BAYSIDE BRUNSWICK DEVELOPMENT GROUNDWATER ASSESSMENT RESPONSE TO SUBMISSIONS



waste solutions
AUSTRALIA PTY LTD

CODLEA PTY LTD
RN12 / W516-4 / 01
December 2012

Document Control Summary Sheet

Title	Bayside Brunswick Development, Groundwater Assessment, Response to Submissions
Document Type	Report
Issued By	Waste Solutions Australia Pty Ltd (ABN 64 010 824 487)
Author/s	Paul Smith
Client	Codlea Pty Ltd (Codlea)
Document ID	(RN12-W516/4-01)
Recipient	

Revision Status				
Status	**Revision**	**Date**	**Author**	**Verified**
Draft	A	27 November 2012	Ines Roeser, Paul Smith	Paul Smith
Final	0	05 December 2012	Patrick Mason, Paul Smith	Paul Smith

Table of Contents

List of Appendices

APPENDIX A	–	Groundwater Investigation, Aquifer Modelling and Sampling Report (WSA, 2012)

List of Acronyms/Abbreviations

ASS	Acid Sulphate Soil
BTEX	Benzene Toluene Ethyl-benzene Xylene
CRZ	Core Riparian Zone
CTCE	CivilTech Consulting Engineers
DOP	NSW Department of Planning
ESCP	Erosion and Sediment Control Plan
GDE's	Groundwater Dependent Ecosystems
GWMP	Groundwater Management Plan
JGA	Jim Glazebrook and Associates Pty Ltd
JWA	James Warren and Associates Pty Ltd
OOW	Office of Water
SEPP	State Environmental Planning Policy
SWMP	Surface Water Management Plan
TKN	Total Kjeldahl Nitrogen
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
WA	Water Act 1912
WSA	Waste Solutions Australia Pty Ltd

1 BACKGROUND

Waste Solutions Australia Pty Ltd (WSA) was commissioned by Codlea Pty Ltd to undertake an assessment of groundwater resources and their interaction under Lot 1 DP 871039, located at Bayside Way, Brunswick Heads NSW. Following the exhibition of the Environmental Assessment (which included the WSA report) by LandPartners, submissions were received from interested parties as well as regulatory agencies. This report reviews these submissions and responds to the relevant issues raised.

1.1 Scope of Work

Groundwater is only mentioned in the response from the Office of Water and in two private submissions. These responses will be examined in detail below in *Section 2*.

This report does not address issues raised around acid sulphate soils (ASS), surface water flow/ flooding or the water quality of the runoff water treated through the proposed detention basin system.

2 OFFICE OF WATER (OOW) RESPONSE

- *Applicant must forward details of monitoring bores to Office of Water Licencing Branch. If additional monitoring bores for ASS testing have not been decommissioned they must be licensed. If additional monitoring bores are to be established in the future, they must also be licenced.*

Response: The requested drill log data from the early drilling in 2009 was submitted to OOW to complete the licence requirements. As no ASS testing holes were retained as groundwater monitoring bores, these holes did not require a license.

- *Applicant to be aware of licensing requirements under the Water Act & Management Act. Dam construction may require consent.*

Response: The Applicant is aware of his licensing requirements under the Act. The storm water detention basin will require controlled activity approval. It is proposed that this license be conditioned as part of the project design phase.

- *Bond or Bank Guarantee will be required if a ground water or surface water licence is required.*

Response: It is proposed that this bond be conditioned as part of the project design phase.

- *OOW recommends the applicant prepare Groundwater and Surface Water Management Plans that incorporate a detailed description of a sustainable and efficient water supply.*

Response: Following discussions with OOW, it was agreed that the Groundwater Management Plan will be prepared and submitted as part of the project design phase.

- *Office of Water is satisfied that the storm water management arrangements adequately addresses the type and location of on-site detention, major overland flows and discharge calculations and the quantity direction and rate of surface and nutrients discharges from the site. However, concerns and recommendations include but are not limited to:*

1. the potential to contaminate groundwater through the direct infiltration of storm water runoff or the construction of storm water detention basins and swales that intercept the water table which may provide further movement of pollutants down gradient that could discharge to surface waters;

2. detention basins and swales that are constructed below the water table should be lined (clay or geo-fabric) to minimise the hydraulic connection within the surrounding groundwater system or if unlined, constructed so that the base of the excavation is 1m above the water table for most of the time;

Response: WSA has undertaken additional drilling, pump testing and numerical modelling in order to assess whether the requirement for lining of the detention basin is necessary to stop potential adverse impacts of the treated infiltration water on the adjacent SEPP 14 and 7 (a) zone land. This work has been discussed in detail in the attached report (called ***Appendix A***).

The main conclusion from this study is that the shallow perched aquifer into which any detention basin infiltration water will flow does not discharge to the SEPP 14 wetlands or the 7(a) lands. In addition, even with a 1 in 100 year storm event and a dry aquifer, the distance the water will infiltrate before returning back to the drain is limited.

3. the potential of ASS to be exposed when constructing detention basins, swales and drains creating acid leachate;

Response: This issue will be discussed elsewhere by JGA.

4. on coastal land of very low relief flooding is an issue especially considering the longer term possibility of sea level rise and increase in the range of inundation depths; and

Response: This issue will be discussed elsewhere by CivilTech Consulting Engineers (CTCE)

5. all works that intercept groundwater must be licensed under Part 5 WA.

Response: This will be undertaken.

- *Applicant to provide evidence that sediment and erosion works concur with the 'blue book'. ESCP to be incorporated into a GWMP and/or SWMP.*

Response: It is proposed that this will be included in the SWMP.

- *Applicant must demonstrate in a SWMP and GWMP what mitigation measures will be adopted to avoid and/or treat the following potential impacts:*

1. TSS (total suspended solids) may increase in surface water due to erosion and runoff of cleared areas during construction stages of the proposed development;

Response: The sediment and erosion controls documented in the SWMP will describe the control measures which will limit adverse environmental outcomes.

2. low conductivity in Simpsons Creek and high conductivity in groundwater from storm water runoff discharge and reduced recharge respectively due to sealed surfaces on the site;

Response: As Simpsons Creek is a tidal creek, conductivity will vary daily and seasonally. All existing groundwater conductivities are low. After development, conductivity of groundwater within the upper perched aquifer may increase through the addition of fertilizers to gardens and grass. The conceptual hydrogeological model

indicates that the groundwater from this upper aquifer will not reach the SEPP 14 wetlands. The lower aquifer is unlikely to be affected as it is isolated from the upper aquifer by a confining "coffee rock" layer at depth (refer to the conceptual model discussions in ***Appendix A***).

> *3. decreases in groundwater level and flow rates from reduced recharge which may potentially impact on GDEs;*

Response: The top perched aquifer under the proposed development does not contribute a significant volume of water to the SEPP 14 wetlands. Most excess water from this aquifer will discharge to the central N-S drain before directly discharging to Simpson Creek during a wet season. Hence, any potential loss to the groundwater from hard surfaces within the development will have no impact on the adjacent GDE's.

> *4. Eutrophication of water sources and higher PH from increased application of fertilisers and soil conditioning agents to gardens/lawns; and*

Response: Routine baseline testing of the upper and lower aquifers show that both these aquifers already contain significant quantities of nutrients (see ***Appendix A***).

> *5. increased concentrations of TPH (total petroleum hydrocarbons), BTEX (benzene toluene ethyl-benzene xylene), pesticides and metal from road runoff and domestic activities.*

Response: If low concentrations of these contaminants exist in groundwater discharging to the detention basin, the treatment process within the detention basin will reduce/remove the materials before discharge to the Simpson Creek.

- *Recommended baseline monitoring for water quality for a minimum of 2 years. Also recommend more extensive monitoring program which includes all aquifers, watercourses and wetlands within and adjacent to the project site.*

Response: The monitoring program was discussed with the OOW. The proposed monitoring program is described in ***Appendix A*** *– Section 1.3*.

- *The GWMP and SWMP should incorporate the results of the baseline data monitoring already undertaken, proposed future monitoring and reporting programs, including a contingency plan. Should also include measures to protect natural environment (SEPP 14, 7(a) zone land etc.). The plans should be forwarded to the Office of Water for review.*

Response: The GWMP will incorporate the baseline sampling data, details of any reporting and a contingency plan. The Plan will also include any protection measures, should they be required, for the SEPP 14 and 7(a) zone land. The draft Plan will be sent to OOW for review prior to finalisation.

- *Recommend 100m buffer to estuarine aquatic vegetation.*

Response: This aspect will be discussed by James Warren & Associates Pty Ltd (JWA) or CTCE.

- *Give consideration to NSW State Rivers & Estuaries Policy 1993 when preparing SWMP and GWMP.*

Response: The Policy will be taken into account when preparing the GWMP.

- *Applicant to take into account NOW's "Guidelines for Controlled Activities" including the minimum core riparian zone (CRZ) widths which should be adhered to. In addition to the CRZ widths, an additional vegetated buffer is to be provided*

on both sides of the water course.

Response: This aspect will be handled by JWA once CRZ extent is known.

- *The APZ is not to form part of the CRZ.*

Response: JWA to address

3 PUBLIC SUBMISSIONS

There were two public submissions which mentioned groundwater. The submissions were from:

- Mr Peter McCulloch of 2/57 Fingal St, Brunswick Heads and
- Ms Eleanor Sharman of 2/57 Fingal St, Brunswick Heads

The submissions both stated:

"The flood report claims that the majority of the site is underlaid by a continuous sand aquifer with a shallow water table generally between 0.3 m and 0.8 m. Compromising the stability, health and safety of any residential dwellings."

Response: the most recent fieldwork showed that the groundwater levels underneath the proposed site are 1 - 3 m below ground level (see ***Appendix A***). It is possible that higher groundwater levels will occur after prolonged wet periods. However, elevated water levels are not considered a health risk. WSA cannot comment on the impact of elevated groundwater levels on the stability or safety of residential dwellings.

4 RECOMMENDATIONS

- Based on the modeling results, WSA recommends that the detention basin sides do not have to be lined assuming the whole structure is underlain by the low permeability "Coffee Rock" material.
- The groundwater and surface water monitoring program, as listed in ***Appendix A****, Section 1.3*, should be instigated to gather further chemical data before the construction phase of the housing estate begins. This will determine impact of the development on the receiving environment.

5 LIMITATIONS

Waste Solutions Australia Pty Ltd has prepared this report for the use of Codlea Pty Ltd and the NSW Department of Planning and Infrastructure in accordance with generally accepted consulting practice. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report may not contain sufficient information for purposes other than for the client and its respective consulting advisers.

The accuracy of the assessment made in this report is dependent upon the accuracy and reliability of evidence drawn together from a number of sources. The field investigations on which this report is based were restricted to a level of detail appropriate for the current stage of the project. Waste Solutions Australia Pty Ltd has taken steps to ensure the accuracy and reliability of field observations and investigations. It is important, however, that the limitations of the assessment be clearly recognised when the findings of this study are being interpreted. This report is based on information derived partly from other parties over which Waste Solutions

Australia Pty Ltd has no control.

The report is based on conditions encountered in a limited number of investigation locations. Conditions may be encountered in subsequent investigations or during site redevelopment, which were not encountered in this investigation.

6 SIGNATORIES

Prepared by:

Paul Smith
MSc (Hydrogeo) MSc (Enviro Studies)
Director & Principal Consultant
Waste Solutions Australia Pty Ltd

APPENDIX A

GROUNDWATER INVESTIGATION, AQUIFER MODELLING AND SAMPLING REPORT (WSA, 2012)

GROUNDWATER INVESTIGATION, AQUIFER MODELLING AND SAMPLING REPORT



waste solutions
AUSTRALIA PTY LTD

CODLEA PTY LTD

RN12 / W516-4 / 02

December 2012

Document Control Summary Sheet

Title	Groundwater Investigation, Aquifer Modelling and Sampling Report
Document Type	Report
Issued By	Waste Solutions Australia Pty Ltd (ABN 64 010 824 487)
Author/s	Patrick Mason Paul Smith Ines Roeser
Client	Codlea Pty Ltd (Codlea)
Document ID	(RN12-W516/4-02)
Recipient	

Revision Status				
Status	**Revision**	**Date**	**Author**	**Verified**
Draft	A	27 November 2012	Patrick Mason, Ines Roeser, Paul Smith	Paul Smith
Final	0	05 December 2012	Patrick Mason, Paul Smith	Paul Smith

Table of Contents

List of Appendices

Table of Figures – Appendix A

List of Tables

List of Acronyms/Abbreviations

AHD	Australian Height Datum
BTEX	Benzene Toluene Ethyl-benzene Xylene
DOP	NSW Department of Planning
LOR	Laboratory Limit of Reporting
mAHD	Metres Australian Height Datum
mBGL	Metres Below Ground Level
MEQ/L	Milliequivalents per Litre
µS/cm	Microsiemens Per Centimetre
µg/L	Micrograms Per Litre
N	Nitrogen
NATA	National Association of Testing Authorities
NTU	Nephelometric Turbidity Units
OOW	Office of Water
QA	Quality Assurance
QC	Quality Control
RPD	Relative Percent Difference
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
WSA	Waste Solutions Australia Pty Ltd

1 INTRODUCTION

1.1 Background and Objective

Waste Solutions Australia Pty Ltd (WSA) was commissioned by Codlea Pty Ltd to undertake a groundwater investigation, numerical aquifer modelling and groundwater and surface water sampling of their site located at Bayside Way, Brunswick Heads NSW (real property description, Lot 1 DP 871039). Codlea Pty Ltd proposes that the site be developed into a residential subdivision. An area of wetlands located in the far east of the site has been protected under the State Environmental Planning Policy (SEPP) No 14 - Coastal Wetlands.

The aim of this report was to undertake investigations in order to understand the hydrogeological conditions of the site so that a more detailed conceptual model of the site can be developed (building upon that of WSA 2010). This will allow a numerical groundwater model of the site to be used to determine any impact to the receiving environment from the construction of the planned housing estate, in particular the storm water detention basins and swales. Additionally, WSA has developed a groundwater and surface water sampling plan for on-going assessment of environmental conditions at the site. This plan has been discussed with the NSW Office of Water (OOW). The results of environmental sampling undertaken up to this report (November 2012), including historical sampling results, will be presented and discussed.

A site plan showing the locations of the monitoring bores, as well as the surface water sample location sites are shown in *Figure 1*.

1.2 Scope of Work

The scope of works comprised:

- Installation of a further four groundwater monitoring bores to enable assessment of interaction between the deeper and shallow aquifer on site. New bores installed were Bores 3B, 4A, 4B, and 5. This work was undertaken on the 13-14 November 2012;
- Undertake short term pump tests within two deep bores (Bores 3B and 4B) to measure the response in the adjacent shallow monitoring bores (Bores 3A and 4A);
- Undertake recovery tests in the deep and shallow bores across the site to determine aquifer transmissivity values (Bores 3A, 3B, 4B, and 5);
- Undertake falling head infiltration tests at two locations in the base of the major north-south drainage channel that bisects the site to determine infiltration rates. This information forms an essential element of the hydrogeological behaviour of the numerical modelling of the shallow unsaturated aquifer at this depth;
- Surveying of all the groundwater monitoring bores to the Australian Height Datum (AHD);
- Surface water and groundwater sampling and analysis: measurement of groundwater levels within the site bores and sampling of the bores (with

available water) to determine the groundwater quality on the site prior to the development. Sampling of Simpson Creek to the east of the property and the drainage lines that intersect the property to determine the quality of the surface water on and near the site prior to the development. Analysis of water samples for a range of water quality parameters and potential contaminants (with the analyte list as agreed with OOW);

- Numerical modelling of the hydrogeology of the site to determine the impact of the storm water detention basin on the local aquifer; and,
- Submission of a report to Codlea detailing the findings of the investigation. This report would also be suitable for submission to the OOW and for public viewing.

1.3 Groundwater and Surface Water Sampling and Analysis Plan

Discussions were held with the OOW. The proposed sampling plan for the Codlea site is as follows for groundwater and surface water. To date, sampling as per this plan has not been carried out; however groundwater and surface water samples have been obtained at intervals over the course of investigative work by WSA since 2009. The locations of the monitoring bores are shown on *Figure 1*.

1.3.1 Groundwater

The proposed groundwater sampling plan includes sampling of all the monitoring bores on a monthly basis for analysis of the following parameters:

- On site parameters measured using a multiparameter probe (turbidity, pH, EC, DO),
- Nutrients (ammonia, nitrate, total nitrogen, total phosphorus),
- Major anions and cations (calcium, magnesium, sodium, potassium, chloride, sulphate, bicarbonate), and
- Metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc and mercury) to be analysed quarterly only.

Water level data loggers were installed in Bores 3A, 3B, 4A, and 4B after installation of the new deep bores during November 2012. These loggers will be downloaded at least quarterly.

1.3.2 Surface Water

Surface water sample sites are Drains 1-4 and Simpson Creek near the southerly site extent. These locations are shown on *Figure 1*.

The OOW has requested sampling be undertaken during rainfall events and not during routine groundwater sampling. WSA proposes to collect grab samples from the above sites during two runoff events during the next wet season and a total of two runoff events during this dry season or the next dry season (should suitable events occur). Grab samples were obtained during the 11 September 2012 site visit from locations with available water. Surface water samples are to be analysed for the following parameters:

- On site parameters measured using a multiparameter probe (turbidity, pH, EC,

DO),

- Nutrients (ammonia, nitrate, total nitrogen, total phosphorus),
- Total suspended solids (TSS),
- Total Petroleum Hydrocarbons (by fractions), and
- Total algae count (including cyanobacteria).

2 RESULTS OF FIELD INVESTIGATIONS

2.1 Field Work Summary

Investigative fieldwork for this project was undertaken from September to November 2012. WSA undertook initial site investigations during June and October 2009, the results of this work is outlined in the WSA report *Surface and Groundwater Assessment, Lot 1 DP 871039, Bayside Way, Brunswick Heads (*WSA 2010).

The breakdown of field tasks undertaken for this investigation and the dates these occurred are as follows:

- 11 September 2012: Groundwater samples were obtained from Bore 3A and the surface water sites: Drain 1, Drain 2, Drain 3 and Ck South 1 (Simpson Creek). Drain 4 was dry at the time of sampling. Using an endoscope camera, obstructions within Bores 1 and 2 were examined and it was found that tree roots had fouled the casing prohibiting functioning of the bores.
- 18 September 2012: The tree roots in Bores 1 and 2 were cleaned out. Bore 1 was almost dry and was not able to be sampled; however a groundwater sample was able to be obtained from Bore 2.
- 5 October 2012: Recovery testing was carried out on Bore 3A and permeability testing of the main site drainage channel was undertaken in two locations (Test 1 and Test 2, shown in *Figure 1*).
- 13-14 November 2012: Installation of Bores 3B, 4A, 4B and 5 was undertaken by Geotech Investigations Pty Ltd. Installation of the deep bores was done using wash boring to keep the holes open to allow installation of the casing within the collapsible sand environment that the site is situated on.
- 14 November 2012: A short term pump test was undertaken on Bore 3B, measuring the response in 3A, and a short term pump test was undertaken on Bore 4B, measuring the response in 4A. Recovery testing was then undertaken on Bores 3B and 4B after the pump test. A recovery test was also undertaken on Bore 5. All new bores were developed after drilling by purging adequate volumes using a 12v submersible pump. Groundwater samples were obtained from all newly installed bores.
- 19 November 2012: All monitoring bores were surveyed.

The results of this work will be discussed in the relevant sections to follow.

2.2 Quality Assurance and Quality Control

2.2.1 Field Quality Assurance and Quality Control

All field work was carried out in accordance with WSA standard operating procedures for field Quality Assurance (QA) and Quality Control (QC). These procedures cover:

- The use of appropriate equipment for obtaining samples;
- The use of suitable sample containers;
- Appropriate sample storage, preservation and transportation;
- Rigorous decontamination procedures;
- The collection of QC samples (rinsate blanks and field duplicates);
- Field measurements, including calibration of equipment; and
- Documentation of all fieldwork, including sample locations and observations.

Field QA samples were obtained as per WSA field quality assurance standards. No metals rinsate sample was obtained, as disposable syringes and filters were used to filter samples for dissolved metals analysis.

Two duplicate samples were obtained during the project. A duplicate sample was obtained at Bore 3A on the 11 September 2012 and Bore 3B on the 14 November 2012. The Relative Percent Difference (RPD%) (a measure of precision between two values expressed as a percentage) between the original sample and the duplicate ranged from 0-23.1% (Bore 3A) and 0-17.4% (Bore 3B) for the inorganic analyses. The laboratory reports that ionic balances were within acceptable limits. The field QA and QC results are considered acceptable and analysis results are suitable for use in this report.

The laboratory completed routine QA and QC procedures in accordance with National Association of Testing Authorities (NATA) requirements and internal laboratory standards as part of the analytical testing program. The results of this testing can be found on the appropriate reports within ***Appendix B***. All samples were within holding times with the exception of pH which has a holding time of 6 hours only. The remaining laboratory duplicate, method blank, laboratory control spike, and matrix spike samples that were a part of this work order were within ALS acceptable standards.

2.3 Groundwater and Surface Water Monitoring Results

2.3.1 Drilling of New Boreholes

Installation of a further four groundwater monitoring bores to enable assessment of interaction between the deeper and shallow aquifer on site was carried out on the 13-14 November 2012. New bores installed were Bores 3B, 4A, 4B, and 5. The bore logs have been supplied in ***Appendix C***. The geological findings of the drilling investigations will be discussed in *Section 3* below, groundwater conceptual model.

2.3.2 Groundwater Levels

Bore details and recorded groundwater levels reduced to meters Australian Height Datum (mAHD), from survey data, are shown below in *Table 1*. The groundwater levels

show significant seasonal variation with levels fluctuating by several meters in Bores 1 and 2. Bore 3A has fluctuated less over the monitoring period, by up to 0.92m.

The shallow bores have been installed within the upper sand aquifer on the site, while the deep bores have been installed below an extensive cemented sand ("coffee rock") layer (terminating between 8-10 m below ground level). There is a distinct difference in piezometric groundwater level between these two aquifers, with the deeper aquifer being approximately 2.1-2.2 meters deeper than the shallow aquifer.

Water level data loggers were installed in Bores 3A, 3B, 4A, and 4B after installation of the new deep bores during November 2012. No data is available for review for this report.

