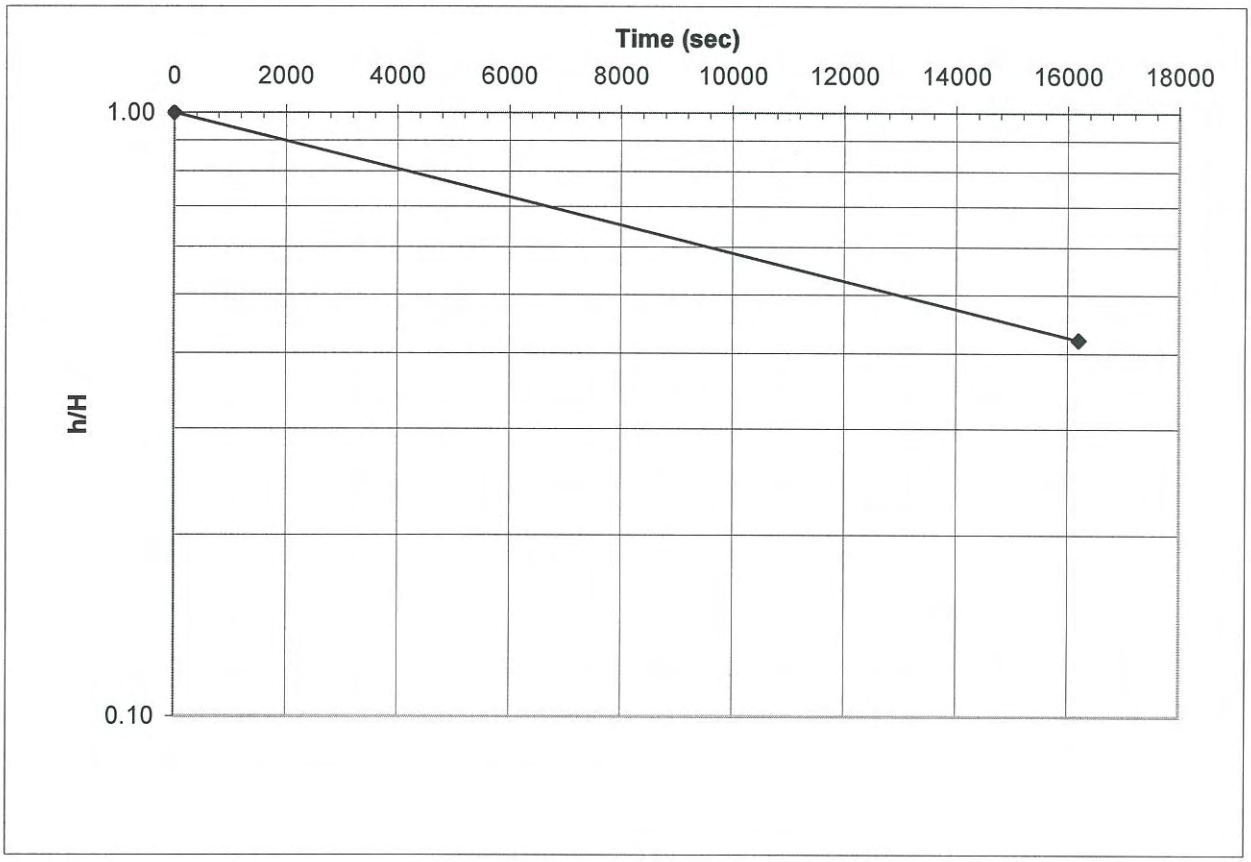
BORE DETAILS

Bore No.	BH5
Piezometer length (L)	3 m
Piezometer radius (r)	0.025 m
Bore radius (R)	0.075 m
Depth of piezometer	10.33 m
Static water level	5.27 m
Lag time T_o (37% recovery)	8800 sec

Results

Time (sec)	Depth to water (m)	Change in level (m)	h/H
Static	5.27		
0	10.33	5.06	1.00
16200	7.40	2.13	0.42

