



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		Sampling date / time		BH02_0.8-1		BH02_1.8-2		BH02_2.8-3	
Compound	CAS Number	LOR	Unit	Result	Result	Result	Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)											
pH Value	---	0.1	pH Unit	5.8	---	8.2	---	7.7	---	---	---
EA010: Conductivity (1:5)											
Electrical Conductivity @ 25°C	---	1	µS/cm	1440	---	626	---	217	---	---	---
ED005: Exchange Acidity											
Ø Exchange Acidity	---	0.1	meq/100g	<0.1	---	---	---	---	---	---	---
Ø Exchangeable Aluminium	---	0.1	meq/100g	<0.1	---	---	---	---	---	---	---
ED006: Exchangeable Cations on Alkaline Soils											
Ø Exchangeable Calcium	---	0.2	meq/100g	---	---	10.0	---	9.6	---	---	---
Ø Exchangeable Magnesium	---	0.2	meq/100g	---	---	7.9	---	6.7	---	---	---
Ø Exchangeable Potassium	---	0.2	meq/100g	---	---	0.4	---	0.6	---	---	---
Ø Exchangeable Sodium	---	0.2	meq/100g	---	---	3.2	---	1.6	---	---	---
Ø Cation Exchange Capacity	---	0.2	meq/100g	---	---	21.5	---	18.5	---	---	---
Ø Exchangeable Sodium Percent	---	0.2	%	---	---	14.9	---	8.8	---	---	---
Ø Calcium/Magnesium Ratio	---	0.2	-	---	---	1.3	---	1.4	---	---	---
Ø Magnesium/Potassium Ratio	---	0.2	-	---	---	19.0	---	11.5	---	---	---
ED008: Exchangeable Cations											
Exchangeable Calcium	---	0.1	meq/100g	10.5	---	---	---	---	---	---	---
Exchangeable Magnesium	---	0.1	meq/100g	13.3	---	---	---	---	---	---	---
Exchangeable Potassium	---	0.1	meq/100g	0.2	---	---	---	---	---	---	---
Exchangeable Sodium	---	0.1	meq/100g	2.8	---	---	---	---	---	---	---
Cation Exchange Capacity	---	0.1	meq/100g	26.8	---	---	---	---	---	---	---
Exchangeable Sodium Percent	---	0.1	%	10.5	---	---	---	---	---	---	---
Calcium/Magnesium Ratio	---	0.1	-	0.8	---	---	---	---	---	---	---
Magnesium/Potassium Ratio	---	0.1	-	58.7	---	---	---	---	---	---	---



QUALITY CONTROL REPORT

Work Order

: EB2318839

Page

: 1 of 5

Client

: BRISBANE C

: [REDACTED]

Project

: [REDACTED]

: GK15 - Sherwood Arboretum & Secret Forest

Order number

: 123

C-O-C number

: ---

Sampler

: [REDACTED]

Site

: Sherwood Arboretum

Quote number

: EB23BRICIT0002

No. of samples received

: 8

No. of samples analysed

: 8

Telephone

: +61 7 3552 8616

Date Samples Received

: 22-Jun-2023

Date Analysis Commenced

: 26-Jun-2023

Issue Date

: 28-Jun-2023

Project

: GK15 - Sherwood Arboretum & Secret Forest

Order number

: 123

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Sampler

: [REDACTED]

Site

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Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

Signatories

Position

Accreditation Category

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The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

= Indicates failed QC

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

Sub-Matrix: SOIL					Laboratory Duplicate (DUP) Report				
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA002: pH 1:5 (Soils) (QC Lot: 5128888)									
EB2318873-001	Anonymous	EA002: pH Value	*****	0.1	pH Unit	8.9	8.9	0.0	0% - 20%
EB2318730-006	Anonymous	EA002: pH Value	*****	0.1	pH Unit	7.0	7.0	0.0	0% - 20%
EA010: Conductivity (1:5) (QC Lot: 5128887)									
EB2318873-001	Anonymous	EA010: Electrical Conductivity @ 25°C	*****	1	µS/cm	88	79	11.7	0% - 20%
EB2318730-006	Anonymous	EA010: Electrical Conductivity @ 25°C	*****	1	µS/cm	121	129	6.1	0% - 20%
ED005: Exchange Acidity (QC Lot: 5134692)									
EB2318839-001	BH01_0.3-0.5	ED005: Exchange Acidity	*****	0.1	meq/100g	8.2	8.1	0.0	0% - 20%
		ED005: Exchangeable Aluminium	*****	0.1	meq/100g	7.0	6.9	1.5	0% - 20%
ED005: Exchange Acidity (QC Lot: 5134695)									
EB2318839-006	BH02_0.8-1	ED005: Exchange Acidity	*****	0.1	meq/100g	<0.1	<0.1	0.0	No Limit
		ED005: Exchangeable Aluminium	*****	0.1	meq/100g	<0.1	<0.1	0.0	No Limit
ED006: Exchangeable Cations on Alkaline Soils (QC Lot: 5134683)									
EB2318839-004	BH01_2.3-2.5	ED006: Exchangeable Calcium	*****	0.2	meq/100g	3.1	# 4.3	32.4	0% - 20%
		ED006: Exchangeable Magnesium	*****	0.2	meq/100g	7.1	# 9.8	31.7	0% - 20%
		ED006: Exchangeable Potassium	*****	0.2	meq/100g	<0.2	0.2	0.0	No Limit
		ED006: Exchangeable Sodium	*****	0.2	meq/100g	4.4	# 6.1	32.2	0% - 20%
		ED006: Cation Exchange Capacity	*****	0.2	meq/100g	14.8	# 20.4	32.1	0% - 20%
ED007: Exchangeable Cations (QC Lot: 5134685)									
EB2318742-067	Anonymous	ED007: Exchangeable Calcium	*****	0.1	meq/100g	3.3	3.3	0.0	0% - 20%
		ED007: Exchangeable Magnesium	*****	0.1	meq/100g	8.4	8.4	0.0	0% - 20%
		ED007: Exchangeable Potassium	*****	0.1	meq/100g	0.4	0.4	0.0	No Limit
ED007: Exchangeable Cations (QC Lot: 5134691)		ED007: Exchangeable Sodium	*****	0.1	meq/100g	1.1	1.1	0.0	0% - 50%



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
ED007: Exchangeable Cations (QC Lot: 5134691) - continued									
EB2318839-001	BH01_0.3-0.5	ED007: Exchangeable Calcium	-----	0.1	meq/100g	4.4	4.4	0.0	0% - 20%
		ED007: Exchangeable Magnesium	-----	0.1	meq/100g	7.9	7.9	0.0	0% - 20%
		ED007: Exchangeable Potassium	-----	0.1	meq/100g	0.3	0.3	0.0	No Limit
		ED007: Exchangeable Sodium	-----	0.1	meq/100g	1.6	1.6	0.0	0% - 50%
ED008: Exchangeable Cations (QC Lot: 5134690)									
EB2318839-003	BH01_1.8-2	ED008: Exchangeable Calcium	-----	0.1	meq/100g	3.4	3.4	0.0	0% - 20%
		ED008: Exchangeable Magnesium	-----	0.1	meq/100g	10.0	10.0	0.0	0% - 20%
		ED008: Exchangeable Potassium	-----	0.1	meq/100g	0.2	0.2	0.0	No Limit
		ED008: Exchangeable Sodium	-----	0.1	meq/100g	3.1	3.2	0.0	0% - 20%
ED008: Exchangeable Cations (QC Lot: 5134696)									
EB2318839-006	BH02_0.8-1	ED008: Exchangeable Calcium	-----	0.1	meq/100g	10.5	# 8.2	24.9	0% - 20%
		ED008: Exchangeable Magnesium	-----	0.1	meq/100g	13.3	11.4	15.4	0% - 20%
		ED008: Exchangeable Potassium	-----	0.1	meq/100g	0.2	0.2	0.0	No Limit
		ED008: Exchangeable Sodium	-----	0.1	meq/100g	2.8	2.4	16.6	0% - 20%