Table 1 Monitoring bore details

Borehole Location	UTM MGA94 Co-ordinate Easting	UTM MGA94 Co-ordinate Northing	Casing height (mAHD)[1]	Casing Height (mAGL)[2]	Bore Depth (mBTOC)[3]	Groundwater Level 4/06/09 (mAHD)	Groundwater Level 8/10/09 (mAHD)	Groundwater Level 11/09/12 (mAHD)	Groundwater Level 14/11/12 (mAHD)
Bore 1	553888.484	6840943.733	5.385	0.515	3.02	3.875	Dry	2.395	Dry
Bore 2	553953.278	6840829.324	5.165	0.615	2.9	3.855	2.59	2.765	Dry
Bore 3A	553819.893	6840801.054	4.37	-0.05 (gatic)	2.1	4.11	3.19	3.37	3.39
Bore 3B	553815.892	6840800.437	4.29	-0.07 (gatic)	11.87	NI[4]	NI	NI	1.257
Bore 4A	553804.108	6840534.801	4.46	-0.1 (gatic)	2.94	NI	NI	NI	3.741
Bore 4B	553804.377	6840531.391	4.47	-0.07 (gatic)	10	NI	NI	NI	1.456
Bore 5	554099.484	6840943.733	5.37	0.72	12.68	NI	NI	NI	0.995

(1) Casing height (measurement point) meters Australian Height Datum
(2) Casing height (measurement point) meters Above Ground Level
(3) Bore Depth meters below top of casing
(4) Not Installed

2.3.3 Comparative Guideline Values

Field and laboratory chemical data has been compared against the:

- ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality Australian Government Department of Environment, Water, Heritage and the Arts, Canberra; and
- The "Dutch Guidelines": Ministry of Housing, Spatial Planning and the Environment. Environmental Quality Objectives in the Netherlands: A review of environmental quality objectives and their policy framework in the Netherlands (1994).

Values chosen for each analyte are as per values stipulated in WSA 2010 for consistency across the reports. Where available, estuarine values have been adopted, as estuarine environments represent the major receiving environment at the site. For metals, the freshwater 95% protection of species has been chosen as the majority of water types are freshwater across the site. Values have been applied to dissolved metals, not totals as was done in WSA 2010.

2.3.4 Groundwater Chemistry

The standing water level was measured in each bore prior to purging. Approximately three times the volume of water in each bore was removed via bailer (Bores 2 and 3A)

or a 12v submersible pump (Bores 3B, 4A, 4B, 5), and the wells were allowed to recover prior to drawing a groundwater sample. Field recordings are provided in ***Appendix D***. A low-flow sampling pump was not used to collect the groundwater sample as the bores required development and cleaning out after drilling. This is quite important as the bores were installed using the wash boring technique. Several hundred litres were purged prior to obtaining the groundwater sample from each newly installed bore, with the exception of Bore 5 which went dry after purging 25L.

Groundwater samples were decanted into appropriately preserved sample bottles prepared by a NATA accredited laboratory and delivered to the lab for analysis. Two duplicate samples were obtained for quality assurance purposes (refer to *Section 2.2.1* above). The full NATA accredited results are provided in ***Appendix B***.

The analytical results have been tabulated in *Table 3* below with a comparison to the guideline values as discussed above in *Section 2.3.3*. Three groundwater monitoring rounds have been competed in total, during June 2009, October 2009 and September/November 2012.

The results of the groundwater sampling indicate that the shallow sand aquifer is fresh (between 60-260 μS/cm) and acidic (between pH 3.5 and 4.8), the low pH originating from the natural coastal environment in which the site is situated. The groundwater is sodium-chloride dominated, again due to the coastal environment. The spatial distribution of groundwater chemical types across the site can be compared by plotting Stiff diagrams on a map of the site (refer to ***Figure 2***). The total area of each diagram indicates the Total Dissolved Solids (TDS) of a sample.

Groundwater sampling from the deeper aquifer indicates that groundwater is fresh (between 80-210 μS/cm) and acidic (between pH 5 and 5.6). The major difference between the deeper and shallower aquifer is pH, in which the deeper aquifer is approximately one pH unit higher. A comparison of major ion chemistry between the shallow and deeper aquifers is shown on ***Figure 2***. Groundwater types are similar across the site, with Bore 3A having a similar TDS and water type to Bore 4B. Even with these similarities, these aquifers can still be considered separate due to the differences in pH and water levels.

Metal concentrations within samples collected during 2009 were elevated for copper and zinc; however the most recent round of sampling during September/November 2012 recorded low concentrations of copper and zinc (with the exception of Bore 5 for zinc). Arsenic was above the Dutch guideline value for Bore 5 during the November sampling.

Nutrient concentration of the groundwater was highly variable over time. Ammonia, nitrite and nitrate concentrations were generally low within all bores, with the exception of nitrate in Bore 5 with 3800μg/L. Total nitrogen and total phosphorus were elevated, exceeding the ANZECC guidelines for every groundwater sample obtained. Total nitrogen varied between 400μg/L and 8200μg/L and total phosphorus varied between 60μg/L and 590μg/L over the monitoring period for all bore holes. Both the shallow and deep aquifers have elevated concentrations of nutrients with the highest concentrations recorded in Bore 3A (shallow) and Bore 5 (deep). These results suggest high concentrations of existing nutrients inherent to both aquifers at the site.

2.3.5 Surface Water Chemistry

The surface water sample points and their geographical coordinates are listed below

on *Table 2* and shown on *Figure 1*. Three surface water monitoring rounds have been competed in total, during June 2009, October 2009 and September/November 2012. It should be noted that these samples were grab samples that were not obtained during flow events associated with rainfall as stipulated in the surface water sampling plan.

The results suggest low to no hydrocarbon contamination within the surface water sites. Nutrient concentrations were lower than those within the groundwater bores with total nitrogen results varying between 200μg/L and 2900μg/L and total phosphorus varying between less than the limit of reporting (LOR) to 1590μg/L over the monitoring period for the sites. The drain samples were not obtained during flow events and therefore are a result of direct groundwater discharge (flow) into the drain. Therefore results are similar to that of the groundwater with a low pH and elevated nutrients.

Table 2 Surface water monitoring location details

Sample Location	UTM GDA94 Co-ordinate Easting	UTM GDA94 Co-ordinate Northing	Description
Ck South 1	56 554225	6840444	Simpson Creek near the southern boundary of the site
Drain 1	56 553771	6840502	Drainage channel running north-south though the site, with the sample point located on the southern site boundary. The source of this water is from surface water runoff and groundwater discharge during drier times.
Drain 2	56 553671	6840809	Sample taken at the storm water discharge pipe into the drainage channel that runs south to the Drain 1 sample location. Again, the source of this water is from surface water runoff and groundwater discharge during drier times.
Drain 3	56 553858	6841019	Sample taken in running water from the discharge of a man made dam servicing the nursery adjacent to the north. The source of this water is from surface water runoff (and groundwater discharge during drier times) into a drainage channel running east-west though the existing housing estate.
Drain 4	56 554018	6840724	Natural drainage depression running north from the southern site boundary toward Simpson Creek. Dry if no recent rain.

Table 3 Groundwater sampling results

Analyte	Units	Dutch Guidelines	ANZECC Guidelines	Bore Name / Date Sampled	Bore 1 4/06/09	Bore 2 4/06/09	Bore 2 8/10/09	Bore 2 18/09/12	Bore 3A 4/06/09	Bore 3A 8/10/09	Bore 3A 11/09/12	Bore 3B 14/11/12	Bore 4A 14/11/12	Bore 4B 14/11/12	Bore 5 14/11/12
Field pH	pH Unit	NE	7-8.5		-	-	3.45	4.00	-	3.87	4.83	5.22	4.46	5.07	5.60
Field Conductivity	µS/cm	NE	125-2200		-	-	136.3	65	-	259	204	85	99	211	141
Field Temperature	°C	NE	NE		-	-	-	19.1	-	-	23.6	21.3	21.4	21.9	21.9
Field Redox	mV	NE	NE		-	-	-	+251	-	-	-22	-178	-109	-149	+94
Field DO	mg/L	NE	<5		-	-	1.78	6.11	-	2.20	5.33	2.97	3.06	2.30	6.07
Field Total Dissolved Solids (TDS)	mg/L	NE	NE		-	-	78.3	42	-	150	132	55	64	137	91
Field Turbidity	NTU	NE	0.5-10		-	-	16	-	-	210	912	625	1297	654	699
Total Suspended Solids (TSS)	mg/L	NE	NE		-	-	37	729	-	1090	-	-	-	-	-
Bicarbonate Alkalinity as CaCO3	mg/L	NE	NE		<1	<1	<1	<1	4	5	<1	21	<1	15	3
Sulfate as SO4	mg/L	NE	NE		29	4	5	42	6	3	<1	<1	5	<1	35
Chloride	mg/L	NE	NE		12	26	22	20	94	48	65	22	29	69	30
Calcium	mg/L	NE	NE		4	4	<1	<1	1	<1	<1	2	1	3	7
Magnesium	mg/L	NE	NE		1	2	2	1	8	5	7	3	3	4	2
Sodium	mg/L	NE	NE		11	16	15	8	47	30	32	16	19	38	22
Potassium	mg/L	NE	NE		<1	<1	<1	<1	<1	<1	<1	<1	<1	2	2
Arsenic	µg/L	60	24(III), 13(V)		-	-	<1	<1	-	<1	<1	4	<1	8	95
Cadmium	µg/L	6	0.2		-	-	0.1	0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	µg/L	30	1(VI)		-	-	<1	<1	-	1	<1	2	<1	<1	<1
Copper	µg/L	75	1.4		-	-	33	17	-	8	<1	<1	<1	<1	<1
Lead	µg/L	75	3.4		-	-	7	2	-	2	<1	<1	<1	<1	<1
Nickel	µg/L	75	11		-	-	2	1	-	<1	<1	<1	1	<1	4
Zinc	µg/L	800	8		-	-	170	37	-	37	7	5	8	6	45
Mercury	µg/L	0.3	0.6		-	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ammonia	µg/L	NE	15		-	-	20	140	-	80	70	560	100	390	240
Nitrite + Nitrate	µg/L	NE	15		-	-	<10	<50	-	<10	<10	<10	<10	20	3800
Nitrite	µg/L	NE	NE		-	-	90	<10	-	40	<10	<10	<10	<10	<10
Nitrate	µg/L	NE	NE		20	40	90	<10	<10	40	<10	<10	<10	20	3800
Total Kjeldahl Nitrogen	µg/L	NE	NE		3200	1100	300	2800	8200	1300	3800	1200	4300	500	2600
Total Nitrogen	µg/L	NE	300		3200	1100	400	2800	8200	1300	3800	1200	4300	500	6400
Total Phosphorus	µg/L	NE	30		310	220	60	370	590	110	230	70	230	60	440

Note: NE: value Not Established, Yellow shaded cells indicate an exceedance of the ANZECC Guidelines, Red shaded cells indicate exceedances of the Dutch Guidelines.

Table 4 Surface water sampling results

Analyte	Units	Dutch Guidelines	Draft NEPM Guidelines	Sample Point	Ck South 1	Ck South 1	Ck South 1	Drain 1	Drain 1	Drain 2	Drain 2	Drain 3
				Date Sampled	4/06/2009	8/10/2009	11/09/2012	4/06/2009	11/09/2012	8/10/2009	11/09/2012	11/09/2012
Field pH	pH Unit	NE	7-8.5		-	8.39	6.2	4.6	4.35	3.07	5.58	5.49
Field Conductivity	µS/cm	NE	125-2200		-	50700	19440	120	97	129.6	203	116
Field Temperature	°C	NE	NE		-	-	23.9	-	26.1	19.6	20.2	21.7
Field Redox	mV	NE	NE		-	+182	+155	-	+261	+233	+71	+170
Field DO	mg/L	NE	<5		-	16.4	8.49	-	9.78	12.5	5.74	4.94
Field Total Dissolved Solids (TDS)	mg/L	NE	NE		-	38800	12.65	-	63	78.2	130	76
Field Turbidity	NTU	NE	0.5-10		-	-	313	-	317	-	170	360
Total Suspended Solids (TSS)	mg/L	NE	NE		43	32	96	5	<5	4	110	7
Bicarbonate Alkalinity as CaCO3	mg/L	NE	NE		14	118	-	<1	-	<1	-	-
Sulfate as SO4	mg/L	NE	NE		18	3010	-	5	-	5	-	-
Chloride	mg/L	NE	NE		145	20100	-	23	-	23	-	-
Calcium	mg/L	NE	NE		6	411	-	2	-	<1	-	-
Magnesium	mg/L	NE	NE		9	1300	-	2	-	3	-	-
Sodium	mg/L	NE	NE		83	11400	-	14	-	16	-	-
Potassium	mg/L	NE	NE		4	569	-	1	-	<1	-	-
Ammonia	µg/L	NE	15		-	40	40	-	30	10	60	320
Nitrite + Nitrate	µg/L	NE	15		1300	70	10	-	<10	40	<10	80
Nitrite	µg/L	NE	NE		-	<10	<10	-	<10	<10	<10	<10
Nitrate	µg/L	NE	NE		-	70	10	<10	<10	40	<10	80
Total Kjeldahl Nitrogen	µg/L	NE	NE		1000	200	400	600	1200	600	2900	1600
Total Nitrogen	µg/L	NE	300		2300	200	400	600	1200	700	2900	1700
Total Phosphorus	µg/L	NE	30		180	360	60	<10	100	<10	450	1590
C6 - C9 Fraction	µg/L	NE	NE		<20	<20	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction	µg/L	NE	NE		<50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	NE	NE		<100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	NE	NE		<50	<50	<50	<50	<50	<50	90	<50
Total TPH	µg/L	600	NE		NA	NA	NA	NA	NA	NA	90	NA
Blue Green Algae	cells/mL	NE	NE		-	-	70	-	220	-	180	<1
Total Predominate Algae	cells/mL	NE	NE		-	-	15930	-	2350	-	950	460

Note: NE: value Not Established, Yellow shaded cells indicate an exceedance of the ANZECC Guidelines, Red shaded cells indicate exceedances of the Dutch Guidelines.

2.4 Pump Testing

Two short duration pump tests were undertaken at deep Bores 3B and 4B to measure groundwater level responses on the adjacent shallow bores (3A and 4A). This was done to determine the interaction between the deep and shallow aquifers so that any impact to the deeper aquifer (used by local landholders for water supply) resulting from the construction of the housing estate storm water detention basin and swales could be modeled.

Fieldwork was undertaken on the 14 November 2012. A 12v submersible pump was used to purge Bore 3B and Bore 4B. Bore 3B was purged for 159 minutes with an approximate total volume of 1060 L of groundwater removed from the bore. Bore 4B was purged for 190 minutes with an approximate total volume of 1480 L of groundwater removed from the bore. WSA considers the duration of the tests sufficient to determine interaction between the deep and shallow aquifers.

There were negligible changes in water level in either shallow aquifer monitoring bores during the pump testing. The pump testing confirms no connection between the upper and lower aquifer. Due to obtaining non-interpretable data, the field recordings are not presented in this report.

2.5 Permeability Testing

2.5.1 Recovery Testing in the Shallow Sand Aquifer

Fieldwork was undertaken on the 5 October 2012. A 12v submersible pump was used to purge Bore 3A for 70 minutes with an approximate total volume of 800 L of groundwater removed from the bore.

Following pumping, recovery testing was undertaken. The bore recovered within 4 mm from full recovery after 149 minutes of ceasing pumping. The results of this testing is shown in ***Appendix E***. Recovery data was then analysed for aquifer transmissivity using the Theis Recovery method. A summary of the recovery testing results are shown below in *Table 5*. The results of this testing indicate that the shallow aquifer here is highly permeable with a transmissivity of approximately 21.54 m²/day.

Table 5 Recovery test results in the shallow sand aquifer

	Duration Pumped	Pumped Volume	Total Recorded Drawdown	Residual Drawdown	Duration Recovery Recorded	T	K
Bore name	**mins**	**L**	**m**	**m**	**mins**	**m²/d**	**m/d**
Bore 3A	70	800	0.571	0.004	149	21.54	21.54

2.5.2 Recovery Testing in the Deep Sand Aquifer

Fieldwork was undertaken on the 14 November 2012. A 12v submersible pump was used to purge the following bores: Bore 3B, Bore 4B and Bore 5.

Bore 3B was purged for 160 minutes with an approximate total volume of 1060 L of groundwater removed from the bore. Bore 4B was purged for 190 minutes with an approximate total volume of 1480 L of groundwater removed from the bore. Bore 5 was purged for 9 minutes with an approximate total volume of 25 L of groundwater removed before the bore went dry.

Following pumping recovery testing was undertaken. The results of this testing is shown in ***Appendix E*.** Recovery data was then analysed for aquifer transmissivity using the Theis Recovery method. A summary of the recovery testing results are shown below in *Table 6*. The results of this testing indicate that the deep sand aquifer is less permeable than the upper sand aquifer with a transmissivity of approximately 10 m²/day respectively. Even though the drillers noted a change in lithology at 10m in Bore 5 and installed the slotted section below this, this bore is likely to be installed, or at least partially installed, within the "coffee rock" cemented sands at depth. This explains its low transmissivity when compared to the other deep bores 3B and 4B.

Table 6 Recovery test results in the deep sand aquifer

	Duration Pumped	Pumped Volume	Total Recorded Drawdown	Residual Drawdown	Duration Recovery Recorded	T	K
Bore name	**mins**	**L**	**m**	**m**	**mins**	**m²/d**	**m/d**
Bore 3B	160	1060	1.9	0.013	383	9.6	4.8
Bore 4B	190	1480	0.356	0	92	10	5
Bore 5	9	25	6.52	0.315	83	0.07	0.01

2.5.3 Channel Permeability Testing

Falling head permeability testing was undertaken on two sites within the main drainage channel that bisects the site. This work was undertaken on the 5 October 2012. The locations of the testing locations are shown in *Figure 1*.

The methodology of the permeability testing was as follows:

- Two sites were chosen for testing of the "coffee rock" material that the drainage channel is cut into, one toward the north of the site (Test 1) and one halfway along to the southern boundary of the site (Test 2);
- A shallow soil bore was dug so that the testing apparatus (a 100mm PVC pipe cut to a length of 0.5m) could be placed securely within the tested material. This depth was between 0.05 and 0.10m below the prepared surface. Bentonite was then used to seal around the outside of the casing;
- The testing apparatus was then filled with fresh tap water and the time and date filling occurred recorded. The height and time at which the water level dropped was then recorded for a period of up to five hours; and
- The data gathered in the field was then analysed and hydraulic conductivity determined using the falling head method described by Oweis and Khera (1998, pp 180 Figure 7.24 (E)) for undertaking field soil permeability tests.

The field data and graphical representation of results including the hydraulic conductivity calculation testing time frame for each test is presented in ***Appendix F***.

A tabulation of the results is presented below in *Table 7*. The results suggest that the permeability of the creek bed material is highly variable. At the northern testing location, the coffee rock is very dense and impermeable. At the southern testing site, the permeability is around 100 times higher than at the northern site, but still 100 times lower than in the sand aquifer that lies on top of the coffee rock formation.

Table 7 Permeability test results for two creek bed locations

	K	K
Bore name	**m/s**	**m/day**
Test 1 (north)	3.65×10^{-8}	3.15×10^{-3}
Test 2 (south)	2.81×10^{-6}	2.43×10^{-1}

3 CONCEPTUAL GROUNDWATER MODEL

The site is underlain by three main hydrogeological layers:

- Upper perched sand aquifer, unconfined, 2-5m thickness;
- Coffee rock layer, impermeable/low permeable barrier, 3-7m thickness; and
- Lower sand aquifer, confined. Vertical extent unknown.

Figures 3A and 3B shows the conceptual model of the groundwater system. This site conceptual model was derived using information from the drilling and field investigations that were undertaken on site on the 13 and 14 November 2012 as well as information gathered previously.

3.1 Shallow Sand Aquifer

Figure 3A shows the conceptual model for the shallow perched sand aquifer, consisting of a cross section through the site, from Bore 4A/B to Bore 5. The data collected during the November 2012 investigations represent the “dry weather” groundwater levels prior to start of the wet season. The shallow groundwater discharges into the drainage channel close to Bore 4A/B, with the groundwater level 1.4m above the base of the drainage channel at Bore 4A. Away from the channel, the shallow groundwater flows to the east, toward Simpsons Creek. However it should be noted that there is no groundwater monitoring bores for the upper aquifer in the vicinity of Bore 5, with the exception of Bore 2 to the north, which was dry during the November 2012 investigations (the groundwater level is below 2.265mAHD).

During the wet season, groundwater levels are expected to rise quickly through direct infiltration through the upper sands. When this occurs, the groundwater will rise and discharge into the wetland channel (from which the Drain 4 sample is obtained), as well as the main drainage channel and Simpsons Creek. Both dry and wet weather projected groundwater levels are shown diagrammatically on *Figure 3A*.

The proposed storm water detention basin is shown in *Figure 3A* as the green lines. The maximum water level the basin is expected to fill to from rain events is 3.3mAHD (CivilTech Consulting Engineers). This is below the current shallow groundwater level at Bore 4A by 0.44m. Construction of the basin will move the discharge point of the shallow groundwater laterally, however it is still expected that the shallow groundwater level away from the basin will most likely be above any short term storage in the detention basin. This will result in minimal hydraulic head to push stored water from the detention basin out into the shallow groundwater. Discharge of shallow groundwater into the detention basin is not expected to be above that which is currently occurring as the detention basin has a very similar finished depth as the current drainage channel (proposed depth of 2.22mAHD, current depth of 2.35mAHD).

3.2 Vegetation Effects on Groundwater

In addition to the groundwater drainage towards the surface water discharge lines, the shallow aquifer also loses water through evapotranspiration, i.e. water uptake by tree roots. The proposed development plans to make some changes to the spatial distribution of trees across the site. Many of these changes will be beneficial to the environment of the site, with additional habitat for the Wallum Froglet being constructed along the storm water detention basin. The basin will be revegetated with *Melaleuca quinquenervia* at 12m centres (i.e. 80 plants/ha). Planting of native shrubs and groundcovers will be done to fully vegetate the basin and provide habitat for the Wallum Froglet. East of the estate, open areas will be revegated with swamp sclerophyll forest and tall open sclerophyll forest as shown on Figure 11 in *James Warren and Associates Pty Ltd* (2012). Some revegetation will also be carried out in areas of the site further to the west. WSA assumes that individual allotments of the housing estate will not be heavily vegetated.

Figure 3C shows a conceptual model of the shallow groundwater regime taking into account the final vegetation plantings for the site and the storm water detention basin. During wet periods, groundwater recharge will still occur though natural surfaces throughout the site, however with additional capped surfaces, stored rainwater in tanks and additional runoff from the estate, recharge to the shallow perched aquifer will be diminished. This will have some effect on reducing high groundwater levels during the wet season. During prolonged dry periods, evapotranspiration through the *Melaleuca* trees within the basin is likely to locally reduce groundwater levels further.

The groundwater flow regime is expected to stay the same after development with groundwater flow to the storm water detention basin (and swales) and the wetland flow channel. Groundwater flow to Simpsons Creek will be mainly limited to seepage from the sand dune (located to the east of the proposed development). In the wet season, this dune will form a ridge of groundwater which will prevent any groundwater flow from under the development reaching Simpsons Creek.