TEST METHOD: Rising head



Based on Hvorslev method

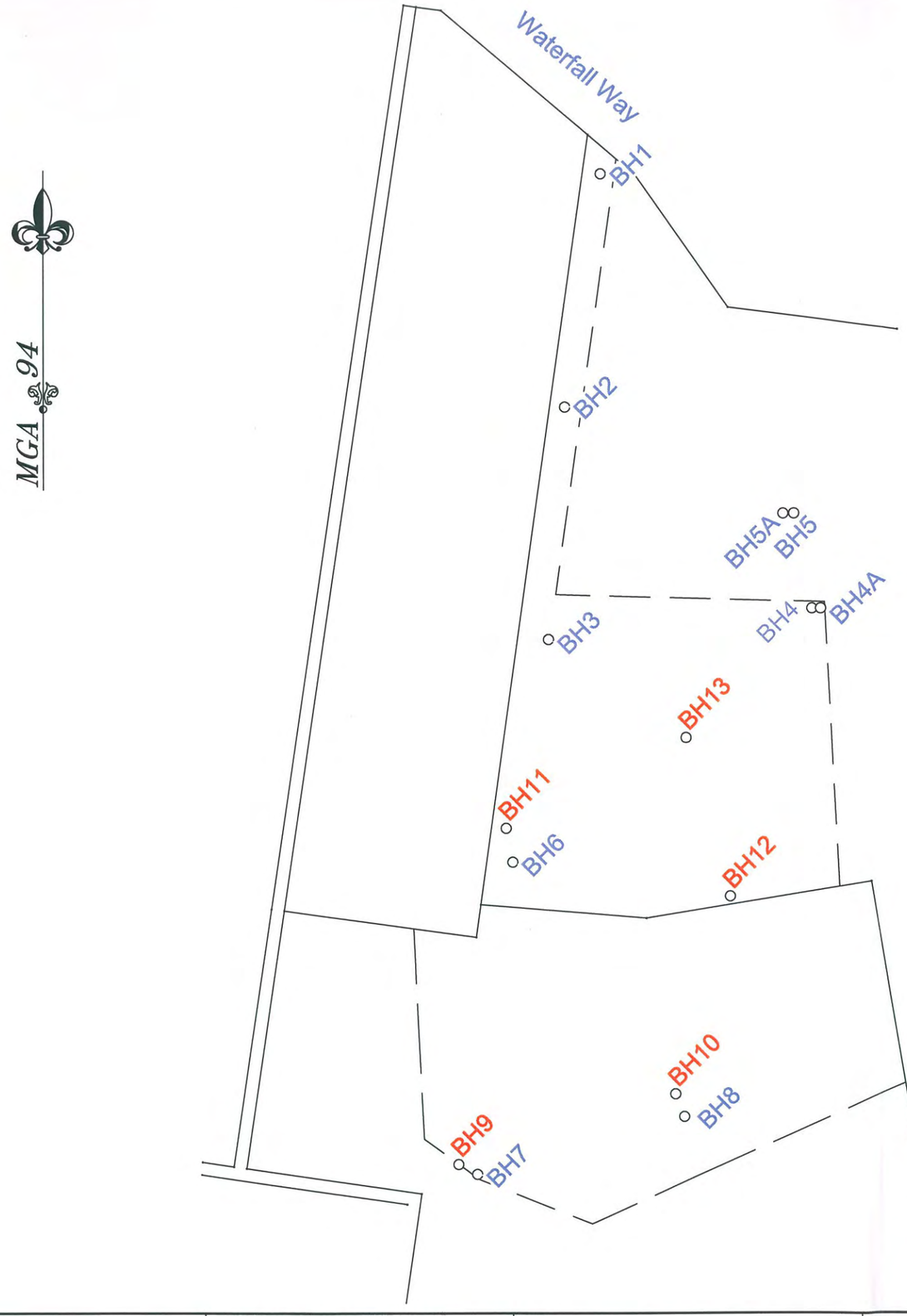
$$K = \frac{r^2 \ln(L/R)}{2LT_o}$$

Calculated Permeability **4.4E-08 m / sec**

RCA Australia	**Tested by: CW**	**Date: 20/4/07**
Office:	**Checked by: MA**	**Date: 22/5/07**

Appendix F

Survey Results



80 0 80 160 240 320 400
SCALE OF METRES 1:8,000

MARK	Easting	Northing	Height
BH1	383353.47	6620262.81	980.48
BH2	383297.43	6619894.91	958.14
BH3	383271.88	6619528.24	962.85
BH6	383215.21	6619176.42	981.14
BH7	383158.60	6618681.95	1010.58
BH8	383484.77	6618773.13	999.37
BH4	383691.47	6619577.55	954.11
BH4A	383693.19	6619577.72	953.96
BH5A	383649.85	6619727.47	953.05
BH5	383650.96	6619727.59	953.13
BH9	383128.77	6618697.86	1014.03
BH10	383470.84	6618809.06	993.78
BH11	383204.64	6619230.01	977.58
BH12	383558.08	6619122.94	969.79
BH13	383488.09	6619373.36	961.70