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

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

Sub-Matrix: SOIL

Sub-Matrix: SOIL				Laboratory Control Spike (LCS) Report						
Method/Compound	CAS Number	LOR	Unit	Method Blank (MB) Report		Spike Recovery (%)			Acceptable Limits (%)	
				Result	Spike Concentration	LCS	Low	High		
EA002: pH 1:5 (Soils) (QCLot: 5128888)										
EA002: pH Value	-----	-----	pH Unit	-----	4 pH Unit 7 pH Unit	-----	100 100	98.0 98.0	102 102	
EA010: Conductivity (1:5) (QCLot: 5128887)										
EA010: Electrical Conductivity @ 25°C	-----	1	µS/cm	<1	1412 µS/cm		100	97.0	103	
ED005: Exchange Acidity (QCLot: 5134692)										
ED005: Exchange Acidity	-----	0.1	meq/100g	<0.1	-----		-----	-----	-----	
ED005: Exchangeable Aluminium	-----	0.1	meq/100g	<0.1	-----		-----	-----	-----	
ED005: Exchange Acidity (QCLot: 5134695)										
ED005: Exchange Acidity	-----	0.1	meq/100g	<0.1	-----		-----	-----	-----	
ED005: Exchangeable Aluminium	-----	0.1	meq/100g	<0.1	-----		-----	-----	-----	
ED006: Exchangeable Cations on Alkaline Soils (QCLot: 5134683)										
ED006: Exchangeable Calcium	-----	0.2	meq/100g	<0.2	5.9974 meq/100g		103	70.0	130	
ED006: Exchangeable Magnesium	-----	0.2	meq/100g	<0.2	4.265 meq/100g		97.9	70.0	130	
ED006: Exchangeable Potassium	-----	0.2	meq/100g	<0.2	0.9193 meq/100g		94.9	70.0	130	
ED006: Exchangeable Sodium	-----	0.2	meq/100g	<0.2	1.2655 meq/100g		114	70.0	130	
ED006: Cation Exchange Capacity	-----	0.2	meq/100g	<0.2	12.4472 meq/100g		102	70.0	130	
ED007: Exchangeable Cations (QCLot: 5134685)										
ED007: Exchangeable Calcium	-----	0.1	meq/100g	<0.1	8.9 meq/100g		101	79.0	113	
ED007: Exchangeable Magnesium	-----	0.1	meq/100g	<0.1	9.52 meq/100g		96.6	85.0	115	
ED007: Exchangeable Potassium	-----	0.1	meq/100g	<0.1	1.49 meq/100g		99.0	70.0	122	
ED007: Exchangeable Sodium	-----	0.1	meq/100g	<0.1	1.3726 meq/100g		102	76.0	112	
ED007: Cation Exchange Capacity	-----	0.1	meq/100g	<0.1	21.283 meq/100g		98.6	82.0	112	
ED007: Exchangeable Cations (QCLot: 5134691)										
ED007: Exchangeable Calcium	-----	0.1	meq/100g	<0.1	8.9 meq/100g		102	79.0	113	
ED007: Exchangeable Magnesium	-----	0.1	meq/100g	<0.1	9.52 meq/100g		98.0	85.0	115	
ED007: Exchangeable Potassium	-----	0.1	meq/100g	<0.1	1.49 meq/100g		100	70.0	122	
ED007: Exchangeable Sodium	-----	0.1	meq/100g	<0.1	1.3726 meq/100g		103	76.0	112	
ED007: Cation Exchange Capacity	-----	0.1	meq/100g	<0.1	21.283 meq/100g		100	82.0	112	
ED008: Exchangeable Cations (QCLot: 5134690)										
ED008: Exchangeable Calcium	-----	0.1	meq/100g	<0.1	8.141 meq/100g		98.2	91.0	109	



Sub-Matrix: SOIL				Method Blank (MB) Report		Laboratory Control Spike (LCS) Report			
Method: Compound		CAS Number	LOR	Unit	Result	Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)	
ED008: Exchangeable Cations (QCLot: 5134690) - continued									
ED008: Exchangeable Magnesium			0.1	meq/100g	<0.1	7.968 meq/100g	98.0	89.0	111
ED008: Exchangeable Potassium			0.1	meq/100g	<0.1	1.197 meq/100g	100	79.0	116
ED008: Exchangeable Sodium			0.1	meq/100g	<0.1	0.3456 meq/100g	104	75.0	118
ED008: Cation Exchange Capacity			0.1	meq/100g	<0.1	17.659 meq/100g	98.2	88.0	110
ED008: Exchangeable Cations (QCLot: 5134696)									
ED008: Exchangeable Calcium			0.1	meq/100g	<0.1	8.141 meq/100g	94.0	91.0	109
ED008: Exchangeable Magnesium			0.1	meq/100g	<0.1	7.968 meq/100g	93.4	89.0	111
ED008: Exchangeable Potassium			0.1	meq/100g	<0.1	1.197 meq/100g	96.5	79.0	116
ED008: Exchangeable Sodium			0.1	meq/100g	<0.1	0.3456 meq/100g	100	75.0	118
ED008: Cation Exchange Capacity			0.1	meq/100g	<0.1	17.659 meq/100g	94.2	88.0	110

Matrix Spike (MS) Report

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

- No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.



QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EB2318839	Page	: 1 of 5
Client	: BRISBANE [REDACTED]	[REDACTED]	[REDACTED]
Site	: [REDACTED]ood Arboretum & Secret Forest	Date Samples Received	: 22-Jun-2023
Sampler	: Sherwood Arboretum [REDACTED]	Issue Date	: 28-Jun-2023
Order number	: 123	No. of samples received	: 8
		No. of samples analysed	: 8

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- NO Method Blank value outliers occur.
- NO Laboratory Control outliers occur.
- NO Matrix Spike outliers occur.
- Duplicate outliers exist - please see following pages for full details.
- For all regular sample matrices, NO surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- NO Quality Control Sample Frequency Outliers exist.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: SOIL

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
ED006: Exchangeable Cations on Alkaline Soils	EB2318839--004	BH01_2.3-2.5	Exchangeable Calcium	----	32.4 %	0% - 20%	RPD exceeds LOR based limits
ED006: Exchangeable Cations on Alkaline Soils	EB2318839--004	BH01_2.3-2.5	Exchangeable Magnesium	----	31.7 %	0% - 20%	RPD exceeds LOR based limits
ED006: Exchangeable Cations on Alkaline Soils	EB2318839--004	BH01_2.3-2.5	Exchangeable Sodium	----	32.2 %	0% - 20%	RPD exceeds LOR based limits
ED006: Exchangeable Cations on Alkaline Soils	EB2318839--004	BH01_2.3-2.5	Cation Exchange Capacity	----	32.1 %	0% - 20%	RPD exceeds LOR based limits
ED008: Exchangeable Cations	EB2318839--006	BH02_0.8-1	Exchangeable Calcium	----	24.9 %	0% - 20%	RPD exceeds LOR based limits

Outliers : Analysis Holding Time Compliance

Matrix: SOIL

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA002: pH 1:5 (Solis)							
Soil Glass Jar - Unpreserved							
BH01_0.3-0.5,	BH01_0.8-1,						
BH01_1.8-2,	BH01_2.3-2.5,						
BH02_0.3-0.5,	BH02_0.8-1,						
BH02_1.8-2,	BH02_2.8-3						
EA010: Conductivity (1:5)							
Soil Glass Jar - Unpreserved							
BH01_0.3-0.5,	BH01_0.8-1,						
BH01_1.8-2,	BH01_2.3-2.5,						
BH02_0.3-0.5,	BH02_0.8-1,						
BH02_1.8-2,	BH02_2.8-3						

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

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

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

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

Matrix: SOIL

Evaluation: **x** = Holding time breach ; **✓** = Within holding time.