3.3 “Coffee Rock” Layer

According to the drill logs, the “Coffee Rock” layer begins at approximately -0.3mAHD and is between 3 and 7m deep. The pump tests during the November field work showed that the coffee rock has low permeability and acts as a confining layer between the shallow and the deep sand aquifer. This means that there is no exchange of water between the shallow and the deep aquifer in the areas tested.

3.4 Deep Sand Aquifer

Figure 3B shows the conceptual model for the deep confined sand aquifer, consisting of a cross section through the site, from Bore 4A/B to Bore 5. The extent of the deep aquifer is unknown, however it starts at approximately -3.5mAHD at Bore 4B and -5.9mAHD at Bore 3B. It is believed that Bore 5 was still within the “Coffee Rock” at -7.3mAHD. The drilling and field measurements confirmed that the deep sand aquifer is confined by the overlying “Coffee Rock” layer. The ultimate point of discharge is unknown as there is no drilling information to the east of Bore 5, however discharge is expected to occur east of Simpsons Creek or further, toward the Pacific Ocean. There is no interaction with the shallow aquifer or the drainage lines that bisect the site.

4 GROUNDWATER MODELING

In order to quantify the potential impact of the detention basin on the groundwater underneath the site, a numerical groundwater model was developed. The model was prepared to assess how far infiltrating water from the detention basin will move laterally during selected rain events. This will assess the necessity for lining the basin on the side walls.

4.1 Model set up

The modeling code used in this project is SPRING (Delta-h, 2012), a finite element code that supports unsaturated groundwater flow. The unsaturated water flow is crucial in this kind of setting. It is likely that some parts of the upper sand aquifer will be dry at the time when the detention basin fills after an event. The unsaturated state of the soil during dry condition delays the initial infiltration of the water into the aquifer.

4.1.1 Hydrological Scenarios

Three hydrological scenarios have been calculated for the nine provided extreme rainfall events (1 year, 10 year and 100 year return period, for a 1h, 24h and 72h event lengths each). The water level in the detention basin for these extreme events was provided by CivilTech Consulting Engineers. These scenarios are:

1. The upper sand aquifer is dry before the rainfall event occurs. This scenario reflects rainfall events that occur during dry hydrological conditions, i.e. after a long, dry period. Assumed starting groundwater level head: 2.1mAHD.
2. The upper sand aquifer is partially saturated before the rainfall event occurs. This scenario reflects rainfall events that occur in average hydrological conditions. Assumed starting groundwater level head: 2.6mAHD.
3. The upper sand aquifer is saturated up to a certain point before the rainfall event occurs. This scenario reflects rainfall events that occur during wet hydrological conditions, i.e. during the wet season. Assumed starting groundwater level head: 3.1mAHD.

After reviewing the interim results, higher starting water levels were not considered, because the impact on the groundwater away from the detention basin was negligible for the third scenario.

The groundwater levels in Bore 4A were measured at 3.741mAHD on the 14 November 2012. Three days before measuring, a rainfall event of 70mm over two days occurred. This would reflect pre-saturation conditions. However, the groundwater levels at Bore 4A were higher than estimated for the wet weather scenario. This can be explained with the higher elevation and the smaller width of the current drain. Once the detention basin is built, the local groundwater levels will be lowered by the new drain.

4.1.2 Model geometry and characteristics

To reflect the processes that happen when the detention basin is filled after a rain event, a vertical section perpendicular to the drain axis was chosen. The influence of the drain on the aquifer is equal on both sides (symmetrical problem, however only one side, to the east is discussed). The left border of the model represents the interface between the aquifer and the drain i.e. the side walls of the detention basin.

Figure 4 illustrates the conceptual model of the interaction of the water within the

detention basin with the shallow aquifer. The numerical model is based on this concept. When the detention basin is empty the groundwater in the shallow sand aquifer drains toward this surface water body. When the detention basin is filled after a rain event, the surface water infiltrates into the shallow sand aquifer. After the basin has emptied again, the infiltrated water will discharge back into the surface water drain.

Figure 5 shows the dimensions, the grid and the hydrogeological properties of the groundwater model. The grid size varies from 1.25 to 5m horizontally and from 2.5 to 5cm vertically. The hydraulic conductivity of the upper sand aquifer is 21.54m/day and 0.25m/d for the coffee rock layer. It is likely that the conductivity in the coffee rock is even lower (see *Table 7*). The worst case scenario, i.e. the higher permeability value was chosen to calculate the impact. On both sides of the model, a fixed head boundary was applied. On the left border, this fixed head boundary level is 2.1mAHD, reflecting the drainage into the detention basin bed, which is at this level. During the modeling runs, this boundary is changing according to the water levels in the detention basin provided by CivilTech Consulting Engineers, up to 3.3mAHD for the 1hr rainfall event with a return period of 100 years. The right boundary was set to 2.05mAHD to generate a gradient towards the east. This boundary is far enough from the surface water / groundwater interface and has no influence on the infiltration modeling (i.e. the exact level of the fixed head at this boundary is not of importance).

It is assumed that the basin and the drainage channel are scraped into the coffee rock. The detention basin bed elevation in the model is 2.1mAHD. Further upstream in the drainage channel it increases up to 2.5mAHD. The lower elevation is considered to be the worst case, because the water depth (and therefore the potential infiltration into the aquifer) will be highest at this point.

The model calculations did not include the infiltration by rainfall. This process was deemed too complex to integrate into this study. Several parameters influence the infiltration of the rain, e.g. soil properties, slope of the land (runoff), land use, percentage of sealed surface. In general, it is expected that the development will lessen the rainfall infiltration due to the presence of sealed surfaces.

The model runs transiently with time steps of 5 minutes length. The total modeling timeframe depends on the length of the rainfall events. The 1hr rainfall events are calculated over 15 hours, the 24hr rainfall events over 3 days and the 72hrs rainfall events over 7 days. The length of the groundwater modeling has to be longer than the event itself in order to calculate the discharge of the groundwater into the surface water.

4.2 Results

The detailed results are shown in ***Appendix G and Appendix H***.

Appendix G shows the hydrographs at selected distances from the detention basin. For each scenario (dry, average and wet) and rainfall event (1hr, 24hr, 72hr), there are six plots showing the groundwater level changes at selected distances from the drain. The results show, that the highest change in water level is caused by the 1h events, but the impact is only of short duration i.e. an hour in the proximity of the drain. On the other extreme, the water level changes of the 72hr rainfall events are the smallest, but they last over the entire 3 days, before the groundwater drains back into the drainage channel. This allows more water to infiltrate the system. *Table 8* summarises the maximum groundwater level changes for all the scenarios.

Table 8 Impact of the detention basin on the aquifer, quantified as water level change (in m) for locations at different distances from the drain

	1h rainfall event	24h rainfall event	72h rainfall event
Scenario 1 – Dry conditions			
2.5 m distance from drain	0.6-1.1	0.6-0.9	0.55-0.78
5 m distance from drain	0.45-0.9	0.5-0.8	0.50-0.75
10 m distance from drain	0.3-0.6	0.4-0.6	0.5-0.65
20 m distance from drain	0.15-0.37	0.33-0.44	0.45-0.60
50 m distance from drain	0.01-0.08	0.13-0.18	0.30-0.42
100 m distance from drain	0	0.02	0.18-0.25
Scenario 2 – Average conditions			
2.5 m distance from drain	0.18-0.62	0.10-0.40	0.18-0.30
5 m distance from drain	0.10-0.55	0.05-0.35	0.05-0.28
10 m distance from drain	0.05-0.40	0-0.22	0.05-0.22
20 m distance from drain	0.05-0.20	0-0.10	0.03-0.18
50 m distance from drain	0	0-0.02	0-0.08
100 m distance from drain	0	0	0-0.03
Scenario 3 – Wet conditions			
2.5 m distance from drain	0.18	0	0
5 m distance from drain	0.10	0	0
10 m distance from drain	0	0	0
20 m distance from drain	0	0	0
50 m distance from drain	0	0	0
100 m distance from drain	0	0	0

Note: - the range of water level changes is between the 1 year and the 100 year return period.
- if the change in water level is negative, the impact on the aquifer is 0 m.

Appendix H shows the plots of the modeled cross section of the upper sand aquifer. The groundwater levels are plotted for four points in time (depending on the length of the event) and for the three return periods. The 100 year events always cause greater impact than the 10 year and 1 year events.

The Scenario 1 (dry condition) has the biggest impact on the groundwater. Because the gradient between the water level in the detention basin and the groundwater is the highest, more water can infiltrate into the aquifer compared to the other two scenarios. With the dry starting conditions, the 72h hour's rainfall event has the biggest impact, because the water in the detention basin stays at a high water level the longest time. After 3 days, the infiltration phase is over and the groundwater drains back into the detention basin (see groundwater level after 5 days).

The calculations did not include any infiltration from rainfall. This process was deemed too complex to integrate into this study. However, the worst case scenario (dry conditions, 72h rainfall) will have less impact than modeled. When the aquifer fills up with rain water, the gradient to the water level in the detention basin gets smaller and therefore the infiltration will be lower. Also, the fresh rainwater will push out the infiltrated water out of the system when draining back into the detention basin.

The scenarios of the average and wet conditions have less impact than the scenario with the dry conditions. The saturated aquifer receives less infiltration due to lower

hydraulic gradients. The groundwater drains towards the detention basin after the rainfall event is over.

5 CONCLUSIONS

5.1 Sampling Results

Groundwater across the site is fresh and acidic, with the major ions being sodium and chloride. The major difference between the shallow and the deeper aquifer on site is the pH results with the deeper aquifer being a pH unit higher than the shallow aquifer. This is attributed to the higher percentage of organic matter (and humic acids) within the shallow system. The groundwater is naturally elevated in nutrients, again most likely due to naturally decaying organic matter within the system. Groundwater discharge into the drainage channels on site is the source of the low pH and nutrients within the surface water drain samples.

5.2 Conceptual Model

Groundwater levels, chemical data, and pump testing have confirmed that the deeper confined sand aquifer below the site is not connected to the shallow perched sand aquifer. The groundwater flow of the deep aquifer is to the east and the discharge point is likely to be east of Simpsons Creek.

During drier times, the shallow groundwater flow is both to the west and east into the north-south drainage channel and Simpsons Creek. Evapotranspiration is likely to have some effect on groundwater levels in the vegetated, eastern part of the site by lowering groundwater levels. During wet periods, groundwater levels will rise from direct infiltration of rainfall into the shallow sand aquifer. Additional groundwater discharge is likely to occur into the wetland flow channel.

After construction of the estate, recharge to the shallow perched aquifer will be diminished because of additional capped surfaces, stored rainwater in tanks and additional runoff. This will have some effect on reducing high groundwater levels during the wet season.

The groundwater flow regime is expected to stay the same after development with flow to the storm water detention basin, and the wetland flow channel. During prolonged dry periods, evapotranspiration through the *Melaleuca* trees within the basin is likely to locally reduce groundwater levels.

As well as modifying rainfall infiltration and runoff, the housing estate will also introduce possible impacts from resident activities, such as gardening. As this site is located in an environmentally sensitive area, it would minimize adverse impact on the environment if residents of the new housing estate were advised about the most ecologically sustainable methods for planting and maintaining lawn and gardens in these conditions.

5.3 Impact of the Detention Basin on the Aquifer

It should be noted that the nearest natural surface water discharge point to the east is 250m from the proposed detention basin (refer to *Figure 1*, “Wetland flow”). Groundwater infiltrated at the detention basin will not discharge into this shallow wetland channel, because the elevation of the natural drain is higher than the expected

groundwater levels caused by infiltration. The new artificial discharge point (detention basin) lies about 1m lower than the natural surface water drain. The groundwater will tend to discharge into the lower point. During wet hydrological conditions groundwater will discharge into the natural drain, however, there will be no infiltration from the detention basin at the same time.

Overall, WSA concludes that infiltration from the detention basin will not discharge into the Simpsons Creek or the adjacent wetlands. Indeed, during wet conditions, infiltration of rainfall into the elevated sand dune to the east of the development will form a groundwater divide preventing any groundwater flow from the west into Simpsons Creek.

The modeled worst case impact at 100m distance from the detention basin is 0.25m of groundwater level rise due to infiltration at the detention basin. This scenario (72h rainfall with dry starting conditions) will have less impact than modeled, once the groundwater levels start rising from rainfall infiltration. Hence, this modeling result can be regarded as being very conservative.

The higher the groundwater levels in the aquifer, the smaller the hydraulic gradient and consequently the smaller the infiltration rate.

6 REFERENCES

- ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality Australian Government Department of Environment, Water, Heritage and the Arts, Canberra.
- James Warren and Associates Pty Ltd (2012) Amended Ecological Assessment, Volume 1 and 2, Lot 73 DP851902, Bayside Way, Brunswick Heads.
- Netherlands Ministry of Housing, Spatial Planning and The Environment (2000) Target Values and intervention values for soil remediation – February 2000. Netherlands Government Gazette, The Hague, Netherlands.
- Delta-h (2012): Simulation of Processes in Groundwater, Version 4.1. www.spring.delta-h.de (English version available)
- Oweis, I. S., and Khera, R. P., (1998), Geotechnology of Waste Management, 2nd Edition, PWS Publishing Company, Boston.

7 LIMITATIONS

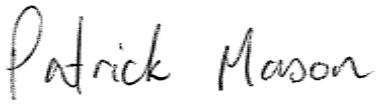
Waste Solutions Australia Pty Ltd has prepared this report for the use of Codlea Pty Ltd and the NSW Department of Planning and Infrastructure in accordance with generally accepted consulting practice. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report may not contain sufficient information for purposes other than for the client and its respective consulting advisers.

The accuracy of the assessment made in this report is dependent upon the accuracy and reliability of evidence drawn together from a number of sources. The field investigations on which this report is based were restricted to a level of detail appropriate for the current stage of the project. Waste Solutions Australia Pty Ltd has taken steps to ensure the accuracy and reliability of field observations and investigations. It is important, however, that the limitations of the assessment be

clearly recognised when the findings of this study are being interpreted. This report is based on information derived partly from other parties over which Waste Solutions Australia Pty Ltd has no control.

8 SIGNATORIES

Prepared by:



Patrick Mason
B. Env Science
Senior Environmental Scientist
Waste Solutions Australia Pty Ltd

Prepared by:

Ines Roeser
MSc (equiv.)
Environmental Engineer / Modeller
Waste Solutions Australia Pty Ltd

Approved by:

Paul Smith
MSc (Hydrogeo) MSc (Enviro Studies)
Director & Principal Consultant
Waste Solutions Australia Pty Ltd

APPENDIX A

FIGURES

N

Legend

- Location of groundwater well (shallow)
- Location of groundwater well (deep)
- Location of surface water sample
- X Location of channel permeability test
- A – – B Conceptual Model Cross Section (see Figure 3)

Approximate Scale

0 100m 200m

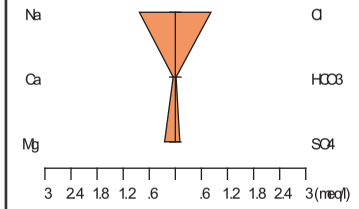
Base image courtesy of Google Maps

waste solutions AUSTRALIA PTY LTD

Codlea Pty Ltd					
Groundwater Investigation, Aquifer Modelling and Sampling Report					
Site Overview and Monitoring Bore Locations					
Drawn: IR	Approved:PS		Date: December 2012	Job: W 516-4	Figure 1

N

Stiff Diagrams:
Concentrations in milliequivelents per litre



Approximate Scale

0 100m 200m

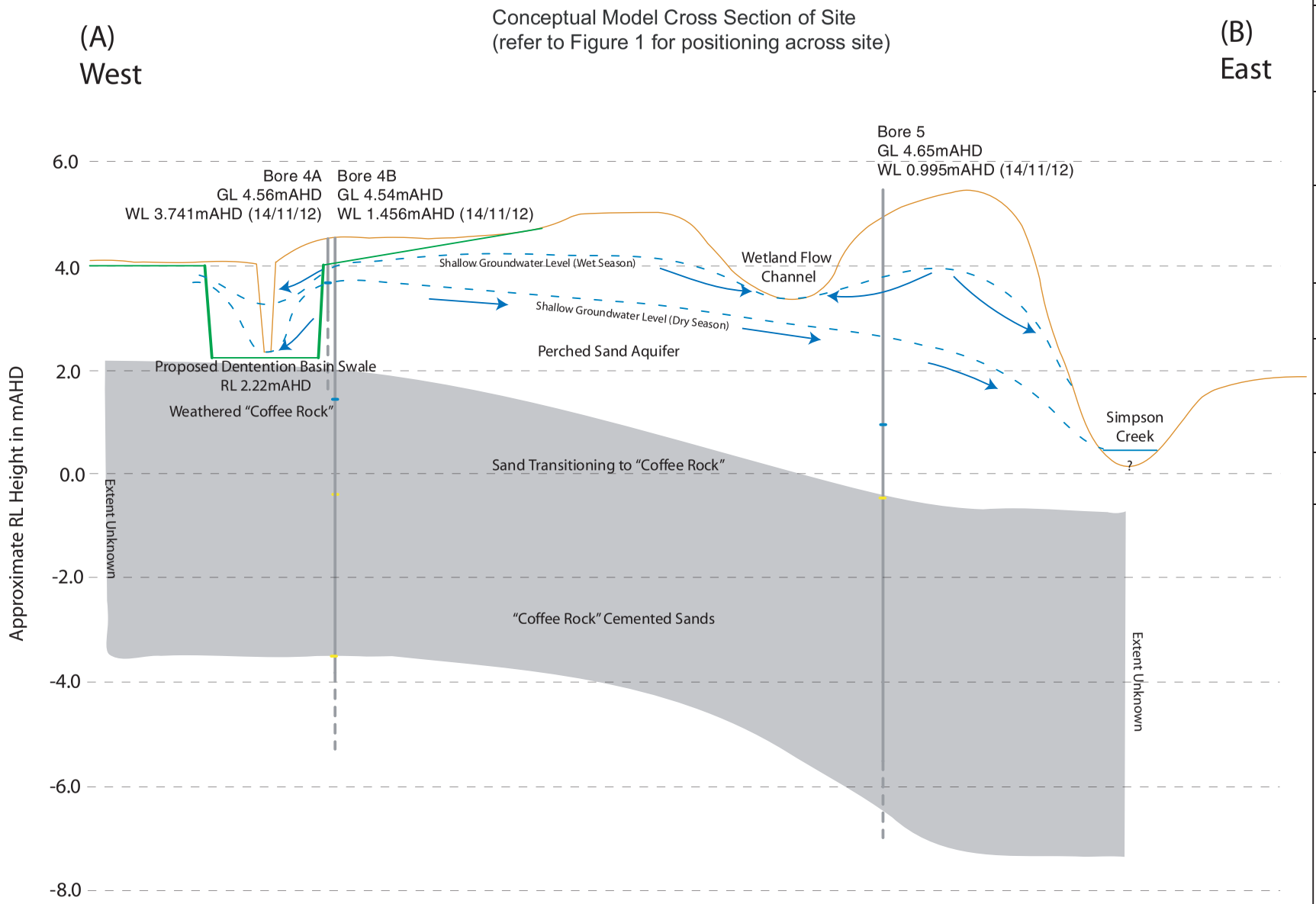
Base image courtesy of Google Maps

Legend

- Location of groundwater well (shallow)
- Location of groundwater well (deep)

waste solutions AUSTRALIA PTY LTD

Codlea Pty Ltd					
Groundwater Investigation, Aquifer Modelling and Sampling Report					
Groundwater Stiff Diagram Comparisons					
Drawn: PM	Approved:PS		Date: December 2012	Job: W 516-4	Figure 1



waste solutions
AUSTRALIA PTY LTD

Codlea Pty Ltd

Groundwater Investigation, Aquifer Modelling and Sampling Report

Conceptual Groundwater Model: Shallow Sand Aquifer

Date: December 2012

Job no: W 516-4

Figure 3A

Drawn by:	Approved:
PM	PS

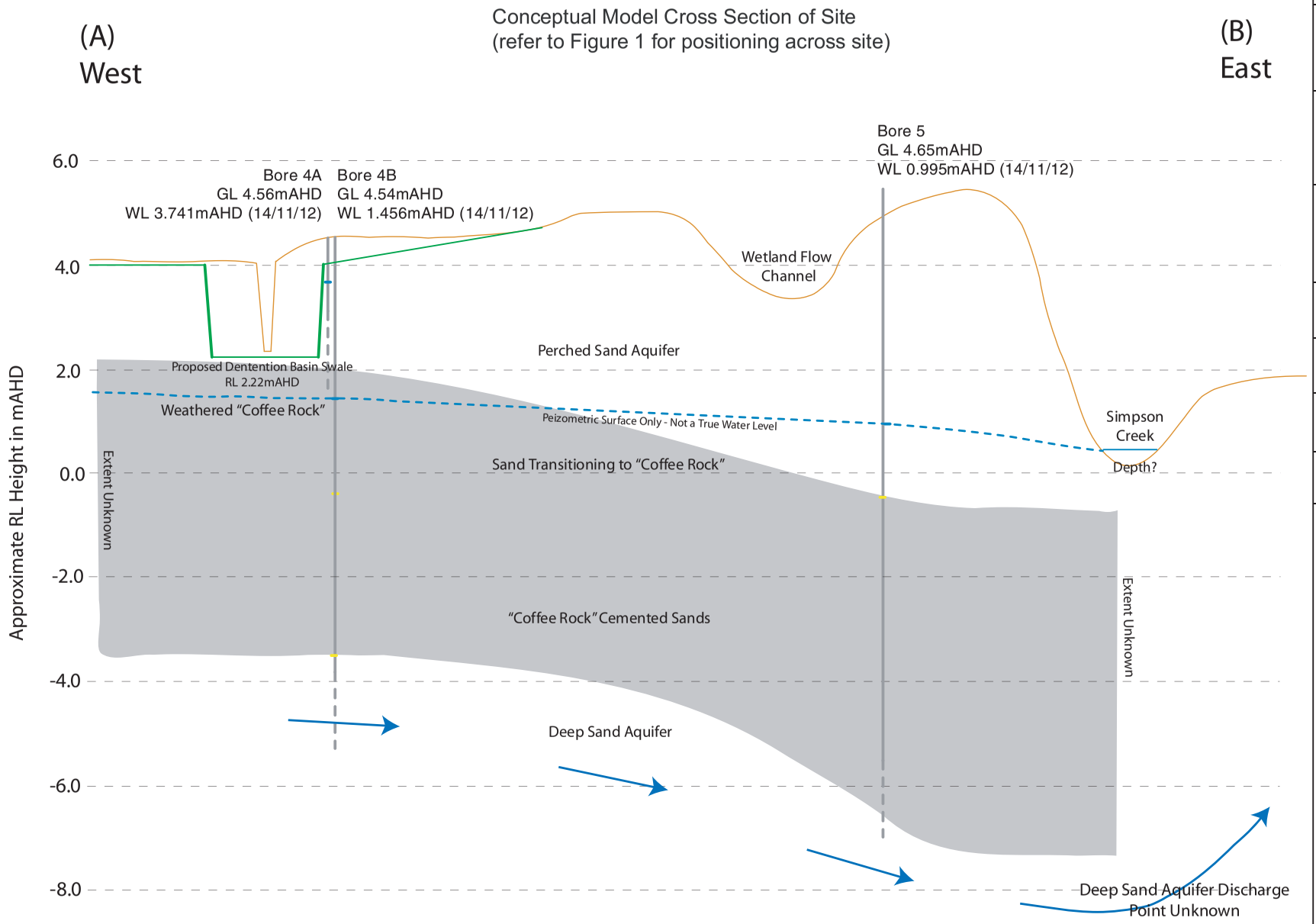
Legend:

Approximate Vertical Scale as shown,
Apprioximate Horizonal Scale:
0 25 50 75 100m

- Natural Surface Level
- Infered Shallow Groundwater Level
- Approximate Consutruction Design Levels (mAHD)
- Groundwater Flow Direction

Bore details:
Grey line - length of casing through profile; dashed grey line - slotted section
Blue dash - Static Groundwater Level;
Yellow dash - Change in litholodgy.