Notes:
1. Coordinates are in Map Grid of Australia, Zone 56 (MGA 94 / 56)
2. Heights are on the Australian Height Datum (AHD)
3. Heights for Monitoring Wells relate to the highest point of the PVC pipe (after removing the cap)
4. Survey conducted on Thursday 10-05-2007
5. Proposed Landfill Boundary is indicative only

Revision	Date	Description
A.	18/5/07	Issued to RCA

THIS SURVEY IS NOT A "SURVEY" AS DEFINED BY THE SURVEYORS ACT 1929. IF ANY CONSTRUCTION IS PLANNED IT WOULD BE ADVISABLE TO CARRY OUT FURTHER SURVEY WORK TO DETERMINE THE BOUNDARY DIMENSIONS.

ELECTRONIC DATA NOTE:

THE HARD COPIES OF THESE PLANS ARE THOSE TO WHICH WE CERTIFY TO BE CORRECT. THE ADDITIONAL ELECTRONIC DATA SUPPLIED IS SUPPLIED ON A "USER BEWARE " BASIS. HAWKINS HOOK & Co. HOLDS ORIGINAL DATA FOR VERIFICATION.

Project:
Proposed Armidale Dumaresq Landfill Site - Waterfall Way (MR76), Armidale NSW

Drawing Title
Borehole & Test Pit Locations

Client:
RCA Australia
PO Box 175
92 Hill Street
Carrington N.S.W. 2294

Hawkins Hook & Co.
Consulting Surveyors & Planners
"Surveying the New England & Planning for our Future"
27 Marsh Street Armidale NSW, 2350
Ph: (02) 6772 3141 Fax: (02) 6771 3658
e-mail: hawkhook@optusnet.com.au

Scale:	1 : 8,000
Cad Scale Factor:	x1.0
Backup Disk No:	hh5
Cad File Name:	20070410
Datum:	A.H.D.
	PM 34119 RL 962.399
Surveyors Reference:	GARA/56/1
Date:	15th, May 2007
Drawn:	R.D.
Surveyed:	R.D. A.B.
Sheet	1 of 1
Revision:	A

A3

Appendix G

Water Sample Field Sheets

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

ENGINEERING FIELD SHEET

WATER SAMPLING RECORD

CLIENT: _____ DATE: 18/4/07

PROJECT: Groundwater Monitoring PROJECT No: 5929

LOCATION: Proposed Landfill Site - Armidale. CLIENT REF: -

WATER METER USED: Horiba U10

DATE & TYPE OF LAST CALIBRATION (1PT OR FULL): 1pt on each day sampling

METHOD OF SAMPLING: Bennett deep sampling pump

PRESERVATION & STORAGE (TICK): Field Temp ☐ Chilled (<4°C) ☑ Frozen ☐

Un-preserved ☐ Preserved: ☐ Acid (H_2SO_4) ☐ Acid (HNO_3) ☐ Alkaline (NaOH) ☐ Filtered ☐

TESTS REQUIRED: _____

OTHER DETAILS: _____

BORE OR LOCATION ID: BH9

TIME: _____ TO _____

BORE DEPTH: _____ HEIGHT ABOVE GROUND LEVEL: 0.95 (raised 0.52)

DEPTH TO AQUIFER: 46.2m (46.7m) VOLUME PURGED: >100L

RESULTS OF WATER QUALITY CHECK:

Check No.	pH	Conductivity (mS/cm)	Turbidity	Dissolved (O_2)	Temperature (°C)	Salinity (%)
1/	7.59	1.26	38	6.53	19.3	0.05
2/	7.63	1.26	31	6.33	20.3	0.05
3/						
4/						
5/						
6/						

Sample Appearance: Clear - No odour

Duplicate/Equipment Wash Identification and Other Remarks: _____

BORE OR LOCATION ID: BH10

TIME: _____ TO _____

BORE DEPTH: _____ HEIGHT ABOVE GROUND LEVEL: 0.67

DEPTH TO AQUIFER: 37.0m VOLUME PURGED: >100L

RESULTS OF WATER QUALITY CHECK:

Check No.	pH	Conductivity (mS/cm)	Turbidity	Dissolved (O_2)	Temperature (°C)	Salinity (%)
1/	7.63	3.46	92	5.04	17.8	0.17
2/	7.63	3.43	74	5.95	17.7	0.17
3/						
4/						
5/						
6/						

Sample Appearance: Clear. No odour

Duplicate/Equipment Wash Identification and Other Remarks: _____

RCA Australia	Sampled by: CW	Date:
Office:		