Method	Sample Date	Extraction / Preparation		Analysis	
		Date extracted	Due for extraction	Date analysed	Due for analysis
Container / Client Sample ID(s)					

Matrix: SOIL										Evaluation: ✖ = Holding time breach ; ✔ = Within holding time			
Method		Sample Date	Extraction / Preparation			Analysis			Evaluation				
Container / Client Sample ID(s)	Date extracted		Due for extraction	Date analysed	Due for analysis								
EA002: pH 1:5 (Solis)													
Soil Glass Jar - Unpreserved (EA002) BH01_0.3-0.5, BH01_1.8-2, BH02_0.3-0.5, BH02_1.8-2,		06-Jun-2023	26-Jun-2023	13-Jun-2023	✖	26-Jun-2023	26-Jun-2023	✔					
EA010: Conductivity (1:5)													
Soil Glass Jar - Unpreserved (EA010) BH01_0.3-0.5, BH01_1.8-2, BH02_0.3-0.5, BH02_1.8-2,		06-Jun-2023	26-Jun-2023	13-Jun-2023	✖	26-Jun-2023	24-Jul-2023	✔					
ED005: Exchange Acidity													
Soil Glass Jar - Unpreserved (ED005) BH01_0.3-0.5, BH01_1.8-2, BH02_0.3-0.5, BH02_1.8-2,		06-Jun-2023	26-Jun-2023	04-Jul-2023	✔	27-Jun-2023	04-Jul-2023	✔					
ED006: Exchangeable Cations on Alkaline Soils													
Soil Glass Jar - Unpreserved (ED006) BH01_0.3-0.5, BH01_1.8-2, BH02_0.3-0.5, BH02_1.8-2,		06-Jun-2023	26-Jun-2023	04-Jul-2023	✔	27-Jun-2023	04-Jul-2023	✔					
ED007: Exchangeable Cations													
Soil Glass Jar - Unpreserved (ED007) BH01_0.3-0.5, BH01_1.8-2, BH02_0.3-0.5, BH02_1.8-2,		06-Jun-2023	26-Jun-2023	04-Jul-2023	✔	27-Jun-2023	04-Jul-2023	✔					
ED008: Exchangeable Cations													
Soil Glass Jar - Unpreserved (ED008) BH01_0.3-0.5, BH01_1.8-2, BH02_0.3-0.5, BH02_1.8-2,		06-Jun-2023	26-Jun-2023	04-Jul-2023	✔	27-Jun-2023	04-Jul-2023	✔					



Quality Control Parameter Frequency Compliance

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

Matrix: SOIL

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification	
Analytical Methods		QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Electrical Conductivity (1:5)	EA010	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Exchange Acidity by 1M Potassium Chloride	ED005	2	4	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	2	9	22.22	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	5	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations with pre-treatment	ED008	2	2	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Electrical Conductivity (1:5)	EA010	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	2	9	22.22	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations with pre-treatment	ED008	2	2	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Electrical Conductivity (1:5)	EA010	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Exchange Acidity by 1M Potassium Chloride	ED005	2	4	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	2	9	22.22	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	5	20.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations with pre-treatment	ED008	2	2	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to Rayment and Lyons 4A1 and APHA 4500H ⁺ . pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
Electrical Conductivity (1:5)	EA010	SOIL	In house: Referenced to Rayment and Lyons 3A1 and APHA 2510. Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
Exchange Acidity by 1M Potassium Chloride	* ED005	SOIL	In house: referenced to Rayment and Lyons, method 15G1. This method is unsuitable for near neutral and alkaline soils. NATA accreditation does not cover performance of this service.
Exchangeable Cations on Alkaline Soils	* ED006	SOIL	In house: Referenced to Soil Survey Test Method C5. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with alcoholic ammonium chloride at pH 8.5. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil.
Exchangeable Cations	ED007	SOIL	In house: Referenced to Rayment & Lyons Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM Schedule B(3).
Exchangeable Cations with pre-treatment	ED008	SOIL	In house: Referenced to Rayment & Lyons Method 15A2. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM Schedule B(3).
Preparation Methods	Method	Matrix	Method Descriptions
Exchangeable Cations Preparation Method (Alkaline Soils)	* ED006PR	SOIL	In house: Referenced to Rayment and Lyons method 15C1.
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Lyons method 15A1. A 1M NH ₄ Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

B3 Factual Report - Sherwood Arboretum Soil and Groundwater
Results – 2024

Tim Davies

From: [REDACTED]
Sent: Monday, 19 February 2024 10:15 AM
To: [REDACTED]
Cc: [REDACTED]
Subject: Sherwood Arboretum and Oxley Creek Common groundwater logger download & water quality data
Attachments: 1 - SherwoodArboretum_OxleySecretForest-GroundwaterWells Charts.xlsb.pdf; 2 - Sherwood-Results Summary.pdf; 3 - Sherwood-Oxley - Piper plot 2023-24.pdf; 4 - Sherwood-Oxley - Slugtests.pdf; 5 - Sherwood-Oxley - K-est.pdf

[REDACTED]

Please find attached 1 charts of the groundwater logger download data and rainfall data from 13 June, 4 & 5 December 2023, 29 January & February 2024. Unfortunately some of the data needed to be trimmed to remove some unreliable readings, these appear as gaps in the charts for MW02 and MW03.
Below is a table of standing water level (SWL) measured at the time of logger installation / download. Total rainfall over the period 247 mm.

Table 1: Groundwater - Gauging Details

Well ID	Date	Time	SWL (m BTOC)
MW01-23	12/06/2023	12:30	3.69
	25/08/2023	10:00	3.653
	4/12/2023	12:30	3.825
	29/01/2024	10:10	3.58
MW02-23	12/06/2023	12:50	1.96
	25/08/2023	10:30	2.075
	4/12/2023	12:50	2.34
	29/01/2024	10:50	1.775
MW03-23	12/06/2023	14:30	2.95
	25/08/2023	11:30	1.845
	5/12/2023	10:45	1.845
	02/02/2024	11:50	0.84
MW04-23	12/06/2023	14:45	2.99
	25/08/2023	11:45	2.445
	5/12/2023	10:10	2.61
	02/02/2023	12:30	1.915

Laboratory Analytical results

Attachment 2 – Laboratory analytical data for sampling events 12 June 2023 and 29 January / 2 February 2024 for groundwater monitoring wells and 29 January 2024 for the pond (surface water SW01).

Attachment 3 – Piper plot of the ionic composition of MW01, MW2 and SW01 from the Sherwood Arboretum and MW03 and MW04 from the Oxley Secret Forest. The plot shows the wells to be distinct and the surface water to be distinct from either well.

Table 2: Groundwater - Water Quality Parameters

Well ID	Date	Temperature (°C)	Dissolved Oxygen (%)	Conductivity (µS/cm)	pH	ORP (mV)	Observations
---------	------	------------------	----------------------	----------------------	----	----------	--------------

MW01	12/06/2023	19.3	33.8	28120	6.16	286.1	Clear then turbid brown. Bailed approximately 18L then goes dry. Left to recharge before sampling.
	29/01/2024	25	21.4	33293	6.2	285.8	Clear then turbid brown. Bailed approximately 18.5L then goes dry. Left to recharge before sampling.
MW02	12/06/2023	18.2	27.9	3857	6.56	271.6	Clear then turbid brown. Bailed approximately 20L then goes dry. Left to recharge before sampling.
	29/01/2024	24.7	15.9	3652	6.59	256.9	Clear then turbid brown. Bailed approximately 20L then goes dry. Left to recharge before sampling.
MW03	12/06/2023	18	16.9	17663	6.58	57.4	Very turbid, grey. Bailed approximately 6L then dry. Left to recharge before sampling.
	2/02/2024	25.3	0.7	20373	6.21	-76	Very turbid, grey. Bailed approximately 11.5L then dry. Left to recharge before sampling.
MW04	12/06/2023	18.5	41.7	21546	4.69	316.9	Slightly turbid, bailed approximately 5L goes dry. Left to recharge before sampling.
	2/02/2024	26.6	13.6	24512	4.79	42	Slightly turbid, bailed approximately 6.5L goes dry. Left to recharge before sampling.
SW01	29/01/2024	27.6	20.4	469	6.74	173.5	Sampled from platform. Clear with slight turbidity. No flow. Turtles, algae, aquatic plants and turtles present.