Note: All heights are reduced levels to meters Australian Height Datum (mAHD).



waste solutions
AUSTRALIA PTY LTD

Codlea Pty Ltd

Groundwater Investigation, Aquifer Modelling and Sampling Report

Conceptual Model Cross Section: Deep Sand Aquifer

Date: December 2012

Job no: W 516-4

Figure 3B

Drawn by:	Approved:
PM	PS

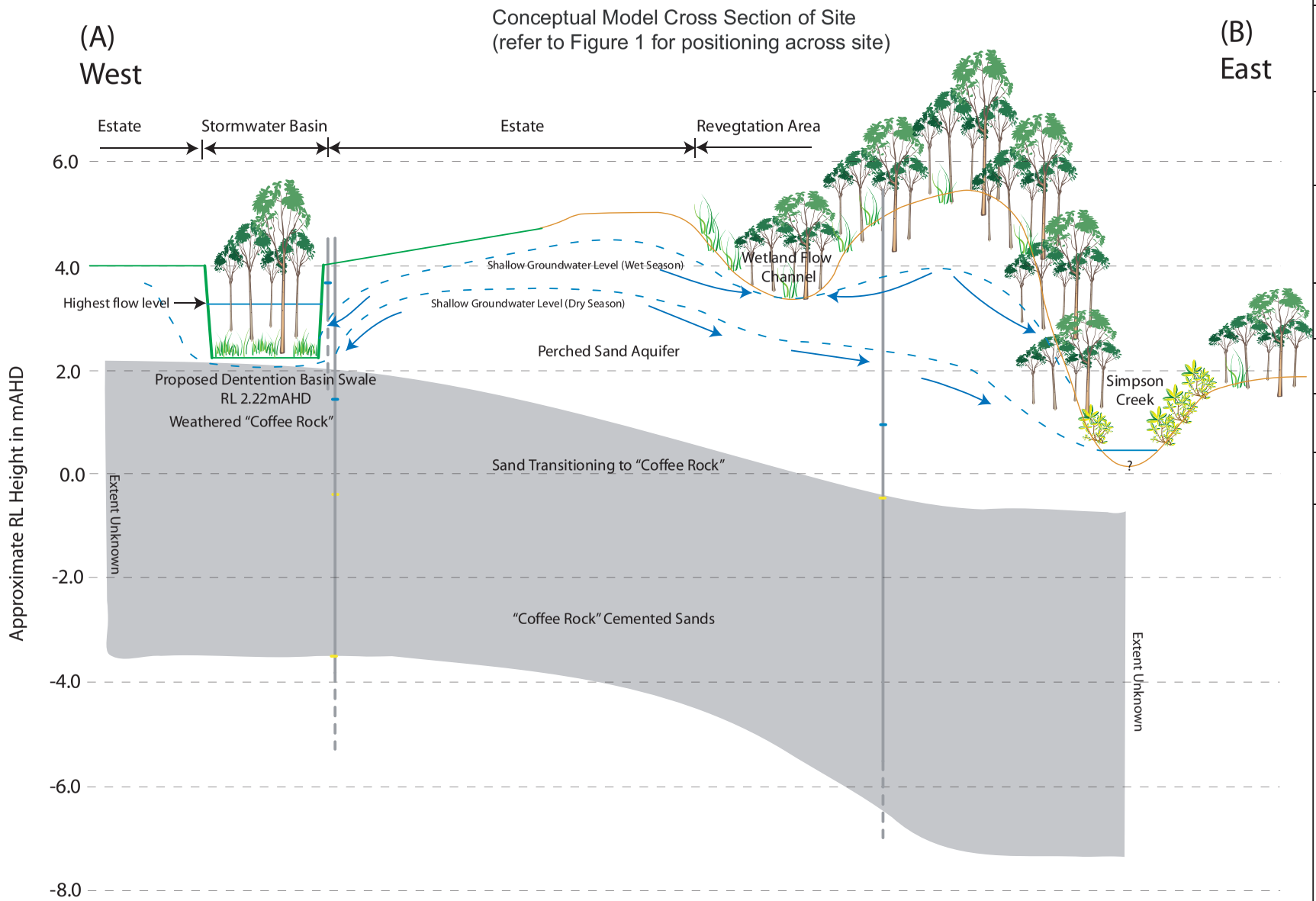
Legend:

Approximate Vertical Scale as shown,
Approrioximate Horizonal Scale:
0 25 50 75 100m

- Natural Surface Level
- Infered Deep Groundwater Level
- Approximate Consutruction Design Levels (mAHD)
- Groundwater Flow Direction

Bore details:
Grey line - length of casing through profile; dashed grey line - slotted section
Blue dash - Static Groundwater Level;
Yellow dash - Change in litholodgy.

Note: All heights are reduced levels to meters Australian Height Datum (mAHD).



waste solutions
AUSTRALIA PTY LTD

Codlea Pty Ltd

Groundwater Investigation, Aquifer Modelling and Sampling Report

Conceptual Groundwater Model: Effect of Trees on Groundwater

Date: December 2012

Job no: W 516-4

Figure 3C

Drawn by:	Approved:
PM	PS

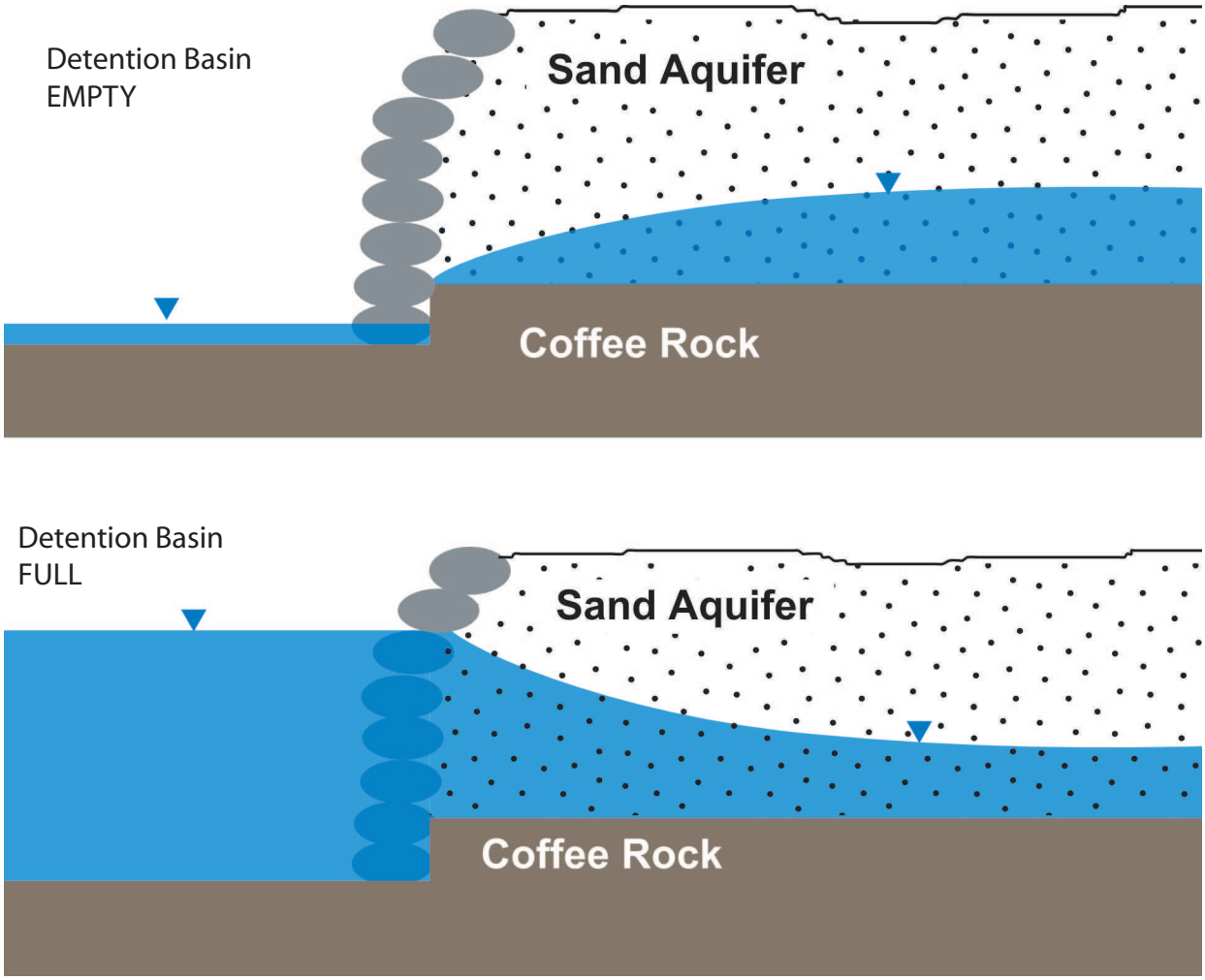
Legend:

Approximate Vertical Scale as shown,
Apprioximate Horizonal Scale:
0 25 50 75 100m

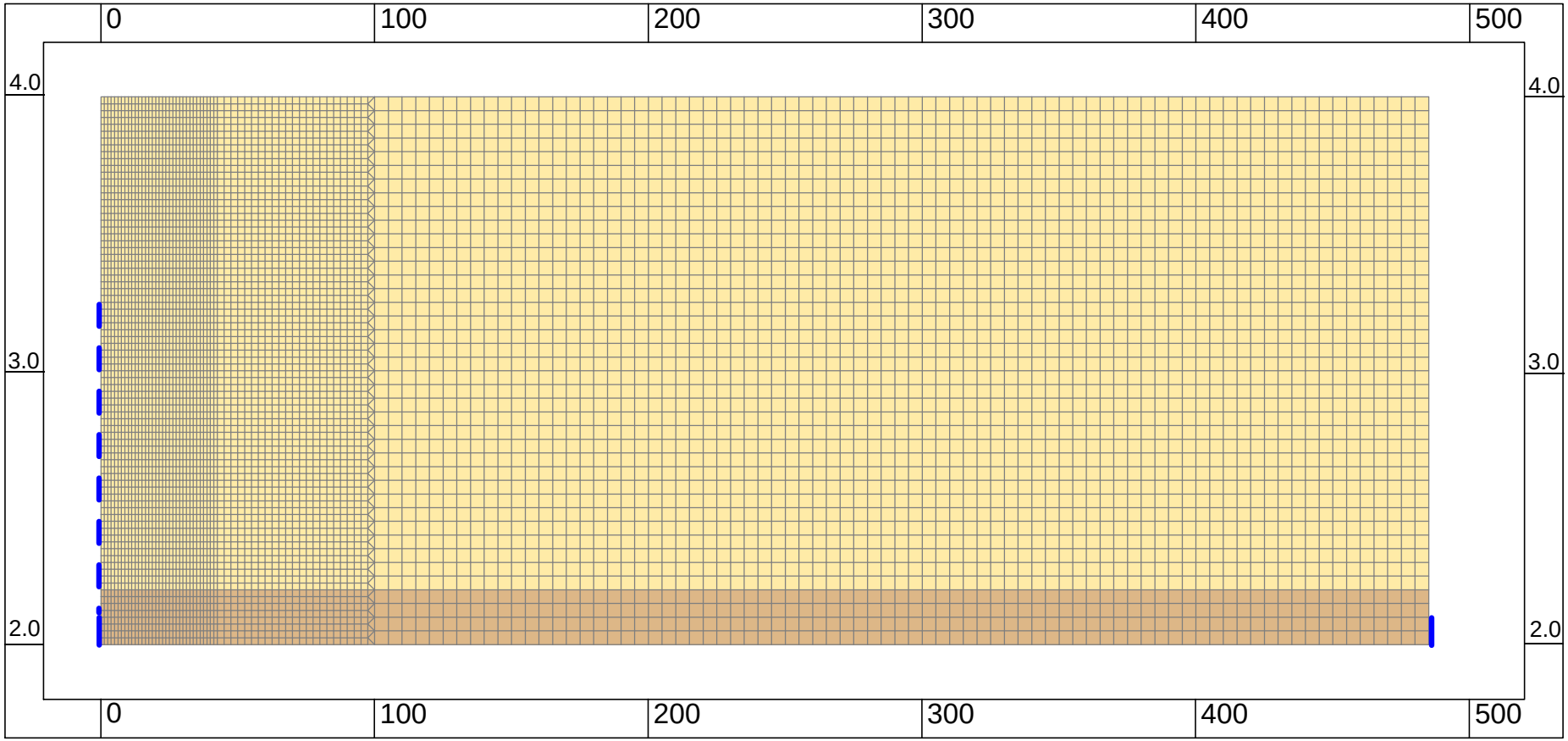
- Natural Surface Level
- Infered Shallow Groundwater Level
- Approximate Consutruction Design Levels (mAHD)
- Groundwater Flow Direction

Bore details:
Grey line - length of casing through profile; dashed grey line - slotted section
Blue dash - Static Groundwater Level;
Yellow dash - Change in litholodgy.

Note: All heights are reduced levels to meters Australian Height Datum (mAHD).



waste solutions AUSTRALIA PTY LTD			Codlea Pty Ltd		
			Groundwater Investigation, Aquifer Modelling and Sampling Report		
			Groundwater Model: concept of the interaction between surface water and groundwater		
	Drawn by: IR	Approved: PS	Date: December 2012	Job: W516-4	Figure 4



waste solutions AUSTRALIA PTY LTD

LEGEND

- Shallow Sand: k=21.5 m/day
- Coffee Rock: k=0.25m/day
- Model Grid
- Fixed Potential
- Fixed Potential, varying head (at detention basin)

Codlea Pty Ltd	W516-4
Groundwater Investigation, Aquifer Modelling and Sampling Report	
Model Geometry and Aquifer Properties	
Drawn by / Approved by: IR / PS	Date: December 2012
Figure 5	

APPENDIX B

LABORATORY REPORTS AND DATA QUALITY EVALUATION REPORT

CHAIN OF CUSTODY

*ALS Laboratory: **please tick** →*

CLIENT:	Waste Solutions Australia Pty Ltd	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☒ Standard TAT **(List due date): 18/09/2012** ☐ Non Standard or urgent TAT **(List due date):**
OFFICE:	L1/254 Waterworks Road, ASHGROVE 4060		
PROJECT:	W 516-3 Codlea	**ALS QUOTE NO.:** BN/020/12	**COC SEQUENCE NUMBER (Circle)** COC: (1) 2 3 4 5 6 7 OF: (1) 2 3 4 5 6 7
ORDER NUMBER:			
PROJECT MANAGER:	Patrick Mason	**CONTACT PH: 07 3366 5778**	
SAMPLER:	Patrick Mason	**SAMPLER MOBILE: 0437 739 142**	
COC emailed to ALS? (YES / NO)		**EDD FORMAT (or default):**	
Email Reports to: patrick@wastesolutions.biz			
Email Invoice to: office@wastesolutions.biz, patrick@wastesolutions.biz			

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact? Yes No N/A

Preservation Required for Analytes present upon receipt? Yes No N/A

Random Sample Temperatures on Receipt: °C

Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Patrick Mason			
DATE/TIME: 11/9/2012.	DATE/TIME: 11/09/12 15:50	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS (MATRIX: Solid(S) Water(W))			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price). Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).							Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL BOTTLES	NT-1 Major Cations + Balance	NT-2 Major Anions + Balance	W-2 Dissolved 8 Metals	NT-8 Nutrients	Total Suspended Solids	TPH/TRH	Total Algae Count including Cyanobacteria	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	BORE 3A	11/9/2012	W		7	✓	✓	✓	✓				
2	DUP	"	"		7	✓	✓	✓	✓				
3	DRAIN 1	"	"		6				✓	✓	✓	✓	
4	DRAIN 2	"	"		6				✓	✓	✓	✓	
5	DRAIN 3	"	"		6				✓	✓	✓	✓	
6	CK SOUTH 1	"	"		6				✓	✓	✓	✓	
				TOTAL									

Environmental Division Brisbane

Work Order

EB1224090

Telephone : +61-7-3243 7222

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial 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.

Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order : **EB1224090**

Client	: **WASTE SOLUTIONS AUSTRALIA P/L**	Laboratory	: Environmental Division Brisbane
Contact	: MR PATRICK MASON	Contact	: Customer Services
Address	: P O BOX 514 ASHGROVE QLD, AUSTRALIA 4060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: patrick@wastesolutions.biz	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 33665778	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 33667302	Facsimile	: +61 7 3243 7218
Project	: W 516-3 Codlea	Page	: 1 of 2
Order number	: ----		
C-O-C number	: ----	Quote number	: EB2012WASSOL0366 (BN/020/12)
Site	: ----		
Sampler	: Patrick Mason	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 11-SEP-2012	Issue Date	: 12-SEP-2012 12:18
Client Requested Due Date	: 14-SEP-2012	Scheduled Reporting Date	: **14-SEP-2012**

Delivery Details

Mode of Delivery	: Client Drop off	Temperature	: 4.6°C - Ice present
No. of coolers/boxes	: 1 MEDIUM	No. of samples received	: 6
Security Seal	: Intact.	No. of samples analysed	: 6

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- Samples received in appropriately pretreated and preserved containers.
- A 25% surcharge is applicable for results returned within 3 days.
- **Samples received in appropriately pretreated and preserved containers.**
- **MW024.C: Cyanobacteria swapped to MW024.T: Total Agae ID & Count as per email request from Martin Spencer 12/09/12 @ 11:00.**
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Matt Goodwin.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (60 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(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 the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: **WATER**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	WATER - EA025H Suspended Solids (High Level)	WATER - EN055 - PG Ionic Balance by ED037P, ED041G, ED045G & ED093F)	WATER - MW024.T (Subcontracted) Total Algae Count	WATER - NT-01 Major Cations (Ca, Mg, Na, K)	WATER - NT-02 Major Anions (Chloride, Sulphate, Alkalinity)	WATER - NT-08 Total Nitrogen + NO2 + NO3 + NH3 + Total P	WATER - TPH TPH (fractions)	WATER - W-02 8 Metals
EB1224090-001	11-SEP-2012 12:00	BORE3A		✓		✓	✓	✓		✓
EB1224090-002	11-SEP-2012 12:00	DUP		✓		✓	✓	✓		✓
EB1224090-003	11-SEP-2012 12:00	DRAIN 1	✓		✓			✓	✓	
EB1224090-004	11-SEP-2012 12:00	DRAIN 2	✓		✓			✓	✓	
EB1224090-005	11-SEP-2012 12:00	DRAIN 3	✓		✓			✓	✓	
EB1224090-006	11-SEP-2012 12:00	CK SOUTH 1	✓		✓			✓	✓	

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV)	Email	office@wastesolutions.biz

MR PATRICK MASON

- *AU Certificate of Analysis - NATA (COA)	Email	patrick@wastesolutions.biz
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	patrick@wastesolutions.biz
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	patrick@wastesolutions.biz
- A4 - AU Sample Receipt Notification - Environmental HT (SRN	Email	patrick@wastesolutions.biz
- Attachment - Report (SUBCO)	Email	patrick@wastesolutions.biz
- Chain of Custody (CoC) (COC)	Email	patrick@wastesolutions.biz
- EDI Format - ENMRG (ENMRG)	Email	patrick@wastesolutions.biz
- EDI Format - XTab (XTAB)	Email	patrick@wastesolutions.biz

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1224090**	Page	: 1 of 6
Client	: **WASTE SOLUTIONS AUSTRALIA P/L**	Laboratory	: Environmental Division Brisbane
Contact	: MR PATRICK MASON	Contact	: Customer Services
Address	: P O BOX 514 ASHGROVE QLD, AUSTRALIA 4060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: patrick@wastesolutions.biz	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 33665778	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 33667302	Facsimile	: +61 7 3243 7218
Project	: W 516-3 Codlea	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 11-SEP-2012
Sampler	: Patrick Mason	Issue Date	: 14-SEP-2012
Site	: ----		
		No. of samples received	: 6
Quote number	: BN/020/12	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Organics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

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.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: BORE3A	DUP	DRAIN 1	DRAIN 2	DRAIN 3
				Client sampling date / time: 11-SEP-2012 12:00	11-SEP-2012 12:00	11-SEP-2012 12:00	11-SEP-2012 12:00	11-SEP-2012 12:00
				EB1224090-001	EB1224090-002	EB1224090-003	EB1224090-004	EB1224090-005
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	----	----	<5	**110**	**7**
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	<1	<1	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	<1	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	**65**	**65**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	<1	----	----	----
Magnesium	7439-95-4	1	mg/L	**7**	**7**	----	----	----
Sodium	7440-23-5	1	mg/L	**32**	**32**	----	----	----
Potassium	7440-09-7	1	mg/L	<1	<1	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.007**	**0.006**	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.07**	**0.08**	**0.03**	**0.06**	**0.32**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	**0.01**	<0.01	<0.01	**0.08**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	**0.01**	<0.01	<0.01	**0.08**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: BORE3A	DUP	DRAIN 1	DRAIN 2	DRAIN 3
			Client sampling date / time	11-SEP-2012 12:00	11-SEP-2012 12:00	11-SEP-2012 12:00	11-SEP-2012 12:00	11-SEP-2012 12:00
				EB1224090-001	EB1224090-002	EB1224090-003	EB1224090-004	EB1224090-005
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**3.8**	**4.3**	**1.2**	**2.9**	**1.6**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	**3.8**	**4.3**	**1.2**	**2.9**	**1.7**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.23**	**0.29**	**0.10**	**0.45**	**1.59**
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**1.83**	**1.83**	----	----	----
Total Cations	----	0.01	meq/L	**1.97**	**1.97**	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	----	----	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L	----	----	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L	----	----	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L	----	----	<50	**90**	<50
^ **C10 - C36 Fraction (sum)**	----	50	µg/L	----	----	<50	**90**	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	20	µg/L	----	----	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L	----	----	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L	----	----	<100	**120**	<100
>C34 - C40 Fraction	----	100	µg/L	----	----	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L	----	----	<100	**120**	<100
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	----	----	**106**	**101**	**115**
Toluene-D8	2037-26-5	0.1	%	----	----	**105**	**98.4**	**113**
4-Bromofluorobenzene	460-00-4	0.1	%	----	----	**110**	**104**	**124**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: CK SOUTH 1	----	----	----	----
				Client sampling date / time: 11-SEP-2012 12:00	----	----	----	----
				EB1224090-006	----	----	----	----
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	**96**	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.04**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.01**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.01**	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.4**	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	**0.4**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.06**	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	----	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
^ **C10 - C36 Fraction (sum)**	----	50	µg/L	<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	20	µg/L	<20	----	----	----	----
>C10 - C16 Fraction	----	100	µg/L	<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L	<100	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	**102**	----	----	----	----
Toluene-D8	2037-26-5	0.1	%	**102**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	**107**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	66.1	137.9
Toluene-D8	2037-26-5	79.2	119.6
4-Bromofluorobenzene	460-00-4	74.2	118.0