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No 5929
DATE 19/4/07

BORE OR LOCATION ID: BH11
TIME: _____ TO _____
BORE DEPTH: _____ HEIGHT ABOVE GROUND LEVEL: 0.72 (raised 0.32)
DEPTH TO AQUIFER: 27.70m (28.02 m) VOLUME PURGED: >100L
RESULTS OF WATER QUALITY CHECK:

Check No.	pH	Conductivity (mS/cm)	Turbidity	Dissolved (O_2)	Temperature (°C)	Salinity (%)
1/	7.74	1.23	152	5.61	18.6	0.05
2/	7.71	1.18	144	5.21	18.6	0.05
3/						
4/						
5/						
6/						

Sample Appearance: Clear – slightly turbid – no odour
Duplicate/Equipment Wash Identification and Other Remarks:

Max pump rate 12 min/40L Falling head – 40L introduced : 660 sec to 3cm recovery

BORE OR LOCATION ID: BH12
TIME: _____ TO _____
BORE DEPTH: _____ HEIGHT ABOVE GROUND LEVEL: 0.62
DEPTH TO AQUIFER: 21.32m VOLUME PURGED: >100L
RESULTS OF WATER QUALITY CHECK:

Check No.	pH	Conductivity (mS/cm)	Turbidity	Dissolved (O_2)	Temperature (°C)	Salinity (%)
1/	7.58	1.32	89	2.32	19.1	0.06
2/	7.54	1.32	30	1.89	18.8	0.06
3/						
4/						
5/						
6/						

Sample Appearance: Clear – no odour
Duplicate/Equipment Wash Identification and Other Remarks:

BORE OR LOCATION ID: BH13
TIME: _____ TO _____
BORE DEPTH: _____ HEIGHT ABOVE GROUND LEVEL: 0.60
DEPTH TO AQUIFER: 13.32m VOLUME PURGED: >100L
RESULTS OF WATER QUALITY CHECK:

Check No.	pH	Conductivity (mS/cm)	Turbidity	Dissolved (O_2)	Temperature (°C)	Salinity (%)
1/	7.65	1.33	111	2.94	17.6	0.06
2/	7.71	1.32	110	3.35	17.5	0.06
3/						
4/						
5/						
6/						

Sample Appearance: Clear – slightly turbid . No odour
Duplicate/Equipment Wash Identification and Other Remarks:

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No 5929
DATE 20/4/07

BORE OR LOCATION ID: BH4
TIME: _____ TO _____
BORE DEPTH: 18.70 HEIGHT ABOVE GROUND LEVEL: 0.72
DEPTH TO AQUIFER: 6.35 VOLUME PURGED: > 100L
RESULTS OF WATER QUALITY CHECK:

Check No.	pH	Conductivity (mS/cm)	Turbidity	Dissolved (O_2)	Temperature (°C)	Salinity (%)
1/	7.64	1.68	630	1.08	17.9	0.08
2/	7.61	1.67	535	0.55	17.9	0.07
3/						
4/						
5/						
6/						

Sample Appearance: Mod turbid. No odour.
Duplicate/Equipment Wash Identification and Other Remarks:

BORE OR LOCATION ID: BH5
TIME: _____ TO _____
BORE DEPTH: 10.33 HEIGHT ABOVE GROUND LEVEL: 0.82
DEPTH TO AQUIFER: 5.27 VOLUME PURGED: Bore Purged dry after removal ≈ 30L
RESULTS OF WATER QUALITY CHECK:

Check No.	pH	Conductivity (mS/cm)	Turbidity	Dissolved (O_2)	Temperature (°C)	Salinity (%)
1/	~~8.81~~ 7.76	4.68	585	0.76	20.1	0.25
2/	Insufficient recovery to allow further readings.					
3/						
4/						
5/						
6/						

Sample Appearance: Mod turbid, No odour.
Duplicate/Equipment Wash Identification and Other Remarks:

Bore empty 12:45 pm (10.33m) target 6.3m = 80%. 7.40 @ 5:15pm

BORE OR LOCATION ID: _____
TIME: _____ TO _____
BORE DEPTH: _____ HEIGHT ABOVE GROUND LEVEL: _____
DEPTH TO AQUIFER: _____ VOLUME PURGED: _____
RESULTS OF WATER QUALITY CHECK:

Check No.	pH	Conductivity (mS/cm)	Turbidity	Dissolved (O_2)	Temperature (°C)	Salinity (%)
1/						
2/						
3/						
4/						
5/						
6/						

Sample Appearance:
Duplicate/Equipment Wash Identification and Other Remarks:

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