Figure 1- Location of surface water sample point (SW01)

Rising and falling head tests

One well from each site was selected and a rising and falling head test was performed. A slug was lowered into the well, displacing the water in the well. Solinst level loggers were installed in the groundwater wells and set to record a standing water level (SWL) reading every second. Data retrieved from the loggers was entered to the Solinst program. Charts of the rising and falling head tests are in attachment 4. The estimated K value (hydraulic conductivity) was calculated using the modified Bouwer-Rice equation (attachment 5).

Table 3: Rising and falling head test data

Location	Well ID	Screened lithology	Top of Screen depth (m BGL)	Total depth (m BGL)	Water strike (m BGL)	Recovered SWL (m BTOC)		Estimated Hydraulic conductivity (K-value)
Sherwood Arboretum	MW02/23	Natural: silty clay with organic material, very stiff to hard, moist	1.935	5.935	4.1	12/06/2023	1.96	3.1 x 10 ⁻⁶
						25/08/2023	2.075	
						4/12/2023	2.34	
						29/01/2024	1.775	
Oxley Secret Forest	MW03/23	Natural: silty clay, firm to stiff, becoming firm to soft at depth	0.940	3.940	3.0	12/06/2023	2.95	1.3 x 10 ⁻⁶
						25/08/2023	1.845	
						5/12/2023	1.845	
						02/02/2024	0.84	

Regards



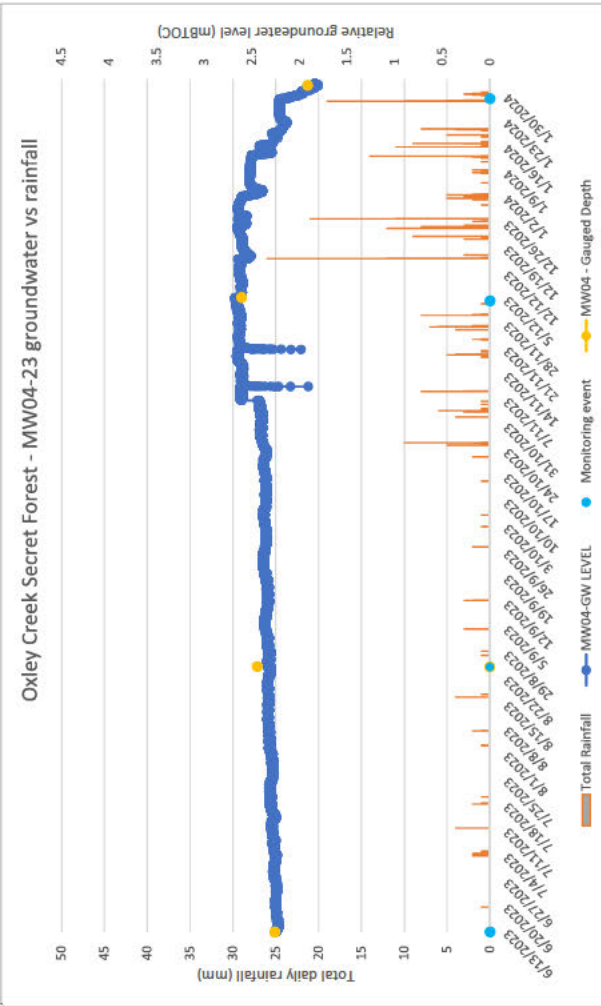
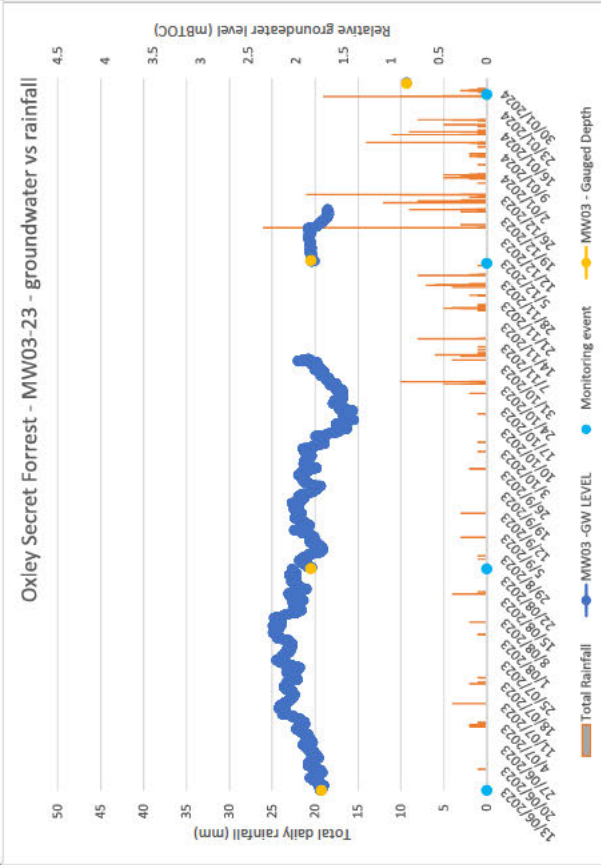
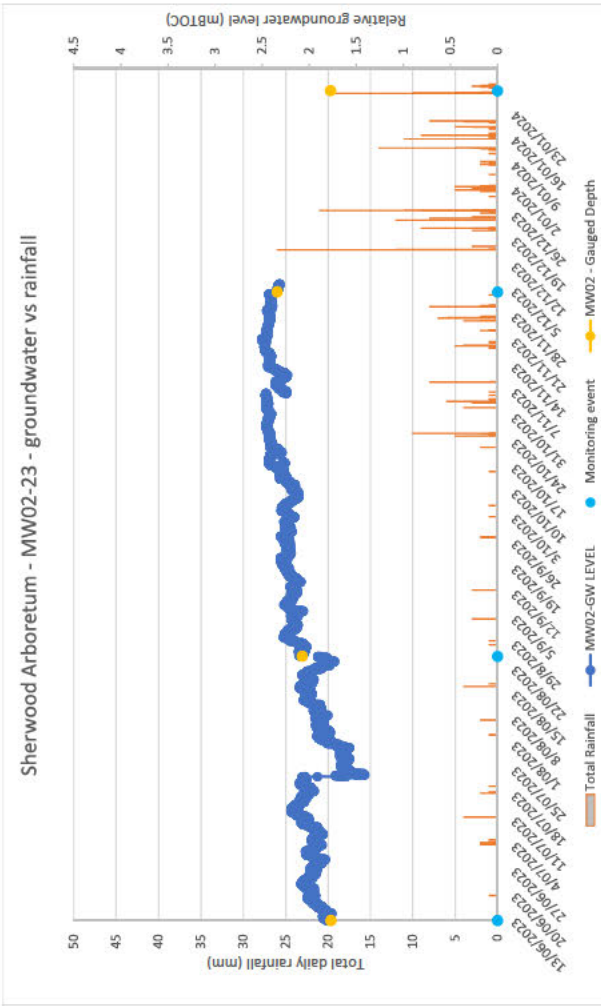
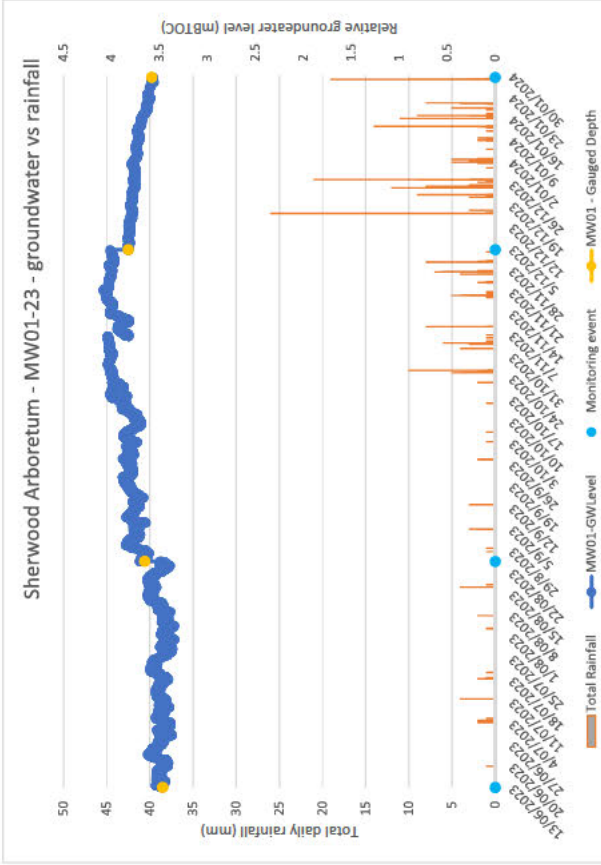
City Projects Office | Brisbane Infrastructure | **BRISBANE CITY COUNCIL**