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1224090**	Page	: 1 of 8
Client	: WASTE SOLUTIONS AUSTRALIA P/L	Laboratory	: Environmental Division Brisbane
Contact	: MR PATRICK MASON	Contact	: Customer Services
Address	: P O BOX 514 ASHGROVE QLD, AUSTRALIA 4060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: patrick@wastesolutions.biz	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 33665778	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 33667302	Facsimile	: +61 7 3243 7218
Project	: W 516-3 Codlea	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 11-SEP-2012
Sampler	: Patrick Mason	Issue Date	: 14-SEP-2012
Order number	: ----		
		No. of samples received	: 6
Quote number	: BN/020/12	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non -volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA025: Suspended Solids							
Clear Plastic Bottle - Natural (EA025H)							
DRAIN 1, DRAIN 2, DRAIN 3, CK SOUTH 1	**11-SEP-2012**	---	18-SEP-2012	----	**13-SEP-2012**	18-SEP-2012	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
BORE3A, DUP	**11-SEP-2012**	---	25-SEP-2012	----	**12-SEP-2012**	25-SEP-2012	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
BORE3A, DUP	**11-SEP-2012**	---	09-OCT-2012	----	**12-SEP-2012**	09-OCT-2012	✓
ED045G: Chloride Discrete analyser							
Clear Plastic Bottle - Natural (ED045G)							
BORE3A, DUP	**11-SEP-2012**	---	09-OCT-2012	----	**12-SEP-2012**	09-OCT-2012	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Natural (ED093F)							
BORE3A, DUP	**11-SEP-2012**	---	18-SEP-2012	----	**12-SEP-2012**	18-SEP-2012	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
BORE3A, DUP	**11-SEP-2012**	---	10-MAR-2013	----	**12-SEP-2012**	10-MAR-2013	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)							
BORE3A, DUP	**11-SEP-2012**	---	09-OCT-2012	----	**12-SEP-2012**	09-OCT-2012	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
BORE3A, DUP, DRAIN 1, DRAIN 2, DRAIN 3, CK SOUTH 1	**11-SEP-2012**	---	09-OCT-2012	----	**12-SEP-2012**	09-OCT-2012	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
BORE3A, DUP, DRAIN 1, DRAIN 2, DRAIN 3, CK SOUTH 1	**11-SEP-2012**	---	13-SEP-2012	----	**12-SEP-2012**	13-SEP-2012	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
BORE3A, DUP, DRAIN 1, DRAIN 2, DRAIN 3, CK SOUTH 1	**11-SEP-2012**	**---**	09-OCT-2012	----	**12-SEP-2012**	09-OCT-2012	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
BORE3A, DUP, DRAIN 1, DRAIN 2, DRAIN 3, CK SOUTH 1	**11-SEP-2012**	**14-SEP-2012**	09-OCT-2012	✓	**14-SEP-2012**	09-OCT-2012	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
BORE3A, DUP, DRAIN 1, DRAIN 2, DRAIN 3, CK SOUTH 1	**11-SEP-2012**	**14-SEP-2012**	09-OCT-2012	✓	**14-SEP-2012**	09-OCT-2012	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071)							
DRAIN 1, DRAIN 2, DRAIN 3, CK SOUTH 1	**11-SEP-2012**	**12-SEP-2012**	18-SEP-2012	✓	**13-SEP-2012**	22-OCT-2012	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft							
Amber VOC Vial - Sulfuric Acid (EP080)							
DRAIN 1, DRAIN 2, DRAIN 3, CK SOUTH 1	**11-SEP-2012**	**13-SEP-2012**	25-SEP-2012	✓	**13-SEP-2012**	25-SEP-2012	✓
MW024T: Total Algae Identification							
White Plastic Bottle-Lugols Iodine (MW024.T)							
DRAIN 1, DRAIN 2, DRAIN 3, CK SOUTH 1	**11-SEP-2012**	**----**	----	----	**13-SEP-2012**	10-MAR-2013	✓

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(where) 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: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	13	**15.4**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	1	7	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	11	**18.2**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	2	**50.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	4	**25.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	7	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	2	14	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	12	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	2	19	**10.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	15	**13.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	3	30	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	13	**7.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	1	7	**14.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	11	**18.2**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	2	**50.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	4	**25.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	7	**14.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	14	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	12	**8.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	1	19	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	15	**6.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	2	30	**6.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	4	**25.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	7	**14.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	11	**9.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	2	**50.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	4	**25.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	7	**14.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	14	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	12	**8.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	1	19	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	15	**6.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	2	30	**6.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
TPH - Semivolatile Fraction	EP071	1	4	**25.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	7	**14.3**	**5.0**	✓	ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	11	**9.1**	**5.0**	✓	ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	2	**50.0**	**5.0**	✓	ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	4	**25.0**	**5.0**	✓	ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	7	**14.3**	**5.0**	✓	ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	14	**7.1**	**5.0**	✓	ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	15	**6.7**	**5.0**	✓	ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	2	30	**6.7**	**5.0**	✓	ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement

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
Suspended Solids (High Level)	EA025H	WATER	In-House, APHA 21st ed., 2540D A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Alkalinity by PC Titrator	ED037-P	WATER	APHA 21st ed., 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	APHA 21st ed., 4500-SO4 Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Chloride by Discrete Analyser	ED045G	WATER	APHA 21st ed., 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	Major Cations is determined based on APHA 21st ed., 3120; USEPA SW 846 - 6010 The ICPAES technique ionises the 0.45um filtered sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) Sodium Absorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) Hardness parameters are calculated based on APHA 21st ed., 2340 B. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	AS 3550, APHA 21st ed. 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45 um filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Ammonia as N by Discrete analyser	EK055G	WATER	APHA 21st ed., 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrite as N by Discrete Analyser	EK057G	WATER	APHA 21st ed., 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Analytical Methods	Method	Matrix	Method Descriptions
Nitrate as N by Discrete Analyser	EK058G	WATER	APHA 21st ed., 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	APHA 21st ed., 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	APHA 21st ed., 4500-Norg D. 25mL water samples are digested using a traditional Kjeldahl digestion followed by determination by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	APHA 21st ed., 4500-Norg / 4500-NO3-. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	APHA 21st ed., 4500-P B&F This procedure involves sulphuric acid digestion of a 100mL sample to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	APHA 21st Ed. 1030F. The Ionic Balance is calculated based on the major Anions and Cations. The major anions include Alkalinity, Chloride and Sulfate which determined by PCT and DA. The Cations are determined by Turbi SO4 by DA. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
TPH - Semivolatile Fraction	EP071	WATER	USEPA SW 846 - 8015A The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
TPH Volatiles/BTEX	EP080	WATER	USEPA SW 846 - 8260B Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Algae Count	MW024.T	WATER	Hotzel and Croome 1999

Preparation Methods	Method	Matrix	Method Descriptions
Separatory Funnel Extraction of Liquids	ORG14	WATER	USEPA SW 846 - 3510B 500 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2). ALS default excludes sediment which may be resident in the container.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EK067G: Total Phosphorus as P by Discrete Analyser	EB1224021-001	Anonymous	**Total Phosphorus as P**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**

Regular Sample Surrogates

Sub-Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP080S: TPH(V)/BTEX Surrogates	EB1224090-005	DRAIN 3	**4-Bromofluorobenzene**	460-00-4	124 %	74.2-118.0 %	**Recovery greater than upper data quality objective**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- **No Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

Environmental Division

QUALITY CONTROL REPORT

Work Order	: **EB1224090**	Page	: 1 of 8
Client	: **WASTE SOLUTIONS AUSTRALIA P/L**	Laboratory	: Environmental Division Brisbane
Contact	: MR PATRICK MASON	Contact	: Customer Services
Address	: P O BOX 514 ASHGROVE QLD, AUSTRALIA 4060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: patrick@wastesolutions.biz	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 33665778	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 33667302	Facsimile	: +61 7 3243 7218
Project	: W 516-3 Codlea	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 11-SEP-2012
Sampler	: Patrick Mason	Issue Date	: 14-SEP-2012
Order number	: ----		
		No. of samples received	: 6
Quote number	: BN/020/12	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

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

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Organics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

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.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

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 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%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA025: Suspended Solids (QC Lot: 2497168)									
EB1224089-026	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	28	24	15.4	No Limit
EB1224203-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	12	14	15.4	No Limit
ED037P: Alkalinity by PC Titrator (QC Lot: 2495434)									
EB1223690-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	501	502	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	501	502	0.0	0% - 20%
EB1223738-003	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	153	153	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	153	153	0.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2494871)									
EB1224022-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	2180	2560	16.3	0% - 20%
EB1224024-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	397	403	1.4	0% - 20%
ED045G: Chloride Discrete analyser (QC Lot: 2494870)									
EB1224022-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	3	3	0.0	No Limit
EB1224024-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	1570	1580	0.6	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2494869)									
EB1224022-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	273	281	2.7	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	74	74	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	16	16	0.0	0% - 50%
		ED093F: Potassium	7440-09-7	1	mg/L	4	5	0.0	No Limit
EB1224024-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	18	18	0.0	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	34	34	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	1500	1540	2.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	15	15	0.0	0% - 50%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2494625)									
EB1224071-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.004	0.004	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 2494627)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG035F: Dissolved Mercury by FIMS (QC Lot: 2494627) - continued									
EB1224090-001	BORE3A	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2494618)									
EB1224021-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.07	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2494873)									
EB1224036-002	Anonymous	EK057G: Nitrite as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EB1224097-001	Anonymous	EK057G: Nitrite as N	----	0.01	mg/L	0.36	0.37	0.0	0% - 20%
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2494617)									
EB1224021-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	1.03	1.03	0.0	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2498074)									
EB1223763-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	<0.1	0.0	No Limit
ER1200049-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.2	1.1	0.0	0% - 50%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2498073)									
EB1223422-013	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.10	0.08	25.4	No Limit
EB1223763-002	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.01	0.02	0.0	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2498075)									
EB1224090-006	CK SOUTH 1	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.06	0.06	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 2494901)									
EB1223422-001	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EB1223422-011	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QC Lot: 2494901)									
EB1223422-001	Anonymous	EP080: C6 - C10 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EB1223422-011	Anonymous	EP080: C6 - C10 Fraction	----	20	µg/L	<20	<20	0.0	No Limit

Method Blank (MB) and Laboratory Control Spike (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: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Suspended Solids (QCLot: 2497168)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	93.3	82	120
ED037P: Alkalinity by PC Titrator (QCLot: 2495434)								
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	----	200 mg/L	97.4	88	112
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2494871)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	118	70	130
ED045G: Chloride Discrete analyser (QCLot: 2494870)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	1000 mg/L	93.9	75	117
ED093F: Dissolved Major Cations (QCLot: 2494869)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
ED093F: Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
ED093F: Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
ED093F: Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS (QCLot: 2494625)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.100 mg/L	98.8	78	122
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.100 mg/L	91.0	79	121
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.100 mg/L	93.3	81	122
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.200 mg/L	89.9	78	122
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.100 mg/L	99.1	80	125
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.100 mg/L	102	75	120
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.200 mg/L	84.4	79	119
EG035F: Dissolved Mercury by FIMS (QCLot: 2494627)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.010 mg/L	85.5	84	116
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2494618)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	99.8	70	120
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2494873)								
EK057G: Nitrite as N	----	0.01	mg/L	<0.01	0.5 mg/L	102	83	119
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2494617)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	103	70	124
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2498074)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10.0 mg/L	88.1	70	115
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2498073)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.2 mg/L	98.6	77	117
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2498075)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2498075) - continued								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.2 mg/L	97.8	77	117
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2494611)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	1275 µg/L	69.7	44	121
EP071: C15 - C28 Fraction	----	100	µg/L	<100	1850 µg/L	86.8	53	135
EP071: C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2494901)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	160 µg/L	115	68	134
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2494611)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	1670 µg/L	76.4	44	129
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	1285 µg/L	84.1	53	131
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2494901)								
EP080: C6 - C10 Fraction	----	20	µg/L	<20	185 µg/L	116	67	135

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.

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Spike Recovery (%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
ED045G: Chloride Discrete analyser (QCLot: 2494870)							
EB1224036-003	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	110	70	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 2494625)							
EB1224071-002	Anonymous	EG020A-F: Arsenic	7440-38-2	0.05 mg/L	110	70	130
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	89.9	70	130
		EG020A-F: Chromium	7440-47-3	0.05 mg/L	71.0	70	130
		EG020A-F: Copper	7440-50-8	0.1 mg/L	90.7	70	130
		EG020A-F: Lead	7439-92-1	0.05 mg/L	106	70	130
		EG020A-F: Nickel	7440-02-0	0.05 mg/L	98.9	70	130
		EG020A-F: Zinc	7440-66-6	0.1 mg/L	89.4	70	130
EG035F: Dissolved Mercury by FIMS (QCLot: 2494627)							
EB1224090-002	DUP	EG035F: Mercury	7439-97-6	0.010 mg/L	95.4	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2494618)							
EB1224090-001	BORE3A	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	92.3	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2494873)							
EB1224036-003	Anonymous	EK057G: Nitrite as N	----	0.4 mg/L	88.2	70	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2494617)							
EB1224090-001	BORE3A	EK059G: Nitrite + Nitrate as N	----	0.4 mg/L	84.0	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2498074)							
EB1224021-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	93.4	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2498073)							
EB1223422-014	Anonymous	EK067G: Total Phosphorus as P	----	1.0 mg/L	98.6	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2498075)							
EB1224021-001	Anonymous	EK067G: Total Phosphorus as P	----	1.0 mg/L	# Not Determined	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2494901)							
EB1223422-002	Anonymous	EP080: C6 - C9 Fraction	----	40 µg/L	102	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2494901)							
EB1223422-002	Anonymous	EP080: C6 - C10 Fraction	----	40 µg/L	97.4	70	130

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are 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.

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2494617)										
EB1224090-001	BORE3A	EK059G: Nitrite + Nitrate as N	----	0.4 mg/L	84.0	----	70	130	----	----
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2494618)										
EB1224090-001	BORE3A	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	92.3	----	70	130	----	----
EG020F: Dissolved Metals by ICP-MS (QCLot: 2494625)										
EB1224071-002	Anonymous	EG020A-F: Arsenic	7440-38-2	0.05 mg/L	110	----	70	130	----	----
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	89.9	----	70	130	----	----
		EG020A-F: Chromium	7440-47-3	0.05 mg/L	71.0	----	70	130	----	----
		EG020A-F: Copper	7440-50-8	0.1 mg/L	90.7	----	70	130	----	----
		EG020A-F: Lead	7439-92-1	0.05 mg/L	106	----	70	130	----	----
		EG020A-F: Nickel	7440-02-0	0.05 mg/L	98.9	----	70	130	----	----
		EG020A-F: Zinc	7440-66-6	0.1 mg/L	89.4	----	70	130	----	----
EG035F: Dissolved Mercury by FIMS (QCLot: 2494627)										
EB1224090-002	DUP	EG035F: Mercury	7439-97-6	0.010 mg/L	95.4	----	70	130	----	----
ED045G: Chloride Discrete analyser (QCLot: 2494870)										
EB1224036-003	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	110	----	70	130	----	----
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2494873)										

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2494873) - continued										
EB1224036-003	Anonymous	EK057G: Nitrite as N	----	0.4 mg/L	88.2	----	70	130	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2494901)										
EB1223422-002	Anonymous	EP080: C6 - C9 Fraction	----	40 µg/L	102	----	70	130	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2494901)										
EB1223422-002	Anonymous	EP080: C6 - C10 Fraction	----	40 µg/L	97.4	----	70	130	----	----
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2498073)										
EB1223422-014	Anonymous	EK067G: Total Phosphorus as P	----	1.0 mg/L	98.6	----	70	130	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2498074)										
EB1224021-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	93.4	----	70	130	----	----
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2498075)										
EB1224021-001	Anonymous	EK067G: Total Phosphorus as P	----	1.0 mg/L	# Not Determined	----	70	130	----	----

CERTIFICATE OF ANALYSIS

Client:	**WASTE SOLUTIONS AUSTRALIA PTY LTD**	**ALS Work Order:**	**EB1224090**
Address:	PO BOX 514 ASHGROVE, QLD, AUSTRALIA 4060	**Laboratory:**	ALS Environmental Brisbane
		Date Sampled:	11.09.2012
Attention:	PATRICK MASON	**Date Received:**	11.09.2012
		Date Analysed:	12.09 & 13.09.2012
Quote:	BN/020/12	**Sample Type:**	AQUEOUS
Project:	W 516-3 CODLEA	**No. of Samples:**	4

PHYTOPLANKTON IDENTIFICATION & ENUMERATION

Comments:

- Under microscopic observation, the samples were clear for algae analysis.
- Analysis of marine samples are not covered by the scope of NATA accreditation.

NOTES

Samples were preserved with Lugols Iodine solution.
Samples were analysed in accordance with ALS Quality Work Instruction QWI-MIC/MW024

Results apply to sample(s) as submitted.
PTP=Potential Toxin Producers;
<1or ND=Not Detected

Organisms are reported and counted only when detected in the portion of 1mL sample.

Duyen Nguyen
Senior Microbiologist
(Signatory)

Date Reported: 14.09.2012

ALS sample ID:	EB1224090-03	EB1224090-04	EB1224090-05	EB1224090-06
Client sample ID:	DRAIN 1	DRAIN 2	DRAIN 3	CK SOUTH 1
Sample Date:	11.09.2012	11.09.2012	11.09.2012	11.09.2012
Sample Time:	NS	NS	NS	NS
Units	Cells/mL	Cells/mL	Cells/mL	Cells/mL
CYANOPHYTES (Blue-green algae)				
Chroococcales				
Cyanodictyon planctonicum	ND	160	ND	ND
Synechococcus spp.	20	20	ND	ND
Total Chroococcales	**20**	**180**	**<1**	**<1**
Nostocales				
Total Nostocales	**<1**	**<1**	**<1**	**<1**
Oscillatoriales				
Pseudanabaena spp.	200	ND	ND	70
Total Oscillatoriales	**200**	**<1**	**<1**	**70**
Stigonematales				
Total Stigonematales	**<1**	**<1**	**<1**	**<1**
Total Cyanophytes	**220**	**180**	**ND**	**70**
CHLOROPHYTES (Green algae)				
Chlorococcales				
Monoraphidium spp.	20	ND	ND	ND
Sphaerocystis spp.	80	ND	ND	ND
Oedogonium spp.	ND	20	ND	ND
Zygnematales				
Closterium spp.	10	ND	ND	ND
Euastrum spp.	2000	ND	ND	ND
Netrium spp.	ND	40	ND	ND
Spirogyra spp.	ND	200	ND	ND
Volvocales				
cf. Volvox spp.	ND	ND	400	ND
Total Chlorophytes	**2110**	**260**	**400**	**<1**
FLAGELLATES				
Euglenophytes				
Euglena spp.	ND	ND	20	ND
Pyrhophytes				
Gymnodinium spp.	ND	ND	ND	20
Cryptophytes				
Chroomonas spp.	ND	ND	ND	20
Cryptomonas spp.	20	320	20	ND
Total Flagellates	**20**	**320**	**40**	**40**
CHRYSOPHYTES (Golden algae)				
Chrysophyceae				
Synura spp.	ND	ND	ND	20
Total Chrysophytes	**<1**	**<1**	**<1**	**20**

ALS sample ID:	EB1224090-03	EB1224090-04	EB1224090-05	EB1224090-06
Client sample ID:	DRAIN 1	DRAIN 2	DRAIN 3	CK SOUTH 1
Sample Date:	11.09.2012	11.09.2012	11.09.2012	11.09.2012
Sample Time:	NS	NS	NS	NS
Units	Cells/mL	Cells/mL	Cells/mL	Cells/mL
RAPHIDOPHYTE				
Total Raphidophyte	**<1**	**<1**	**<1**	**<1**
BACILLARIOPHYTES (Diatoms)				
Centrales				
Cyclotella spp.	ND	ND	ND	100
Melosira spp.	ND	ND	ND	15700
Pennales				
Pinnularia spp.	ND	100	10	ND
Rhoicosphenia spp.	ND	10	ND	ND
Synedra spp.	ND	80	10	ND
Total Bacillariophytes	**<1**	**190**	**20**	**15800**
PREDOMINANT ALGAE	**2350**	**950**	**460**	**15930**

ND = *Not Detected*
cf. = *comparable from*
NS = *Not Specified*

CHAIN OF CUSTODY

*ALS Laboratory: **please tick** →*

CLIENT:	**Waste Solutions Australia Pty Ltd**	**TURNAROUND REQUIREMENTS :** (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☒ Standard TAT **(List due date): 18/09/2012** ☐ Non Standard or urgent TAT **(List due date):**
OFFICE:	**L1/254 Waterworks Road, ASHGROVE 4060**		
PROJECT:	**W 516-3 Codlea**	**ALS QUOTE NO.:** **BN/020/12** BQ	**COC SEQUENCE NUMBER (Circle)**
ORDER NUMBER:			COC: 1 2 3 4 5 6 7
PROJECT MANAGER:	**Patrick Mason**	**CONTACT PH: 07 3366 5778**	OF: 1 2 3 4 5 6 7
SAMPLER:	**Patrick Mason**	**SAMPLER MOBILE: 0437 739 142**	
COC emailed to ALS? (YES / NO)		**EDD FORMAT (or default):**	
Email Reports to: patrick@wastesolutions.biz			
Email Invoice to: office@wastesolutions.biz, patrick@wastesolutions.biz			

RELINQUISHED BY:	**RECEIVED BY:**	**RELINQUISHED BY:**	**RECEIVED BY:**
DATE/TIME: 14/9/12	DATE/TIME: 18/9/12 17:10	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).							Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE *(refer to codes below)*	TOTAL BOTTLES	NT-1 Major Cations + Balance	NT-2 Major Anions + Balance	W-2 Dissolved 8 Metals	NT-8 Nutrients	Total Suspended Solids	TPH/TRH	Total Algae Count including Cyanobacteria	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	BORE2	18/9/12	W		6	✓	✓	✓	✓	✓	✓	✓	
	~~BORE1~~	~~18/9/12~~	~~W~~		6	✓	✓	✓	✓	✓	✓	✓	
				TOTAL									

Environmental Division Brisbane

Work Order

EB1224768

Telephone : +61-7-3243 7222

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial 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.

Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **EB1224768**		
Client	: **WASTE SOLUTIONS AUSTRALIA P/L**	Laboratory	: Environmental Division Brisbane
Contact	: MR PATRICK MASON	Contact	: Customer Services
Address	: P O BOX 514 ASHGROVE QLD, AUSTRALIA 4060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: patrick@wastesolutions.biz	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 33665778	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 33667302	Facsimile	: +61 7 3243 7218
Project	: W 516-3 Codlea	Page	: 1 of 2
Order number	: 873769		
C-O-C number	: ----	Quote number	: EB2012WASSOL0366 (BN/020/12)
Site	: ----		
Sampler	: Patrick Mason	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 18-SEP-2012	Issue Date	: 21-SEP-2012 16:33
Client Requested Due Date	: 26-SEP-2012	Scheduled Reporting Date	: **25-SEP-2012**

Delivery Details

Mode of Delivery	: Client Drop off	Temperature	: 15.2°C - Ice present
No. of coolers/boxes	: 1 SMALL	No. of samples received	: 1
Security Seal	: Intact.	No. of samples analysed	: 1

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Matt Goodwin.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (60 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(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 the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: **WATER**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	WATER - EA025H Suspended Solids (High Level)	WATER - MW024.T (Subcontracted) Total Algae Count	WATER - NT-01 Major Cations (Ca, Mg, Na, K)	WATER - NT-02 Major Anions (Chloride, Sulphate, Alkalinity)	WATER - NT-08 Total Nitrogen + NO2 + NO3 + NH3 + Total P	WATER - TPH TPH (fractions)	WATER - W-02 8 Metals
EB1224768-001	18-SEP-2012 15:00	BORE 2	✓	✓	✓	✓	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV)	Email	office@wastesolutions.biz

MR PATRICK MASON

- *AU Certificate of Analysis - NATA (COA)	Email	patrick@wastesolutions.biz
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	patrick@wastesolutions.biz
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	patrick@wastesolutions.biz
- A4 - AU Sample Receipt Notification - Environmental HT (SRN	Email	patrick@wastesolutions.biz
- A4 - AU Tax Invoice (INV)	Email	patrick@wastesolutions.biz
- Attachment - Report (SUBCO)	Email	patrick@wastesolutions.biz
- Chain of Custody (CoC) (COC)	Email	patrick@wastesolutions.biz
- EDI Format - ENMRG (ENMRG)	Email	patrick@wastesolutions.biz
- EDI Format - XTab (XTAB)	Email	patrick@wastesolutions.biz

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1224768**	Page	: 1 of 5
Client	: **WASTE SOLUTIONS AUSTRALIA P/L**	Laboratory	: Environmental Division Brisbane
Contact	: MR PATRICK MASON	Contact	: Customer Services
Address	: P O BOX 514 ASHGROVE QLD, AUSTRALIA 4060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: patrick@wastesolutions.biz	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 33665778	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 33667302	Facsimile	: +61 7 3243 7218
Project	: W 516-3 Codlea	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: 873769		
C-O-C number	: ----	Date Samples Received	: 18-SEP-2012
Sampler	: Patrick Mason	Issue Date	: 25-SEP-2012
Site	: ----		
		No. of samples received	: 1
Quote number	: BN/020/12	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Metals Production Chemist	Brisbane Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Organics
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

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.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK059G Nitrite & Nitrate as N (NOx) : The LOR for sample BORE 2 has been raised due to matrix interference.**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: BORE 2	----	----	----	----
				Client sampling date / time: 18-SEP-2012 15:00	----	----	----	----
				EB1224768-001	----	----	----	----
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	**729**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**42**	----	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	**20**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
Magnesium	7439-95-4	1	mg/L	**1**	----	----	----	----
Sodium	7440-23-5	1	mg/L	**8**	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0001**	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.017**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.001**	----	----	----	----
Lead	7439-92-1	0.001	mg/L	**0.002**	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.037**	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.14**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.05	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	BORE 2	----	----	----	----
				Client sampling date / time	18-SEP-2012 15:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1224768-001	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**2.8**	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**2.8**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.37**	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	----	----	----	----
C10 - C14 Fraction	----	50	µg/L		<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L		<100	----	----	----	----
C29 - C36 Fraction	----	50	µg/L		<50	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft									
C6 - C10 Fraction	----	20	µg/L		<20	----	----	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		**106**	----	----	----	----
Toluene-D8	2037-26-5	0.1	%		**101**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%		**103**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	66.1	137.9
Toluene-D8	2037-26-5	79.2	119.6
4-Bromofluorobenzene	460-00-4	74.2	118.0

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1224768**	Page	: 1 of 8
Client	: WASTE SOLUTIONS AUSTRALIA P/L	Laboratory	: Environmental Division Brisbane
Contact	: MR PATRICK MASON	Contact	: Customer Services
Address	: P O BOX 514 ASHGROVE QLD, AUSTRALIA 4060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: patrick@wastesolutions.biz	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 33665778	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 33667302	Facsimile	: +61 7 3243 7218
Project	: W 516-3 Codlea	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-SEP-2012
Sampler	: Patrick Mason	Issue Date	: 25-SEP-2012
Order number	: 873769	No. of samples received	: 1
Quote number	: BN/020/12	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non -volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA025: Suspended Solids							
Clear Plastic Bottle - Natural (EA025H)							
BORE 2	**18-SEP-2012**	**---**	25-SEP-2012	----	**21-SEP-2012**	25-SEP-2012	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
BORE 2	**18-SEP-2012**	**---**	02-OCT-2012	----	**20-SEP-2012**	02-OCT-2012	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
BORE 2	**18-SEP-2012**	**---**	16-OCT-2012	----	**20-SEP-2012**	16-OCT-2012	✓
ED045G: Chloride Discrete analyser							
Clear Plastic Bottle - Natural (ED045G)							
BORE 2	**18-SEP-2012**	**---**	16-OCT-2012	----	**20-SEP-2012**	16-OCT-2012	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Natural (ED093F)							
BORE 2	**18-SEP-2012**	**---**	25-SEP-2012	----	**20-SEP-2012**	25-SEP-2012	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
BORE 2	**18-SEP-2012**	**---**	17-MAR-2013	----	**24-SEP-2012**	17-MAR-2013	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)							
BORE 2	**18-SEP-2012**	**---**	16-OCT-2012	----	**25-SEP-2012**	16-OCT-2012	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
BORE 2	**18-SEP-2012**	**---**	16-OCT-2012	----	**25-SEP-2012**	16-OCT-2012	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
BORE 2	**18-SEP-2012**	**---**	20-SEP-2012	----	**20-SEP-2012**	20-SEP-2012	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
BORE 2	**18-SEP-2012**	**---**	16-OCT-2012	----	**25-SEP-2012**	16-OCT-2012	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
BORE 2	**18-SEP-2012**	**24-SEP-2012**	16-OCT-2012	✓	**24-SEP-2012**	16-OCT-2012	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
BORE 2	**18-SEP-2012**	**24-SEP-2012**	16-OCT-2012	✓	**24-SEP-2012**	16-OCT-2012	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft							
Amber Glass Bottle - Unpreserved (EP071)							
BORE 2	**18-SEP-2012**	**24-SEP-2012**	25-SEP-2012	✓	**24-SEP-2012**	03-NOV-2012	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber VOC Vial - Sulfuric Acid (EP080)							
BORE 2	**18-SEP-2012**	**24-SEP-2012**	02-OCT-2012	✓	**24-SEP-2012**	02-OCT-2012	✓
MW024T: Total Algae Identification							
White Plastic Bottle-Lugols Iodine (MW024.T)							
BORE 2	**18-SEP-2012**	**----**	----	----	**21-SEP-2012**	17-MAR-2013	✓

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(where) 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: **WATER**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	16	**12.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	1	6	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	2	16	**12.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	2	**50.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	19	**5.3**	**10.0**	✗	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	7	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	16	**6.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	1	6	**16.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	16	**6.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	2	**50.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	19	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	7	**14.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	6	**16.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	16	**6.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	2	**50.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	19	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	7	**14.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	6	**16.7**	**5.0**	✓	ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	16	**6.3**	**5.0**	✓	ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	2	**50.0**	**5.0**	✓	ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	7	**14.3**	**5.0**	✓	ALS QCS3 requirement

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
Suspended Solids (High Level)	EA025H	WATER	In-House, APHA 21st ed., 2540D A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Alkalinity by PC Titrator	ED037-P	WATER	APHA 21st ed., 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	APHA 21st ed., 4500-SO4 Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Chloride by Discrete Analyser	ED045G	WATER	APHA 21st ed., 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	Major Cations is determined based on APHA 21st ed., 3120; USEPA SW 846 - 6010 The ICPAES technique ionises the 0.45um filtered sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) Sodium Absorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) Hardness parameters are calculated based on APHA 21st ed., 2340 B. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	AS 3550, APHA 21st ed. 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45 um filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Ammonia as N by Discrete analyser	EK055G	WATER	APHA 21st ed., 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrite as N by Discrete Analyser	EK057G	WATER	APHA 21st ed., 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Analytical Methods	Method	Matrix	Method Descriptions
Nitrate as N by Discrete Analyser	EK058G	WATER	APHA 21st ed., 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	APHA 21st ed., 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	APHA 21st ed., 4500-Norg D. 25mL water samples are digested using a traditional Kjeldahl digestion followed by determination by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	APHA 21st ed., 4500-Norg / 4500-NO3-. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	APHA 21st ed., 4500-P B&F This procedure involves sulphuric acid digestion of a 100mL sample to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
TPH - Semivolatile Fraction	EP071	WATER	USEPA SW 846 - 8015A The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
TPH Volatiles/BTEX	EP080	WATER	USEPA SW 846 - 8260B Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Algae Count	MW024.T	WATER	Hotzel and Croome 1999

Preparation Methods	Method	Matrix	Method Descriptions
Separatory Funnel Extraction of Liquids	ORG14	WATER	USEPA SW 846 - 3510B 500 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2). ALS default excludes sediment which may be resident in the container.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EK055G: Ammonia as N by Discrete Analyser	EB1224787-001	Anonymous	**Ammonia as N**	7664-41-7	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EK057G: Nitrite as N by Discrete Analyser	EB1224874-001	Anonymous	**Nitrite as N**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EK067G: Total Phosphorus as P by Discrete Analyser	EB1224722-001	Anonymous	**Total Phosphorus as P**	----	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- **No Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
TPH - Semivolatile Fraction	1	19	5.3	10.0	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Environmental Division

QUALITY CONTROL REPORT

Work Order	: **EB1224768**	Page	: 1 of 8
Client	: **WASTE SOLUTIONS AUSTRALIA P/L**	Laboratory	: Environmental Division Brisbane
Contact	: MR PATRICK MASON	Contact	: Customer Services
Address	: P O BOX 514 ASHGROVE QLD, AUSTRALIA 4060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: patrick@wastesolutions.biz	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 33665778	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 33667302	Facsimile	: +61 7 3243 7218
Project	: W 516-3 Codlea	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-SEP-2012
Sampler	: Patrick Mason	Issue Date	: 25-SEP-2012
Order number	: 873769		
		No. of samples received	: 1
Quote number	: BN/020/12	No. of samples analysed	: 1

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

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

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Metals Production Chemist	Brisbane Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Organics
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

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.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

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 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%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA025: Suspended Solids (QC Lot: 2510529)									
EB1224722-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	8	9	11.8	No Limit
EB1224766-002	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	81	79	2.5	0% - 50%
ED037P: Alkalinity by PC Titrator (QC Lot: 2509653)									
EB1224768-001	BORE 2	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	<1	<1	0.0	No Limit
EB1224823-008	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	496	494	0.4	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	496	494	0.4	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2508860)									
EB1224689-003	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	13	20	38.3	0% - 20%
EB1224874-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	303	303	0.0	0% - 20%
ED045G: Chloride Discrete analyser (QC Lot: 2508859)									
EB1224689-003	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	86	89	3.0	0% - 20%
EB1224874-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	256	265	3.4	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2508858)									
EB1224689-003	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	30	29	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	26	25	4.4	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	74	74	0.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EB1224874-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	78	79	1.4	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	42	42	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	214	217	1.3	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	27	27	0.0	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2510824)									
EB1224768-001	BORE 2	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0001	0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.017	0.017	0.0	0% - 50%
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.037	0.038	4.2	No Limit
EB1224820-009	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2510824) - continued									
EB1224820-009	Anonymous	EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.028	0.030	7.5	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 2510823)									
EB1224768-001	BORE 2	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EB1224963-003	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2511200)									
EB1224768-001	BORE 2	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.14	0.22	45.1	0% - 20%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2508861)									
EB1224874-001	Anonymous	EK057G: Nitrite as N	----	0.01	mg/L	2.19	2.24	2.2	0% - 20%
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2511199)									
EB1224768-001	BORE 2	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.05	<0.05	0.0	No Limit
EB1224954-005	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.50	0.50	0.0	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2512838)									
EB1224061-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.0	0.9	0.0	No Limit
EB1224816-006	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	0.5	0.0	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2512839)									
EB1224061-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	1.43	1.44	0.7	0% - 20%
EB1224816-006	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.08	0.11	34.8	0% - 50%
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 2510553)									
EB1224833-001	Anonymous	EP071: C15 - C28 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	µg/L	<50	<50	0.0	No Limit
		EP071: C29 - C36 Fraction	----	50	µg/L	<50	<50	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 2512802)									
EB1224740-026	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QC Lot: 2510553)									
EB1224833-001	Anonymous	EP071: >C10 - C16 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
		EP071: >C16 - C34 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	µg/L	<100	<100	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QC Lot: 2512802)									
EB1224740-026	Anonymous	EP080: C6 - C10 Fraction	----	20	µg/L	<20	<20	0.0	No Limit

Method Blank (MB) and Laboratory Control Spike (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: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Suspended Solids (QCLot: 2510529)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	104	82	120
ED037P: Alkalinity by PC Titrator (QCLot: 2509653)								
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	----	200 mg/L	97.2	88	112
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2508860)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	84.4	70	130
ED045G: Chloride Discrete analyser (QCLot: 2508859)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	1000 mg/L	92.0	75	117
ED093F: Dissolved Major Cations (QCLot: 2508858)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
ED093F: Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
ED093F: Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
ED093F: Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS (QCLot: 2510824)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.100 mg/L	91.6	78	122
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.100 mg/L	102	79	121
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.100 mg/L	99.0	81	122
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.200 mg/L	97.8	78	122
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.100 mg/L	100	80	125
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.100 mg/L	99.4	75	120
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.200 mg/L	96.2	79	119
EG035F: Dissolved Mercury by FIMS (QCLot: 2510823)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.010 mg/L	103	84	116
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2511200)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	92.4	70	120
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2508861)								
EK057G: Nitrite as N	----	0.01	mg/L	<0.01	0.5 mg/L	102	83	119
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2511199)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	95.6	70	124
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2512838)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10.0 mg/L	74.6	70	115
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2512839)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.2 mg/L	96.7	77	117
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2510553)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	LCS Recovery (%)	Recovery Limits (%): Low	Recovery Limits (%): High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2510553) - continued								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	1275 µg/L	75.6	42	116
EP071: C15 - C28 Fraction	----	100	µg/L	<100	1850 µg/L	88.0	53	135
EP071: C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2512802)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	160 µg/L	102	71	129
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2510553)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	1670 µg/L	79.6	47	125
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	1285 µg/L	85.8	47	133
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2512802)								
EP080: C6 - C10 Fraction	----	20	µg/L	<20	185 µg/L	93.8	70	130

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.

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	MS Recovery (%)	Recovery Limits (%): Low	Recovery Limits (%): High
ED045G: Chloride Discrete analyser (QCLot: 2508859)							
EB1224874-001	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	91.5	70	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 2510824)							
EB1224820-001	Anonymous	EG020A-F: Arsenic	7440-38-2	0.100 mg/L	102	70	130
		EG020A-F: Cadmium	7440-43-9	0.100 mg/L	105	70	130
		EG020A-F: Chromium	7440-47-3	0.100 mg/L	99.6	70	130
		EG020A-F: Copper	7440-50-8	0.200 mg/L	102	70	130
		EG020A-F: Lead	7439-92-1	0.100 mg/L	100	70	130
		EG020A-F: Nickel	7440-02-0	0.100 mg/L	104	70	130
		EG020A-F: Zinc	7440-66-6	0.200 mg/L	104	70	130
EG035F: Dissolved Mercury by FIMS (QCLot: 2510823)							
EB1224826-002	Anonymous	EG035F: Mercury	7439-97-6	0.010 mg/L	96.5	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2511200)							
EB1224787-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	# Not Determined	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2508861)							
EB1224874-001	Anonymous	EK057G: Nitrite as N	----	0.4 mg/L	# Not Determined	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2511199)							
EB1224787-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	2.0 mg/L	89.5	70	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2512838)							
EB1224722-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	93.6	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2512839)							
EB1224722-001	Anonymous	EK067G: Total Phosphorus as P	----	1.0 mg/L	# Not Determined	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2512802)							
EB1224742-141	Anonymous	EP080: C6 - C9 Fraction	----	40 µg/L	104	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2512802)							
EB1224742-141	Anonymous	EP080: C6 - C10 Fraction	----	40 µg/L	101	70	130

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are 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.

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report							
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
ED045G: Chloride Discrete analyser (QCLot: 2508859)										
EB1224874-001	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	91.5	----	70	130	----	----
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2508861)										
EB1224874-001	Anonymous	EK057G: Nitrite as N	----	0.4 mg/L	# Not Determined	----	70	130	----	----
EG035F: Dissolved Mercury by FIMS (QCLot: 2510823)										
EB1224826-002	Anonymous	EG035F: Mercury	7439-97-6	0.010 mg/L	96.5	----	70	130	----	----
EG020F: Dissolved Metals by ICP-MS (QCLot: 2510824)										
EB1224820-001	Anonymous	EG020A-F: Arsenic	7440-38-2	0.100 mg/L	102	----	70	130	----	----
		EG020A-F: Cadmium	7440-43-9	0.100 mg/L	105	----	70	130	----	----
		EG020A-F: Chromium	7440-47-3	0.100 mg/L	99.6	----	70	130	----	----
		EG020A-F: Copper	7440-50-8	0.200 mg/L	102	----	70	130	----	----
		EG020A-F: Lead	7439-92-1	0.100 mg/L	100	----	70	130	----	----
		EG020A-F: Nickel	7440-02-0	0.100 mg/L	104	----	70	130	----	----
		EG020A-F: Zinc	7440-66-6	0.200 mg/L	104	----	70	130	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2511199)										
EB1224787-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	2.0 mg/L	89.5	----	70	130	----	----
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2511200)										
EB1224787-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	# Not Determined	----	70	130	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2512802)										
EB1224742-141	Anonymous	EP080: C6 - C9 Fraction	----	40 µg/L	104	----	70	130	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2512802)										

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2512802) - continued										
EB1224742-141	Anonymous	EP080: C6 - C10 Fraction	----	40 µg/L	101	----	70	130	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2512838)										
EB1224722-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	93.6	----	70	130	----	----
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2512839)										
EB1224722-001	Anonymous	EK067G: Total Phosphorus as P	----	1.0 mg/L	# Not Determined	----	70	130	----	----

CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT:	Waste Solutions Australia Pty Ltd	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☒ Standard TAT (List due date): 22/11/2012
OFFICE:	L1/254 Waterworks Road, ASHGROVE 4060		☐ Non Standard or urgent TAT (List due date):
PROJECT:	W 516-4 Codlea	ALS QUOTE NO.: BN/020/12	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7
ORDER NUMBER:	AA 873889		OF: 1 2 3 4 5 6 7
PROJECT MANAGER:	Patrick Mason	CONTACT PH: 07 3366 5778	
SAMPLER:	Patrick Mason	SAMPLER MOBILE: 0437 739 142	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: pmason@wastesolutions.biz			
Email Invoice to: office@wastesolutions.biz, pmason@wastesolutions.biz			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Patrick Mason	[illegible]		
DATE/TIME: 15/11/12.	DATE/TIME: 15/11/12 10:00	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: Please filter & Acidify samples BORE 4A & BORE 5, could not be field filtered for diss metals

	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	NT-1 Major Cations + Balance	NT-2 Major Anions + Balance	W-2 Dissolved 8 Metals	NT-8 Nutrients	Total Suspended Solids	TPH/TRH	Total Algae Count including Cyanobacteria		Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	BORE 3B	14/11/12	W		3	✓	✓	✓	✓					HT
2	BORE 4A	"	"		2	✓	✓	✓	✓					
3	BORE 4B	"	"		3	✓	✓	✓	✓					
4	BORE 5	"	"		3	✓	✓	✓	✓					
5	DUP	"	"		3	✓	✓	✓	✓					
				TOTAL										

Environmental Division Brisbane
Work Order
EB1229774

Telephone : +61-7-3243 7222

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial 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.

Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **EB1229774**		
Client	: **WASTE SOLUTIONS AUSTRALIA P/L**	Laboratory	: Environmental Division Brisbane
Contact	: MR PATRICK MASON	Contact	: Customer Services
Address	: P O BOX 514 ASHGROVE QLD, AUSTRALIA 4060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: pmason@wastesolutions.biz	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 33665778	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 33667302	Facsimile	: +61 7 3243 7218
Project	: W 516-4 Codlea	Page	: 1 of 2
Order number	: AA 873889		
C-O-C number	: ----	Quote number	: EB2012WASSOL0366 (BN/020/12)
Site	: ----		
Sampler	: Patrick Mason	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 15-NOV-2012	Issue Date	: 15-NOV-2012 22:55
Client Requested Due Date	:	Scheduled Reporting Date	: **22-NOV-2012**

Delivery Details

Mode of Delivery	: Client Drop off	Temperature	: -0.1°C - Ice present
No. of coolers/boxes	: 1 MEDIUM	No. of samples received	: 5
Security Seal	: N/A	No. of samples analysed	: 5

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Sample containers do not comply to pretreatment / preservation standards (AS, APHA, USEPA). Please refer to the Sample Container(s)/Preservation Non-Compliance Log at the end of this report for details.**
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Matt Goodwin.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (60 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

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

Method *Client sample ID*	Sample Container Received	Preferred Sample Container for Analysis
EG020A-F : Dissolved Metals by ICP-MS - Suite A		
BORE 4A	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
BORE 5	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
EG035F : Dissolved Mercury by FIMS		
BORE 4A	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
BORE 5	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered

Summary of Sample(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 the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: **WATER**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	WATER - EN055 - PG Ionic Balance by ED037P, ED041G, ED045G & ED093F)	WATER - NT-01 Major Cations (Ca, Mg, Na, K)	WATER - NT-02 Major Anions (Chloride, Sulphate, Alkalinity)	WATER - NT-08 Total Nitrogen + NO2 + NO3 + NH3 + Total P	WATER - W-02 8 Metals
EB1229774-001	14-NOV-2012 15:00	BORE 3B	✓	✓	✓	✓	✓
EB1229774-002	14-NOV-2012 15:00	BORE 4A	✓	✓	✓	✓	✓
EB1229774-003	14-NOV-2012 15:00	BORE 4B	✓	✓	✓	✓	✓
EB1229774-004	14-NOV-2012 15:00	BORE 5	✓	✓	✓	✓	✓
EB1229774-005	14-NOV-2012 15:00	DUP	✓	✓	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV)	Email	office@wastesolutions.biz

MR PATRICK MASON

- *AU Certificate of Analysis - NATA (COA)	Email	pmason@wastesolutions.biz
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	pmason@wastesolutions.biz
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	pmason@wastesolutions.biz
- A4 - AU Sample Receipt Notification - Environmental HT (SRN	Email	pmason@wastesolutions.biz
- Chain of Custody (CoC) (COC)	Email	pmason@wastesolutions.biz
- EDI Format - ENMRG (ENMRG)	Email	pmason@wastesolutions.biz
- EDI Format - XTab (XTAB)	Email	pmason@wastesolutions.biz

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1229774**	Page	: 1 of 4
Client	: **WASTE SOLUTIONS AUSTRALIA P/L**	Laboratory	: Environmental Division Brisbane
Contact	: MR PATRICK MASON	Contact	: Customer Services
Address	: P O BOX 514 ASHGROVE QLD, AUSTRALIA 4060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: pmason@wastesolutions.biz	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 33665778	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 33667302	Facsimile	: +61 7 3243 7218
Project	: W 516-4 Codlea	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: AA 873889		
C-O-C number	: ----	Date Samples Received	: 15-NOV-2012
Sampler	: Patrick Mason	Issue Date	: 22-NOV-2012
Site	: ----		
		No. of samples received	: 5
Quote number	: BN/020/12	No. of samples analysed	: 5

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Jonathon Angell	Inorganic Coordinator	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

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.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **Ionic balances are within acceptable limits as detailed in the 21st Ed. APHA "Standard Methods for the Examination of Water and Wastewater".**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: BORE 3B	BORE 4A	BORE 4B	BORE 5	DUP
				Client sampling date / time: 14-NOV-2012 15:00	14-NOV-2012 15:00	14-NOV-2012 15:00	14-NOV-2012 15:00	14-NOV-2012 15:00
				EB1229774-001	EB1229774-002	EB1229774-003	EB1229774-004	EB1229774-005
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	**21**	<1	**15**	**3**	**25**
Total Alkalinity as CaCO3	----	1	mg/L	**21**	<1	**15**	**3**	**25**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	**5**	<1	**35**	<1
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	**22**	**29**	**69**	**30**	**24**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**2**	**1**	**3**	**7**	**2**
Magnesium	7439-95-4	1	mg/L	**3**	**3**	**4**	**2**	**3**
Sodium	7440-23-5	1	mg/L	**16**	**19**	**38**	**22**	**16**
Potassium	7440-09-7	1	mg/L	<1	<1	**2**	**2**	<1
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	**0.004**	<0.001	**0.008**	**0.095**	**0.004**
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	**0.002**	<0.001	<0.001	<0.001	**0.002**
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	<0.001	**0.001**	<0.001	**0.004**	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	**0.005**	**0.008**	**0.006**	**0.045**	**0.005**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.56**	**0.10**	**0.39**	**0.24**	**0.54**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	**0.02**	**3.80**	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	**0.02**	**3.80**	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**1.2**	**4.3**	**0.5**	**2.6**	**1.2**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	BORE 3B	BORE 4A	BORE 4B	BORE 5	DUP
				Client sampling date / time	14-NOV-2012 15:00	14-NOV-2012 15:00	14-NOV-2012 15:00	14-NOV-2012 15:00	14-NOV-2012 15:00
					EB1229774-001	EB1229774-002	EB1229774-003	EB1229774-004	EB1229774-005
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**1.2**	**4.3**	**0.5**	**6.4**	**1.2**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.07**	**0.23**	**0.06**	**0.44**	**0.06**
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**1.04**	**0.92**	**2.25**	**1.63**	**1.18**
Total Cations	----	0.01	meq/L		**1.04**	**1.12**	**2.18**	**1.52**	**1.04**

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1229774**	Page	: 1 of 8
Client	: WASTE SOLUTIONS AUSTRALIA P/L	Laboratory	: Environmental Division Brisbane
Contact	: MR PATRICK MASON	Contact	: Customer Services
Address	: P O BOX 514 ASHGROVE QLD, AUSTRALIA 4060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: pmason@wastesolutions.biz	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 33665778	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 33667302	Facsimile	: +61 7 3243 7218
Project	: W 516-4 Codlea	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 15-NOV-2012
Sampler	: Patrick Mason	Issue Date	: 22-NOV-2012
Order number	: AA 873889		
		No. of samples received	: 5
Quote number	: BN/020/12	No. of samples analysed	: 5

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non -volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
BORE 3B, BORE 4A, BORE 4B, BORE 5, DUP	**14-NOV-2012**	---	28-NOV-2012	----	**19-NOV-2012**	28-NOV-2012	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
BORE 3B, BORE 4A, BORE 4B, BORE 5, DUP	**14-NOV-2012**	---	12-DEC-2012	----	**16-NOV-2012**	12-DEC-2012	✓
ED045G: Chloride Discrete analyser							
Clear Plastic Bottle - Natural (ED045G)							
BORE 3B, BORE 4A, BORE 4B, BORE 5, DUP	**14-NOV-2012**	---	12-DEC-2012	----	**16-NOV-2012**	12-DEC-2012	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Natural (ED093F)							
BORE 3B, BORE 4A, BORE 4B, BORE 5, DUP	**14-NOV-2012**	---	21-NOV-2012	----	**16-NOV-2012**	21-NOV-2012	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Natural (EG020A-F)							
BORE 4A, BORE 5	**14-NOV-2012**	---	13-MAY-2013	----	**19-NOV-2012**	13-MAY-2013	✓
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)							
BORE 3B, BORE 4B, DUP	**14-NOV-2012**	---	13-MAY-2013	----	**19-NOV-2012**	13-MAY-2013	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Natural (EG035F)							
BORE 4A, BORE 5	**14-NOV-2012**	---	12-DEC-2012	----	**20-NOV-2012**	12-DEC-2012	✓
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)							
BORE 3B, BORE 4B, DUP	**14-NOV-2012**	---	12-DEC-2012	----	**20-NOV-2012**	12-DEC-2012	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
BORE 3B, BORE 4A, BORE 4B, BORE 5, DUP	**14-NOV-2012**	**---**	12-DEC-2012	----	**20-NOV-2012**	12-DEC-2012	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
BORE 3B, BORE 4A, BORE 4B, BORE 5, DUP	**14-NOV-2012**	**---**	16-NOV-2012	----	**16-NOV-2012**	16-NOV-2012	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
BORE 3B, BORE 4A, BORE 4B, BORE 5, DUP	**14-NOV-2012**	**---**	12-DEC-2012	----	**20-NOV-2012**	12-DEC-2012	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
BORE 3B, BORE 4A, BORE 4B, BORE 5, DUP	**14-NOV-2012**	**21-NOV-2012**	12-DEC-2012	✓	**21-NOV-2012**	12-DEC-2012	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
BORE 3B, BORE 4A, BORE 4B, BORE 5, DUP	**14-NOV-2012**	**21-NOV-2012**	12-DEC-2012	✓	**21-NOV-2012**	12-DEC-2012	✓

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(where) 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: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	1	7	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	5	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	19	**10.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	1	7	**14.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	5	**20.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	19	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	7	**14.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	5	**20.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	19	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	7	**14.3**	**5.0**	✓	ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS) - Continued							
Nitrite as N by Discrete Analyser	EK057G	1	5	**20.0**	**5.0**	✓	ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement

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
Alkalinity by PC Titrator	ED037-P	WATER	APHA 21st ed., 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	APHA 21st ed., 4500-SO4 Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Chloride by Discrete Analyser	ED045G	WATER	APHA 21st ed., 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	Major Cations is determined based on APHA 21st ed., 3120; USEPA SW 846 - 6010 The ICPAES technique ionises the 0.45um filtered sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) Sodium Absorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) Hardness parameters are calculated based on APHA 21st ed., 2340 B. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	AS 3550, APHA 21st ed. 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45 um filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Ammonia as N by Discrete analyser	EK055G	WATER	APHA 21st ed., 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrite as N by Discrete Analyser	EK057G	WATER	APHA 21st ed., 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrate as N by Discrete Analyser	EK058G	WATER	APHA 21st ed., 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	APHA 21st ed., 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Analytical Methods	Method	Matrix	Method Descriptions
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	APHA 21st ed., 4500-Norg D. 25mL water samples are digested using a traditional Kjeldahl digestion followed by determination by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	APHA 21st ed., 4500-Norg / 4500-NO3-. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	APHA 21st ed., 4500-P B&F This procedure involves sulphuric acid digestion of a 100mL sample to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	APHA 21st Ed. 1030F. The Ionic Balance is calculated based on the major Anions and Cations. The major anions include Alkalinity, Chloride and Sulfate which determined by PCT and DA. The Cations are determined by Turbi SO4 by DA. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- **No Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

Environmental Division

QUALITY CONTROL REPORT

Work Order	: **EB1229774**	Page	: 1 of 7
Client	: **WASTE SOLUTIONS AUSTRALIA P/L**	Laboratory	: Environmental Division Brisbane
Contact	: MR PATRICK MASON	Contact	: Customer Services
Address	: P O BOX 514 ASHGROVE QLD, AUSTRALIA 4060	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: pmason@wastesolutions.biz	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 33665778	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 33667302	Facsimile	: +61 7 3243 7218
Project	: W 516-4 Codlea	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 15-NOV-2012
Sampler	: Patrick Mason	Issue Date	: 22-NOV-2012
Order number	: AA 873889	No. of samples received	: 5
Quote number	: BN/020/12	No. of samples analysed	: 5

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

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

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Jonathon Angell	Inorganic Coordinator	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

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.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

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 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%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
ED037P: Alkalinity by PC Titrator (QC Lot: 2601890)									
EB1229774-001	BORE 3B	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	21	21	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	21	21	0.0	0% - 20%
EB1229802-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	4	8	60.9	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	149	144	3.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	153	153	0.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2600395)									
EB1229531-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	1300	1390	6.9	0% - 20%
EB1229774-001	BORE 3B	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.0	No Limit
ED045G: Chloride Discrete analyser (QC Lot: 2600394)									
EB1229531-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	1	2	0.0	No Limit
EB1229774-001	BORE 3B	ED045G: Chloride	16887-00-6	1	mg/L	22	20	6.3	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2600393)									
EB1229531-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	12	12	0.0	0% - 50%
		ED093F: Magnesium	7439-95-4	1	mg/L	19	19	0.0	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	2	2	0.0	No Limit
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EB1229774-001	BORE 3B	ED093F: Calcium	7440-70-2	1	mg/L	2	2	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	3	3	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	16	16	0.0	0% - 50%
		ED093F: Potassium	7440-09-7	1	mg/L	<1	<1	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2602383)									
EB1229696-002	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
EB1229774-003	BORE 4B	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.008	0.008	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2602383) - continued									
EB1229774-003	BORE 4B	EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.006	0.006	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 2602382)									
EB1229696-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EB1229774-004	BORE 5	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2605442)									
EB1229719-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.01	0.01	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2600397)									
EB1229774-001	BORE 3B	EK057G: Nitrite as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2605441)									
EB1229719-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.10	0.10	0.0	0% - 50%
EB1229792-004	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.15	0.16	0.0	0% - 50%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2606533)									
EB1229038-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	10.2	10.3	0.0	0% - 20%
EB1229772-003	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	4.2	4.2	0.0	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2606534)									
EB1229038-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.60	0.54	10.5	0% - 20%
EB1229772-003	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	9.15	8.70	5.0	0% - 20%

Method Blank (MB) and Laboratory Control Spike (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: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
ED037P: Alkalinity by PC Titrator (QCLot: 2601890)								
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	----	200 mg/L	98.2	88	112
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2600395)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	95.4	70	130
ED045G: Chloride Discrete analyser (QCLot: 2600394)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	1000 mg/L	98.1	75	117
ED093F: Dissolved Major Cations (QCLot: 2600393)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
ED093F: Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
ED093F: Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
ED093F: Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS (QCLot: 2602383)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.100 mg/L	93.6	78	122
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.100 mg/L	102	87	109
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.100 mg/L	108	87	115
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.200 mg/L	96.4	85	117
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.100 mg/L	106	88	110
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.100 mg/L	96.7	86	116
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.200 mg/L	98.2	84	118
EG035F: Dissolved Mercury by FIMS (QCLot: 2602382)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.010 mg/L	102	79	119
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2605442)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	97.8	70	120
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2600397)								
EK057G: Nitrite as N	----	0.01	mg/L	<0.01	0.5 mg/L	94.9	83	119
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2605441)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	77.0	70	124
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2606533)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10.0 mg/L	92.5	70	115
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2606534)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.2 mg/L	104	77	117

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.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED045G: Chloride Discrete analyser (QCLot: 2600394)							
EB1229774-002	BORE 4A	ED045G: Chloride	16887-00-6	400 mg/L	106	70	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 2602383)							
EB1229696-004	Anonymous	EG020A-F: Arsenic	7440-38-2	0.100 mg/L	96.3	70	130
		EG020A-F: Cadmium	7440-43-9	0.100 mg/L	95.7	70	130
		EG020A-F: Chromium	7440-47-3	0.100 mg/L	98.0	70	130
		EG020A-F: Copper	7440-50-8	0.200 mg/L	92.7	70	130
		EG020A-F: Lead	7439-92-1	0.100 mg/L	96.6	70	130
		EG020A-F: Nickel	7440-02-0	0.100 mg/L	94.0	70	130
		EG020A-F: Zinc	7440-66-6	0.200 mg/L	101	70	130
EG035F: Dissolved Mercury by FIMS (QCLot: 2602382)							
EB1229696-003	Anonymous	EG035F: Mercury	7439-97-6	0.010 mg/L	94.0	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2605442)							
EB1229719-002	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	107	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2600397)							
EB1229774-002	BORE 4A	EK057G: Nitrite as N	----	0.4 mg/L	101	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2605441)							
EB1229719-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.4 mg/L	93.3	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2606533)							
EB1229732-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	87.7	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2606534)							
EB1229732-001	Anonymous	EK067G: Total Phosphorus as P	----	1.0 mg/L	101	70	130

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are 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.

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report							
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
ED045G: Chloride Discrete analyser (QCLot: 2600394)										
EB1229774-002	BORE 4A	ED045G: Chloride	16887-00-6	400 mg/L	106	----	70	130	----	----
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2600397)										
EB1229774-002	BORE 4A	EK057G: Nitrite as N	----	0.4 mg/L	101	----	70	130	----	----
EG035F: Dissolved Mercury by FIMS (QCLot: 2602382)										

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EG035F: Dissolved Mercury by FIMS (QCLot: 2602382) - continued										
EB1229696-003	Anonymous	EG035F: Mercury	7439-97-6	0.010 mg/L	94.0	----	70	130	----	----
EG020F: Dissolved Metals by ICP-MS (QCLot: 2602383)										
EB1229696-004	Anonymous	EG020A-F: Arsenic	7440-38-2	0.100 mg/L	96.3	----	70	130	----	----
		EG020A-F: Cadmium	7440-43-9	0.100 mg/L	95.7	----	70	130	----	----
		EG020A-F: Chromium	7440-47-3	0.100 mg/L	98.0	----	70	130	----	----
		EG020A-F: Copper	7440-50-8	0.200 mg/L	92.7	----	70	130	----	----
		EG020A-F: Lead	7439-92-1	0.100 mg/L	96.6	----	70	130	----	----
		EG020A-F: Nickel	7440-02-0	0.100 mg/L	94.0	----	70	130	----	----
		EG020A-F: Zinc	7440-66-6	0.200 mg/L	101	----	70	130	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2605441)										
EB1229719-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.4 mg/L	93.3	----	70	130	----	----
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2605442)										
EB1229719-002	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	107	----	70	130	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2606533)										
EB1229732-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	87.7	----	70	130	----	----
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2606534)										
EB1229732-001	Anonymous	EK067G: Total Phosphorus as P	----	1.0 mg/L	101	----	70	130	----	----

APPENDIX C

BORE LOGS

NSW GOVERNMENT Office of Water

Form A Particulars of completed work

BORE 3B

1

Driller's Licence No:	1777
Class of Licence:	1
Driller's Name:	JAMES DICK
Assistant Driller:	MATTHEW McCANN
Contractor:	BORDER TECH/GEOTECH/NV

New bore	X	Replacement bore	
Deepened		Enlarged	
Reconditioned		Other (specify)	

Final Depth: 10.2 m

2

Work Licence No:	30BL185992
Name of Licensee:	PERPETUITY
Intended Use:	GROUNDWATER INVESTIGATION
Completion Date:	14.11.12

3 DRILLING DETAILS

From (m)	To (m)	Hole Diameter (mm)	Drilling Method (See Code 3)
0	1.0	110	2
1.0	12.0	100	7

4 WATER BEARING ZONES

From (m)	To (m)	Thickness (m)	S W L (m)	Estimated Yield (L/s) Individual Aquifer	Estimated Yield (L/s) Cumulative	Test method (See Code 4)		D D L at end of test (m)	Duration Hrs	Duration min	Salinity (Conductivity or TDS) Cond (µS/cm)	Salinity (Conductivity or TDS) TDS (mg/L)
3.0	12	9	3.0									

5 CASING / LINER DETAILS

Material (Code 5)	OD (mm)	Wall Thickness (mm)	From (m)	To (m)	Method Fixing (Code 5)
8	50	3MM	0	10.3	5

Casing support method (See Code 5):

Type of casing bottom (See Code 5):

Centralisers installed {Yes/No}: N (indicate on sketch)

Sump installed {Yes/No}: N From m To m

Pressure cemented {Yes/No}: N From m To m

Casing Protector cemented in place

6 WATER ENTRY DESIGN

General Material (Code 5)	General OD (mm)	General Wall Thickness (mm)	General From (m)	General To (m)	General Opening type (See Code 6)	General Fixing (See Code 5)	Screen Aperture (mm)	Slot Details Length (mm)	Slot Details Width (mm)	Slot Details Alignment (See Code 6)
8	50	3	10.3	11.8	5	5	0.4	50	5	H

7 GRAVEL PACK

Type		Grade		Grain size (mm) From	Grain size (mm) To	Depth (m) From	Depth (m) To	Quantity Litres	Quantity m^3
Rounded		Graded		3	5	10	12		0.01
Crushed	X	Ungraded							
Bentonite/Grout seal (Yes/No)	Y					8	10	10	0.0075
Method of placement of Gravel Pack (See Code 7)									

For Departmental use only: GW

NSW GOVERNMENT Office of Water

Form A Particulars of completed work

BORE 3B **Work Licence No:** 30BL185992

BORE DEVELOPMENT 8

Chemical used for breaking down drilling mud (Yes/No) NO Name:

Method	Bailing/Surging	Jetting	Airlifting	Backwashing	Pumping	Other:
Duration	hrs	hrs	hrs	hrs	hrs	hrs

DISINFECTION ON COMPLETION 9

Chemical(s) used	Quantity applied (Litres)	Method of application

PUMPING TESTS ON COMPLETION 10

Test type		Date	Pump intake depth (m)	Initial Water Level (SWL) (m)	Pumping rate (L/s)	Water Level at end of pumping (DDL) (m)	Duration of Test (hrs)	Recovery: Water level (m)	Recovery: Time taken (hrs)	Recovery: Time taken (mins)
Multi stage (stepped drawdown)	Stage 1									
	Stage 2									
	Stage 3									
	Stage 4									
Single stage (constant rate)										

Height of measuring point above ground level m Test Method See Code 4

WORK PARTLY BACKFILLED OR ABANDONED 11

Original depth of work: m Is work partly backfilled: (Yes/No)

Is work abandoned: (Yes/No) Method of abandonment: Backfilled Plugged Capped

Has any casing been left in the work (Yes/No) From m To m

Sealing / fill type See Code 11	From depth (m)	To depth (m)	Sealing / fill type See Code 11	From depth (m)	To depth (m)

Site chosen by: Hydrogeologist Geologist Driller Diviner Client Other 12

Lot No 1 DP No 871039 13

Work Location Co ordinates Easting Northing Zone

GPS: (Yes/No) YES >> AMG/AGD or MGA/GDA (See explanation)

S 28° 33' 31.0" BORE
E 153° 33' 01.1" 3B

Please mark the work site with "X" on the CLID provided map.

Indicate also the distances in metres from two (2) adjacent boundaries, and attach the map to this Form A package.