Green Square | [Level 2](#) 505 St Pauls Terrace, Fortitude Valley QLD 4006

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SECURITY LABEL: OFFICIAL



		Field parameters										Major ions							
		SWL	base of well	Field pH	Field Electrical Conductivity	Dissolved Oxygen	Temperature	Redox	Calcium	Magnesium	Sodium	Potassium	Chloride	Sulfate as SO4	Hydroxide alkalinity	Carbonate alkalinity	Bicarbonate alkalinity	Total alkalinity	
Limit of Reporting	Units	0.001	0.001	1	1	1	0.1	0.1	1	1	1	1	1	1	0.01	1	1	1	1
Sample ID	Date	Lab Sample ID																	
MW01	12/06/2023	EB2317736001	3.465	7.873	6.16	28120	33.8	19.3	286.1	700	1370	5970	13	9210	5900	<1	<1	<1	149
	29/01/2024	EB2402694001	3.58	7.87	6.2	33293	21.4	25	285.8	752	1310	5550	13	9050	6610	<1	<1	<1	147
MW02	12/06/2023	EB2317736002	1.77	5.935	6.56	3857	27.9	18.2	271.6	248	124	410	15	429	891	<1	<1	<1	462
	29/01/2024	EB2402694002	1.775	5.935	6.59	3652	15.9	24.7	256.9	234	114	356	15	422	862	<1	<1	<1	427
MW03	12/06/2023	EB2317736003	1.735	3.94	6.58	17663	16.9	18	57.4	228	449	3380	72	5900	131	<1	<1	<1	540
	02/02/2024	EB2403533001	0.84	3.94	6.21	20373	0.7	25.3	-76	221	422	2890	65	6400	256	<1	<1	<1	523
MW04	12/06/2023	EB2317736004	2.26	3.913	4.69	21546	41.7	18.5	316.9	612	991	3940	69	6130	7010	<1	<1	<1	142
	02/02/2024	EB2403533002	1.915	3.913	4.79	24512	13.6	26.6	42	588	869	3220	60	5420	6170	<1	<1	<1	<1
SW01	29/01/2024	EB2402694003	-	-	6.74	469	20.4	27.6	173.5	18	8	54	5	82	16	<1	<1	<1	73

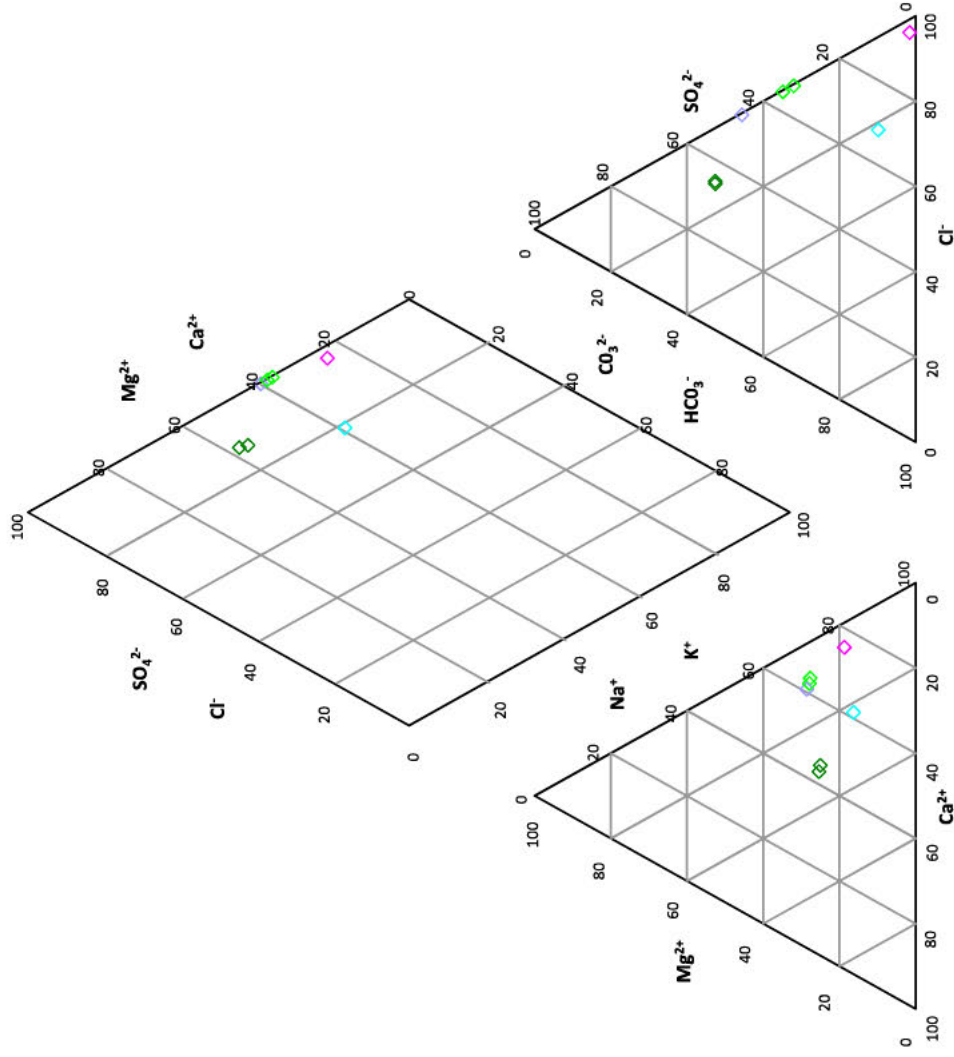
		Nutrients															Observations
		Fluoride	Total Anions	Total Cations	Ionic Balance	Ammonia (as N)	Total Kjeldahl Nitrogen as N	Nitrate as N	Nitrite as N	Nitrite plus N	Total Nitrogen as N	Total Phosphorus as P	Reactive Phosphorus as P				
Sample ID	Date	mg/L	meq/L	meq/L	%	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L			
MW01	12/06/2023	0.1	0.01	0.01	0.01	0.01	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01			
	29/01/2024														-		
MW02	12/06/2023	0.3	386	408	2.78	0.1	<0.5	0.84	<0.01	0.84	0.8	0.26	0.22		Clear then turbid brown. Bailed approx 18L then goes dry, left to recharge before sampling.		
	29/01/2024	0.3	396	387	1.12	<0.05	<0.5	0.88	<0.01	0.88	0.9	0.31	0.26		Clear then turbid brown. Bailed approximately 18.5L then goes dry, left to recharge before sampling.		
MW03	12/06/2023	0.6	39.9	40.8	1.13	0.02	0.2	0.03	<0.01	0.03	0.2	0.37	0.16		Clear then turbid brown. Bailed approx 20L then goes dry, left to recharge before sampling.		
	29/01/2024	0.6	38.4	36.9	1.93	0.09	0.3	0.08	0.02	0.1	0.4	0.22	0.22		Clear then turbid brown. Bailed approximately 20L, left to recharge before sampling.		
MW04	12/06/2023	0.2	180	197	4.57	4.95	13.6	0.02	<0.01	0.02	13.6	2.68	0.21		Very turbid, grey. Bailed approximately 6L then goes dry.		
	02/02/2024	0.3	196	173	6.28	0.11	9.5	<0.01	<0.01	<0.01	9.5	1.98	1.36		Clear then very turbid, grey, bailed approximately 11.5L, left to recharge before sampling.		
SW01	12/06/2023	0.3	322	285	6.01	0.22	6.3	<0.01	0.04	0.03	6.3	0.16	<0.01		Slightly turbid, bailed approximately 5L then goes dry.		
	02/02/2024	0.3	281	242	7.42	0.13	2.9	<0.01	0.03	0.02	2.9	<0.05	0.03		Clear then turbid, bailed approximately 6.5L, left to recharge before sampling.		
	29/01/2024	<0.1	4.1	4.03	0.88	0.13	1.3	0.56	0.02	0.58	1.9	0.3	0.14		Sampled from platom with pole. Turtles and water birds present, no flow, algae and aquatic plants.		

MW01-23 MW02-23 MW03 MW04 MW01-23
 MW02-23 SW01

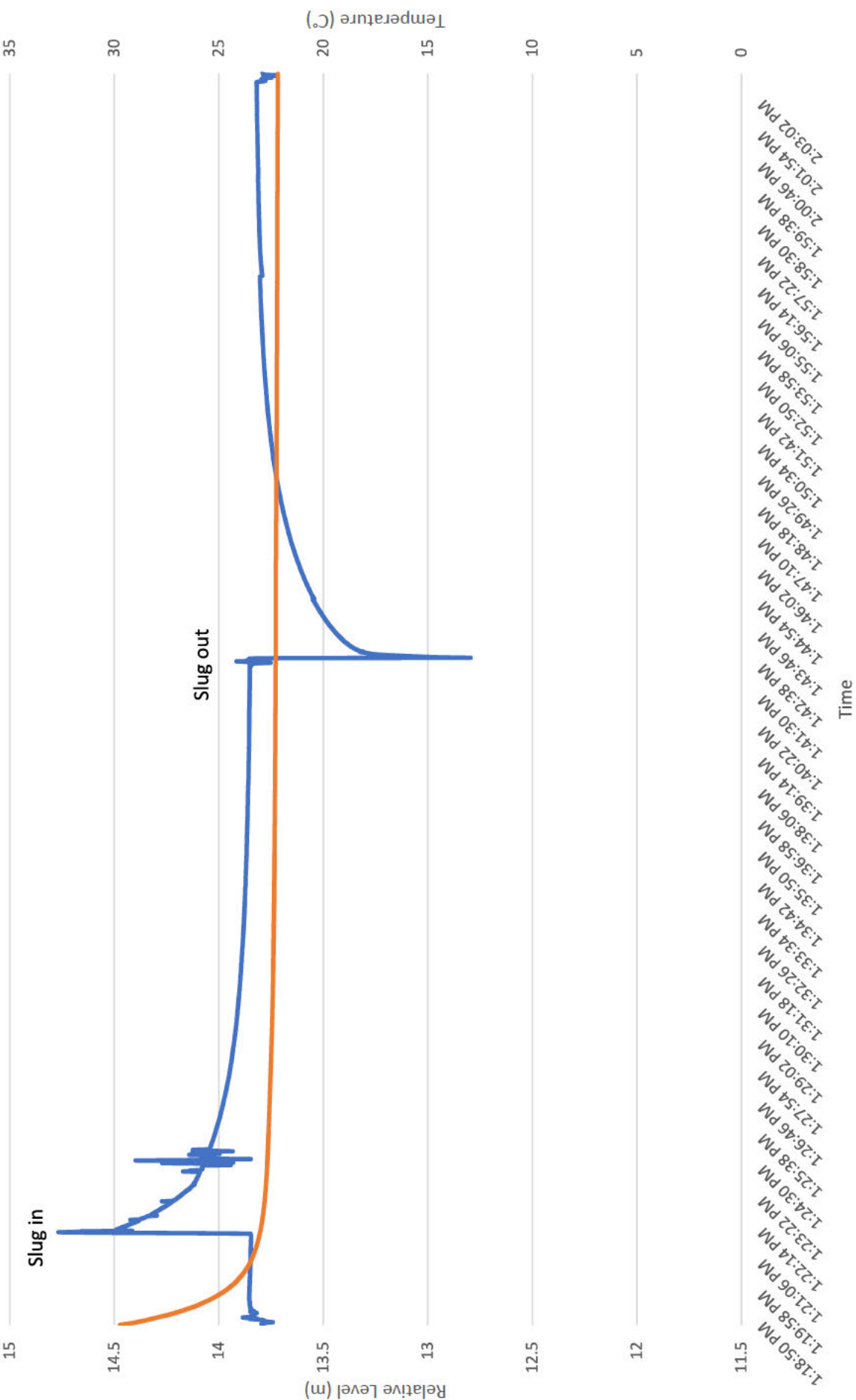
Ionic ratios from the monitoring locations.

MW01, MW02 and SW are from Sherwood Arboretum, MW03 and MW04 from Secret Forest at Oxley.

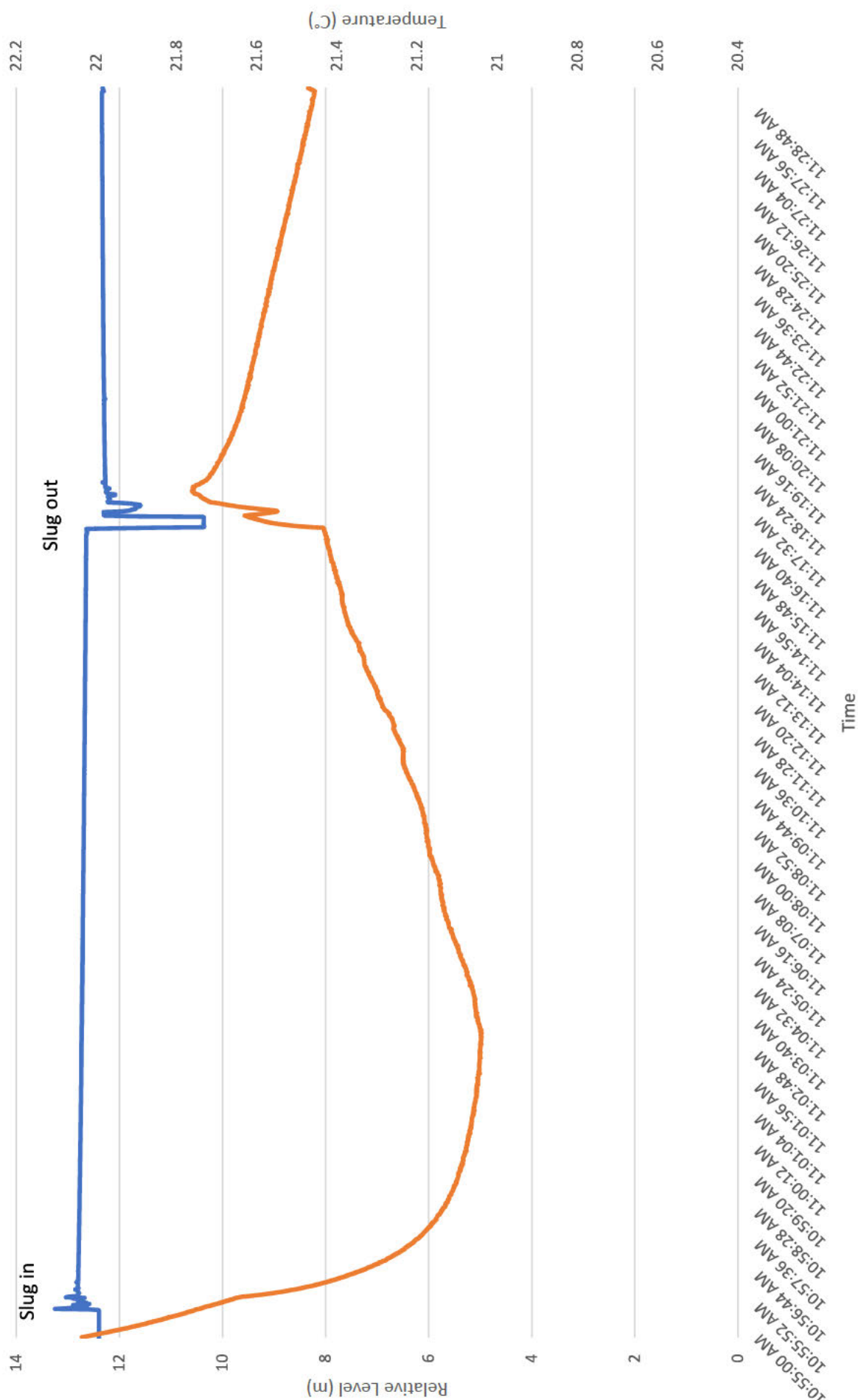
This piper plot shows that the "fingerprint" chemistry of the two wells at Sherwood are distinct, and that the surface water is also distinct from either well.



Sherwood Arboretum - MW02/23 Falling and Rising Head Test

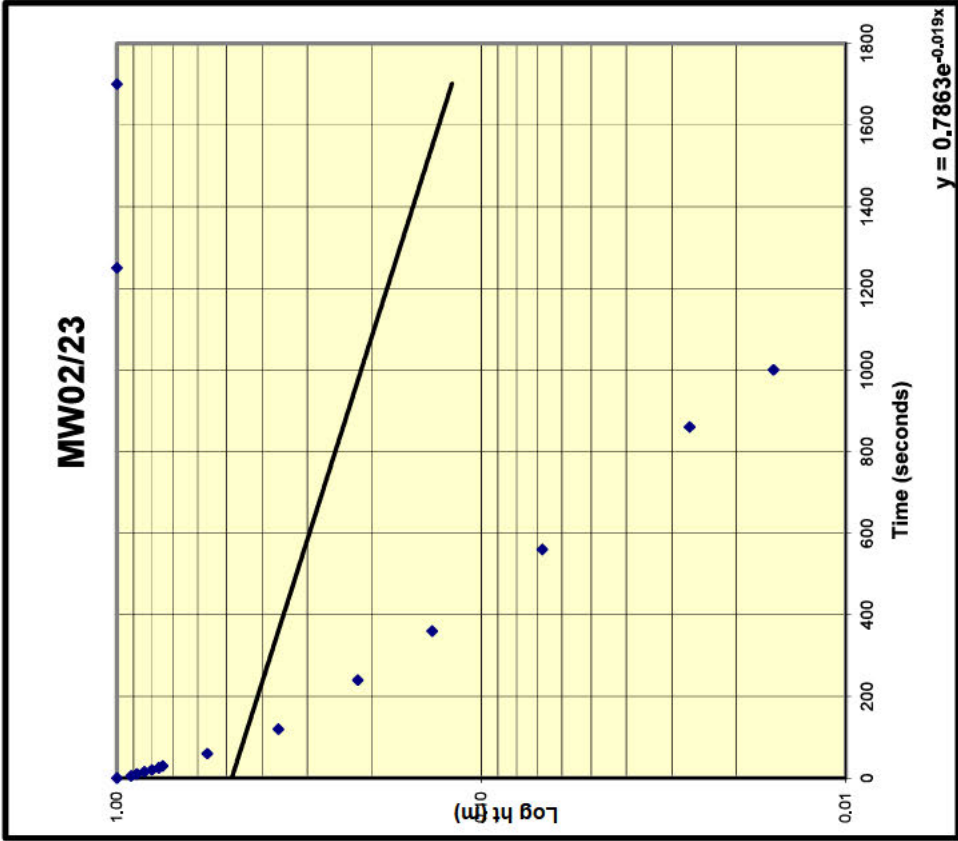


Oxley Creek Common - MW03/23 Falling and Rising Head Test



FALLING HEAD TEST ANALYSIS (MODIFIED BOUWER-RICE)

PROJECT NO:	GY94		
SITE LOCATION:	Sherwood Arboretum		
TESTED BY:	SW		
DATE:	4/12/2023	CHECKED BY:	SD



The modified Bouwer-Rice Equation
(Kruseman & De Ridder, 1970) is:

$$K = \frac{r_c^2 \cdot \ln(R_e / r_w)}{2d} \cdot \frac{1}{t} \cdot \ln\left(\frac{h_o}{h_t}\right)$$

WELL AND AQUIFER DATA

Initial Water Level (h_o)	=	13.847	metres
Wetted Screen Length (d)	=	3.00	metres
Pipe Radius (r_c)	=	0.025	metres
Borehole Radius (r_w)	=	0.050	metres
Aquifer Thickness (D)	=	5	metres

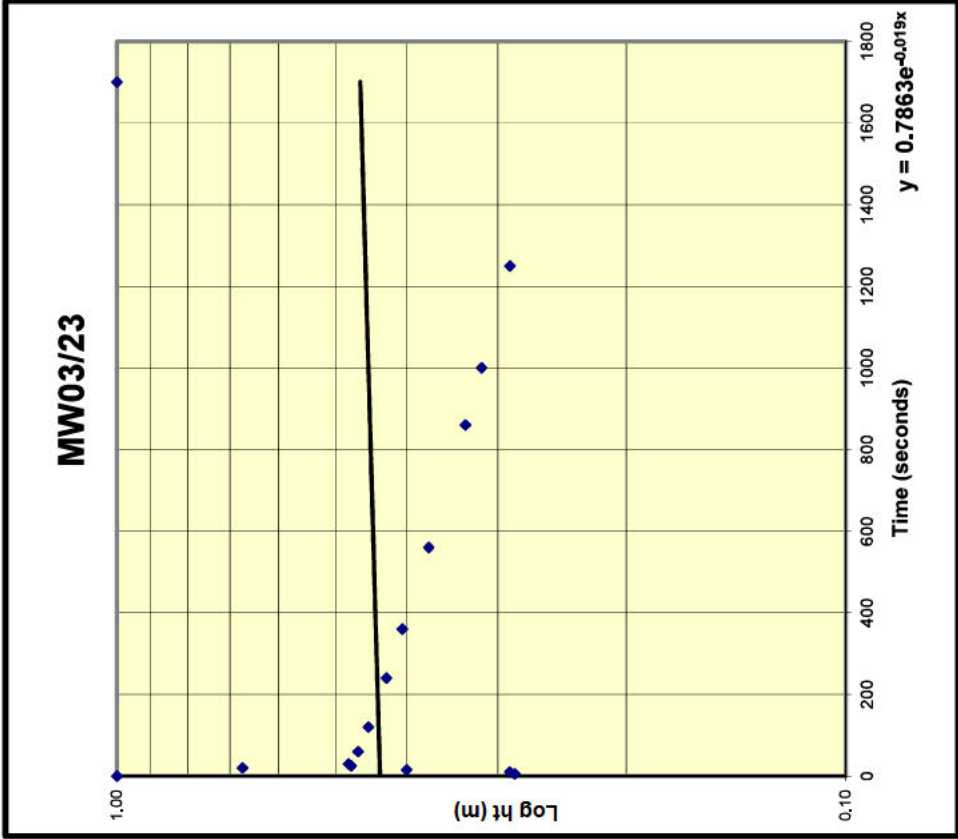
DRAWDOWN DATA

Time [s]	SWL (m)	h_t	(h_t/h_o)	$\log(h_t/h_o)$
0	14.5555	0.709	1.0000	0.0000
5	14.495	0.648	0.9147	-0.0387
10	14.4715	0.625	0.8815	-0.0548
15	14.4427	0.596	0.8409	-0.0753
20	14.415	0.568	0.8018	-0.0959
25	14.3906	0.544	0.7674	-0.1150
30	14.377	0.530	0.7482	-0.1260
60	14.2472	0.401	0.5651	-0.2479
120	14.1022	0.256	0.3606	-0.4430
240	14.0013	0.155	0.2182	-0.6611
360	13.9434	0.097	0.1365	-0.8647
560	13.8948	0.048	0.0680	-1.1675
860	13.8656	0.019	0.0268	-1.5718
1000	13.858	0.011	0.0158	-1.8014
1250	13.007	-0.840	1.0000	0.0000
1700	13.745	-0.102	1.0000	0.0000

K= 2.7E-06 m/sec; 2.37240E-01 m/day

FALLING HEAD TEST ANALYSIS (MODIFIED BOUWER-RICE)

PROJECT NO:	GY94
SITE LOCATION:	Sherwood Arboretum
TESTED BY:	SW
DATE:	5/12/2023
CHECKED BY:	HvR



The modified Bouwer-Rice Equation
(Kruseman & De Ridder, 1970) is:

$$K = \frac{r_c^2 \cdot \ln(R_e / r_w)}{2d} \cdot \frac{1}{t} \cdot \ln\left(\frac{h_o}{h_t}\right)$$

WELL AND AQUIFER DATA

Initial Water Level (h_o)	=	12.402	metres
Wetted Screen Length (d)	=	3.50	metres
Pipe Radius (r_c)	=	0.025	metres
Borehole Radius (r_w)	=	0.050	metres
Aquifer Thickness (D)	=	5	metres

DRAWDOWN DATA

Time [s]	SWL (m)	h_t	(h_t/h_o)	$\log(h_t/h_o)$
0	13.2466	0.844	1.0000	0.0000
5	12.6424	0.240	0.2845	-0.5460
10	12.6463	0.244	0.2891	-0.5390
15	12.7403	0.338	0.4004	-0.3975
20	12.97	0.568	0.6724	-0.1724
25	12.8052	0.403	0.4773	-0.3212
30	12.8084	0.406	0.4811	-0.3178
60	12.7964	0.394	0.4668	-0.3308
120	12.7837	0.381	0.4518	-0.3451
240	12.7626	0.360	0.4268	-0.3698
360	12.7449	0.343	0.4059	-0.3916
560	12.7176	0.315	0.3735	-0.4277
860	12.683	0.281	0.3325	-0.4782
1000	12.669	0.267	0.3160	-0.5004
1250	12.646	0.244	0.2890	-0.5392
1700	12.319	-0.083	1.0000	0.0000

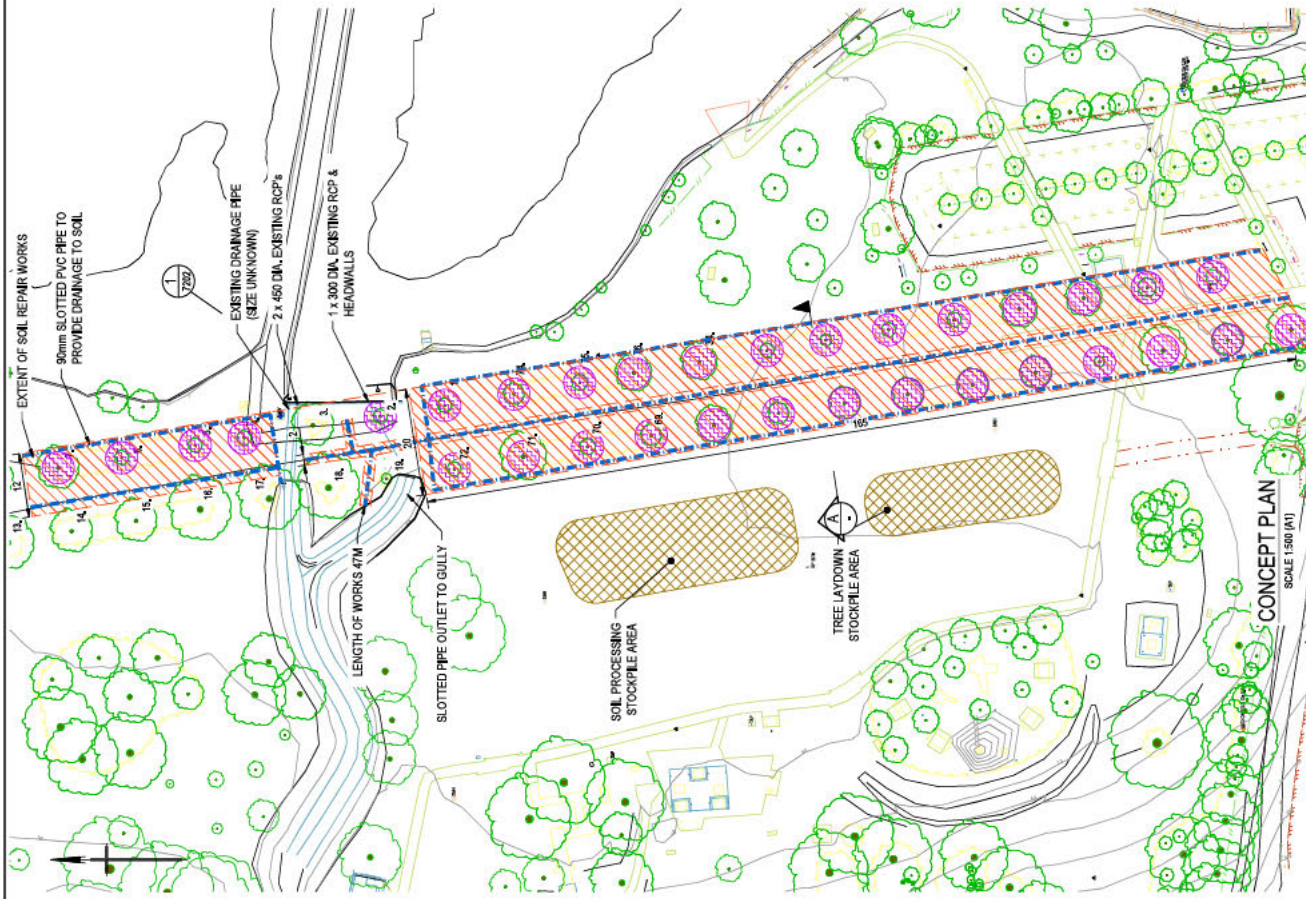
K= **1.1E-06** **m/sec;** **9.59540E-02** **m/day**

Appendix C **Remediation Option Plans**

C1 Concept Drainage Plan

C2 Costing of Drainage Plan

C3 Soil Remediation and Drainage Plan



- LEGEND**
- EXTENT OF SOIL REMEDIATION
 - SLOTTED PVC PIPE
 - EXISTING TREE TO BE REPLANTED
 - STOCKPILE AREA
 - EXISTING TREE TO BE PROTECTED & RETAINED

EXISTING TREES WITHIN SOIL REPAIR ZONE TO BE CAREFULLY REMOVED AND REPLANTED ONCE SOIL REPAIR WORKS HAS BEEN UNDERTAKEN.

REINSTATE TO PREVIOUS EXISTING SURFACE LEVEL AND PROVIDE TOPSOIL & TURF

SOIL TO BE EXCAVATED AND REPLACED

SECTION A-A
SCALE 1:50

SCALE 1:500 (BEFORE REDUCTION)

SCALE 1:50 (BEFORE REDUCTION)

CONCEPT

City Projects Office Brisbane City Council 100 South Brisbane Brisbane QLD 4001 Phone: 07 554 4444 Fax: 07 554 4444 Email: cityprojects@brisbanecity.qld.gov.au				PROJECT SHERWOOD ARBORETUM TREE MANAGEMENT				FILE LAYOUT PLAN				DESIGN DATE: _____ CHECKED: _____ DATE: _____ DRAWN: _____ DATE: _____ CHECKED: _____ DATE: _____ REFERENCE NO.: _____ SCALE: 1:500 PROJECT NUMBER / SHEET: 160725 / 7201			
DATE DATE: _____				DATE DATE: _____				DATE DATE: _____				DATE DATE: _____			
DATE DATE: _____				DATE DATE: _____				DATE DATE: _____				DATE DATE: _____			
DATE DATE: _____				DATE DATE: _____				DATE DATE: _____				DATE DATE: _____			

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C4 Costing of Soil Remediation and Drainage Plan