Signatures:

Driller: ---------- **Licensee:** ----------

Date: 30/11/12 **Date:** ----------

NSW GOVERNMENT Office of Water

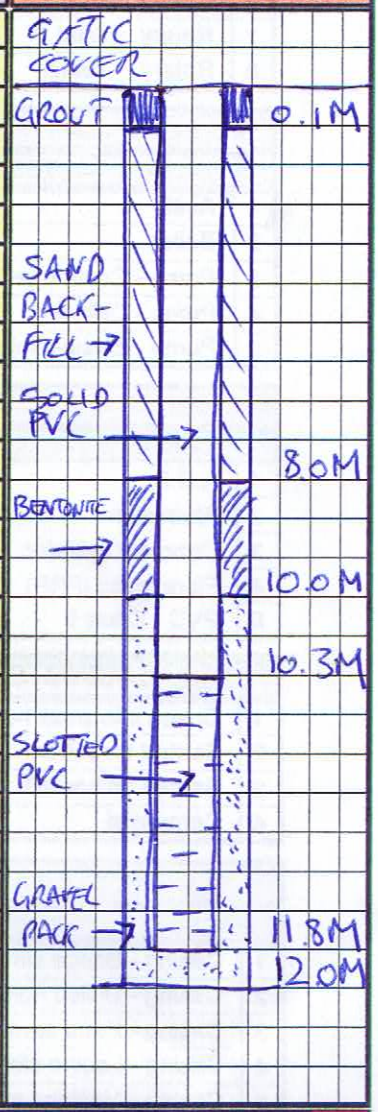
Form A Particulars of completed work

BORE 3B **Work Licence No:** 30BL185992

DRILLER'S ROCK/STRATA DESCRIPTION (LITHOLOGY) — 15

Depth From (m)	Depth To (m)	Description (See Code 15)
0	0.2	(SP) CLAYEY SAND; TRACE OF ORGANICS, TRACE OF SILT FINE TO MEDIUM SAND, MOIST, BROWN
0.2	5.5	(SP) SAND, FINE TO MEDIUM SAND, MOIST, BROWN,
5.5	10.2	(SP) SAND, FINE TO MEDIUM SAND, VERY MOIST, DARK BROWN, SANDY GRAVEL
10.2	12.3	(GP) ~~GRAVELLY SAND~~, FINE TO MEDIUM GRAVEL, FINE TO COARSE SAND, VERY MOIST, PALE BROWN WITH BLUE/GREY GRAVELS

WORK CONSTRUCTION SKETCH — 15



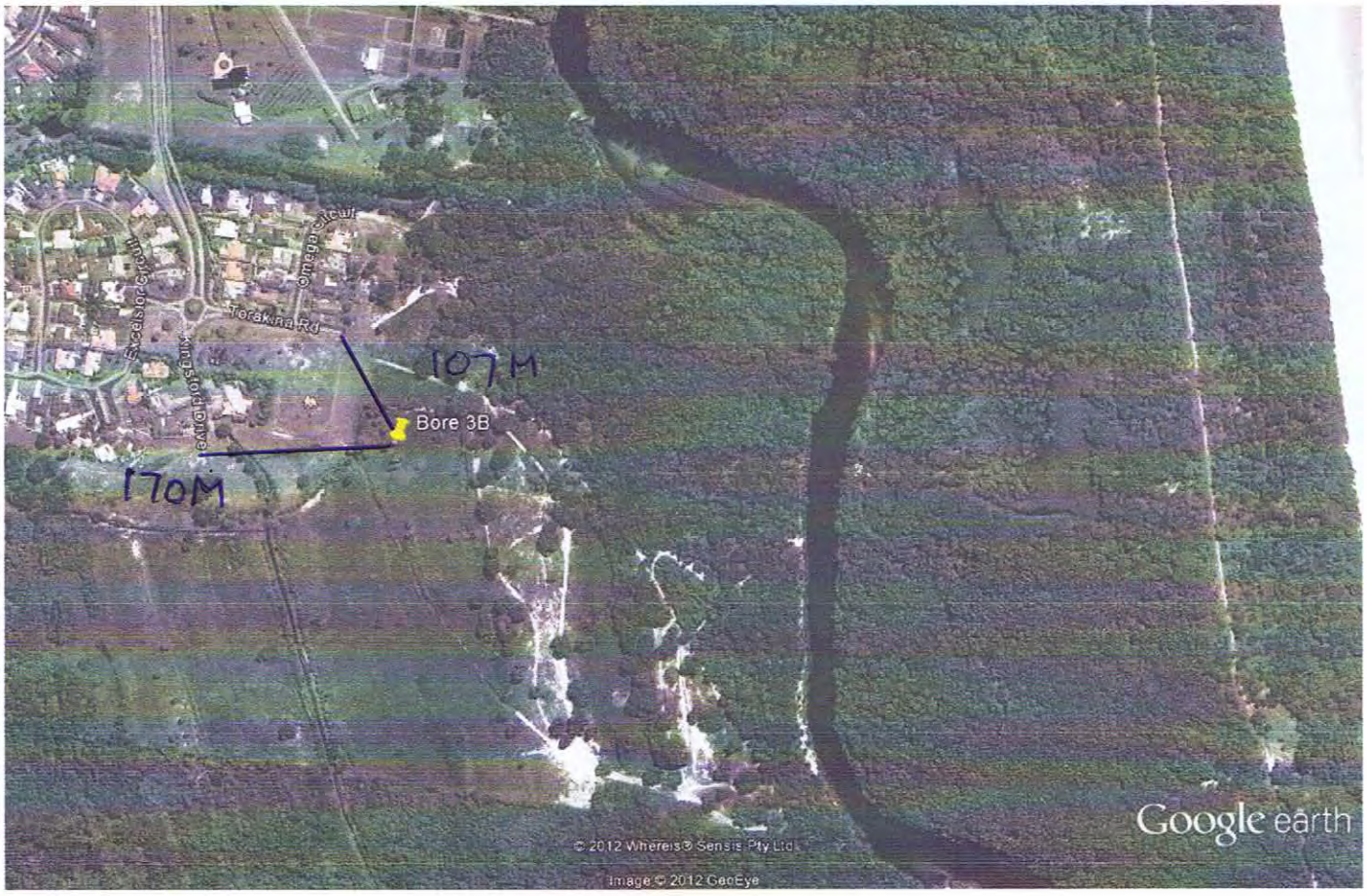
WORK NOT CONSTRUCTED BY DRILLING RIG — 16

Method of excavation: Hand dug ☐ Back hoe ☐ Dragline ☐ Dozer ☐ Other

Depth (m)	Length (m)	Width (m)	Diameter (m)	Lining material	Dimentions of liner (m)	From Depth (m)	To Depth (m)

Please attach copies of the following if available — 17

Geologist log	(Yes/No) N	Laboratory analysis of water Sample	(Yes/No) N	Pumping test(s)	(Yes/No) N
Geophysical log	(Yes/No) ✓	Sieve analysis of aquifer material	(Yes/No) N	Installed Pump details	(Yes/No) ✓



Google earth

feet 1000
meters 600

NSW GOVERNMENT Office of Water

Form A Particulars of completed work

BORE 4A

Driller's Licence No:	1777	1
Class of Licence:	1	
Driller's Name:	JAMES DICK	
Assistant Driller:	MATTHEW McCANN	
Contractor:	BORDER TECH/GEOTECH JV	
New bore	X	
Deepened		
Reconditioned		
Replacement bore		
Enlarged		
Other (specify)		
Final Depth	3.0 m	

Work Licence No:	30BL185992	2
Name of Licensee:	PERPETUITY	
Intended Use:	GROUNDWATER INVESTIGATIONS	
Completion Date:	14.11.12	

DRILLING DETAILS 3

From (m)	To (m)	Hole Diameter (mm)	Drilling Method See Code 3
0	1.0M	110	2
1.0	3.0	100	7

WATER BEARING ZONES 4

From (m)	To (m)	Thickness (m)	S W L (m)	Estimated Yield (L/s) Individual Aquifer	Estimated Yield (L/s) Cumulative	Test method See Code 4		D D L at end of test (m)	Duration Hrs	Duration min	Salinity (Conductivity or TDS) Cond (µS/cm)	Salinity (Conductivity or TDS) TDS (mg/L)
0.7	3	2.3	0.7									

CASING / LINER DETAILS 5

Material Code 5	OD (mm)	Wall Thickness (mm)	From (m)	To (m)	Method Fixing Code 5
8	50	3MM	0	1.4	5

Casing support method — See Code 5

Type of casing bottom — See Code 5

Centralisers installed {Yes/No}: N (indicate on sketch)

Sump installed {Yes/No}: N From m To m

Pressure cemented {Yes/No}: N From m To m

Casing Protector cemented in place

WATER ENTRY DESIGN 6

General Material Code 5	OD (mm)	Wall Thickness (mm)	From (m)	To (m)	Opening type See Code 6	Fixing See Code 5	Screen Aperture (mm)	Slot Details Length (mm)	Width (mm)	Alignment See Code 6
8	50	3	1.4	2.9	5	5	0.4	50	5	H

GRAVEL PACK 7

Type	Grade	Grain size (mm) From	Grain size (mm) To	Depth (m) From	Depth (m) To	Quantity Litres	Quantity m^3
Rounded	Graded	3	5	0.8	3.0		0.01
Crushed X	Ungraded						
Bentonite/Grout seal (Yes/No) Y				0.4	0.8		0.0025

Method of placement of Gravel Pack — See Code 7

For Departmental use only: G W

NSW GOVERNMENT Office of Water

Form A Particulars of completed work

BORE 4A **Work Licence No:** 30BL185992

BORE DEVELOPMENT 8

Chemical used for breaking down drilling mud (Yes/No) NO Name:

Method	Bailing/Surging	Jetting	Airlifting	Backwashing	Pumping	Other:
Duration	hrs	hrs	hrs	hrs	hrs	hrs

DISINFECTION ON COMPLETION 9

Chemical(s) used	Quantity applied (Litres)	Method of application

PUMPING TESTS ON COMPLETION 10

Test type		Date	Pump intake depth (m)	Initial Water Level (SWL) (m)	Pumping rate (L/s)	Water Level at end of pumping (DDL) (m)	Duration of Test (hrs)	Recovery: Water level (m)	Recovery: Time taken (hrs)	Recovery: Time taken (mins)
Multi stage (stepped drawdown)	Stage 1									
	Stage 2									
	Stage 3									
	Stage 4									
Single stage (constant rate)										

Height of measuring point above ground level m Test Method See Code 4

WORK PARTLY BACKFILLED OR ABANDONED 11

Original depth of work: m Is work partly backfilled: (Yes/No)

Is work abandoned: (Yes/No) Method of abandonment: Backfilled Plugged Capped

Has any casing been left in the work (Yes/No) From m To m

Sealing / fill type See Code 11	From depth (m)	To depth (m)	Sealing / fill type See Code 11	From depth (m)	To depth (m)

Site chosen by: Hydrogeologist Geologist Driller Diviner Client Other 12

Lot No 1 DP No 871039 13

Work Location Co ordinates Easting Northing Zone

GPS: (Yes/No) YES >> AMG/AGD or MGA/GDA (See explanation)

S 28° 33' 39.3" BORE
E 153° 33' 00.5" 4A

Please mark the work site with "X" on the CLID provided map.

Indicate also the distances in metres from two (2) adjacent boundaries, and attach the map to this Form A package.

Signatures:

Driller: [redacted] **Licensee:** ----------

Date: 30/11/12 **Date:** ----------

NSW GOVERNMENT Office of Water

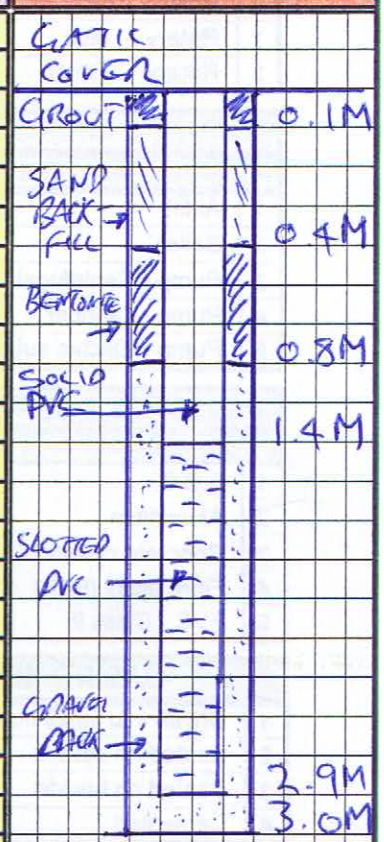
Form A Particulars of completed work

BORE 4A **Work Licence No:** 30BL185992

DRILLER'S ROCK/STRATA DESCRIPTION (LITHOLOGY) — 15

Depth From (m)	Depth To (m)	Description (See Code 15)
0	0.2	(SP) CLAYEY SAND, TRACE OF ORGANICS, TRACE OF SILT, FINE TO MEDIUM SAND, MOIST, BROWN
0.2	1.4	(SP) SAND, FINE TO MEDIUM SAND, VERY MOIST, PALE BROWN,
1.4	3.0	(SP) SAND, FINE TO MEDIUM SAND, VERY MOIST, BROWN

WORK CONSTRUCTION SKETCH



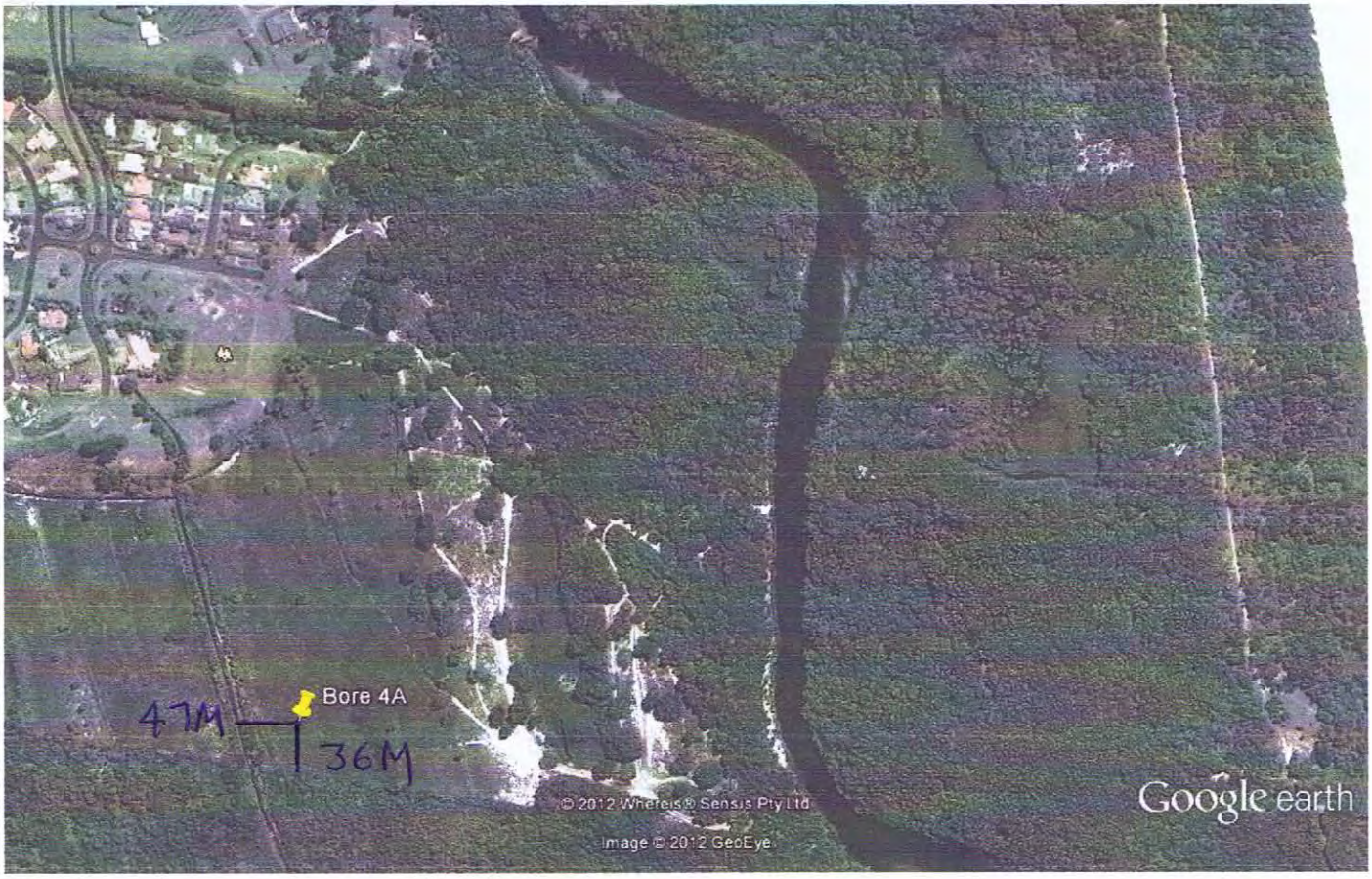
WORK NOT CONSTRUCTED BY DRILLING RIG — 16

Method of excavation: Hand dug ☐ Back hoe ☐ Dragline ☐ Dozer ☐ Other

Depth (m)	Length (m)	Width (m)	Diameter (m)	Lining material	Dimentions of liner (m)	From Depth (m)	To Depth (m)

Please attach copies of the following if available — 17

Geologist log	(Yes/No) ✓	Laboratory analysis of water Sample	(Yes/No) ✓	Pumping test(s)	(Yes/No) ✓
Geophysical log	(Yes/No) ✓	Sieve analysis of aquifer material	(Yes/No) ✓	Installed Pump details	(Yes/No) ✓



Google earth

feet 1000
meters 500

NSW GOVERNMENT Office of Water

Form A Particulars of completed work

BORE 4B

1

Driller's Licence No:	1777
Class of Licence:	1
Driller's Name:	JAMES DICK
Assistant Driller:	MATTHEW MCANN
Contractor:	BORDER TECH/GEOTECH INV.

New bore	X	Replacement bore	
Deepened		Enlarged	
Reconditioned		Other (specify)	

Final Depth: 10.2 m

2

Work Licence No:	30BL185992
Name of Licensee:	PERPETUITY
Intended Use:	GROUNDWATER INVESTIGATIONS
Completion Date:	14.11.12

3 DRILLING DETAILS

From (m)	To (m)	Hole Diameter (mm)	Drilling Method (See Code 3)
0	1.0	110	2
1.0	10.2	100	7

4 WATER BEARING ZONES

From (m)	To (m)	Thickness (m)	S W L (m)	Estimated Yield (L/s) Individual Aquifer	Estimated Yield (L/s) Cumulative	Test method (See Code 4)		D D L at end of test (m)	Duration Hrs	Duration min	Salinity (Conductivity or TDS) Cond (µS/cm)	Salinity (Conductivity or TDS) TDS (mg/L)
0.9	10.2	9.3	0.9									

5 CASING / LINER DETAILS

Material (Code 5)	OD (mm)	Wall Thickness (mm)	From (m)	To (m)	Method Fixing (Code 5)
8	50	3	0	8.5	5

Casing support method (See Code 5):

Type of casing bottom (See Code 5):

Centralisers installed {Yes/No}: N (indicate on sketch)

Sump installed {Yes/No}: N From m To m

Pressure cemented {Yes/No}: N From m To m

Casing Protector cemented in place

6 WATER ENTRY DESIGN

General Material (Code 5)	General OD (mm)	General Wall Thickness (mm)	General From (m)	General To (m)	General Opening type (See Code 6)	General Fixing (See Code 5)	Screen Aperture (mm)	Slot Details Length (mm)	Slot Details Width (mm)	Slot Details Alignment (See Code 6)
8	50	3	8.5	10	8	5	0.4	50	5	H

7 GRAVEL PACK

Type		Grade		Grain size (mm) From	Grain size (mm) To	Depth (m) From	Depth (m) To	Quantity Litres	Quantity m^3
Rounded		Graded		3	5	8.0	10.2		0.01
Crushed	X	Ungraded							
Bentonite/Grout seal (Yes/No)	Y					6.0	8.0		0.0075
Method of placement of Gravel Pack (See Code 7)									

For Departmental use only: GW

NSW GOVERNMENT Office of Water

Form A Particulars of completed work

BORE 4B **Work Licence No:** 30BL185992

BORE DEVELOPMENT 8

Chemical used for breaking down drilling mud (Yes/No) NO Name:

Method	Bailing/Surging	Jetting	Airlifting	Backwashing	Pumping	Other:
Duration	hrs	hrs	hrs	hrs	hrs	hrs

DISINFECTION ON COMPLETION 9

Chemical(s) used	Quantity applied (Litres)	Method of application

PUMPING TESTS ON COMPLETION 10

Test type		Date	Pump intake depth (m)	Initial Water Level (SWL) (m)	Pumping rate (L/s)	Water Level at end of pumping (DDL) (m)	Duration of Test (hrs)	Recovery: Water level (m)	Recovery: Time taken (hrs)	Recovery: Time taken (mins)
Multi stage (stepped drawdown)	Stage 1									
	Stage 2									
	Stage 3									
	Stage 4									
Single stage (constant rate)										

Height of measuring point above ground level m Test Method See Code 4

WORK PARTLY BACKFILLED OR ABANDONED 11

Original depth of work: m Is work partly backfilled: (Yes/No)

Is work abandoned: (Yes/No) Method of abandonment: Backfilled Plugged Capped

Has any casing been left in the work (Yes/No) From m To m

Sealing / fill type See Code 11	From depth (m)	To depth (m)	Sealing / fill type See Code 11	From depth (m)	To depth (m)

Site chosen by: Hydrogeologist Geologist Driller Diviner Client Other 12

Lot No 1 DP No 871039 13

Work Location Co ordinates Easting Northing Zone

GPS: (Yes/No) YES >> AMG/AGD or MGA/GDA (See explanation)

S 28° 33' 39.6" BORE
E 153° 33' 00.4" 4B

Please mark the work site with "X" on the CLID provided map.
Indicate also the distances in metres from two (2) adjacent boundaries, and attach the map to this Form A package.

Signatures:

Driller: ..... **Licensee:** .....

Date: 30/11/12 **Date:** .....

NSW GOVERNMENT Office of Water

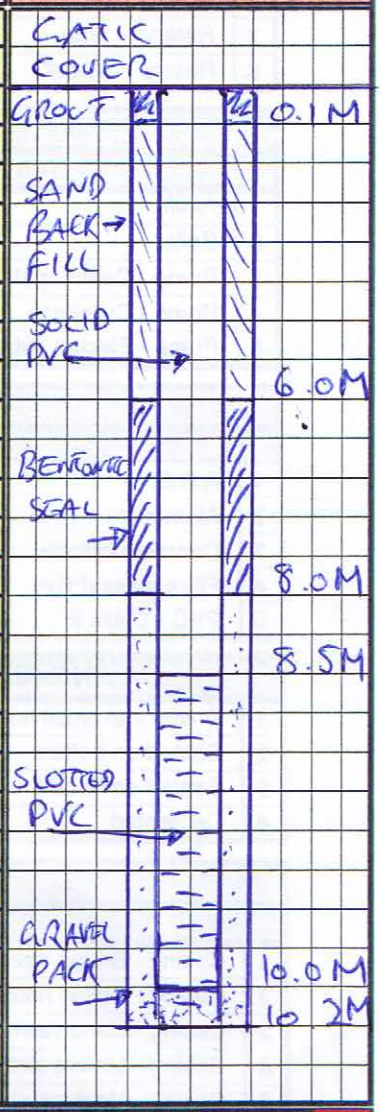
Form A Particulars of completed work

BORE 4B **Work Licence No:** 30BL185992

DRILLER'S ROCK/STRATA DESCRIPTION (LITHOLOGY) — 15

Depth From (m)	Depth To (m)	Description (See Code 15)
0	0.2	(SP) CLAYEY SAND, TRACE OF SILT, FINE TO MEDIUM SAND, MOIST, BROWN
0.2	4.9	(SP) SAND, FINE TO MEDIUM SAND, VERY MOIST, PALE BROWN
4.9	8.0	(SP) SAND, FINE TO MEDIUM SAND, VERY MOIST, DARK BROWN
8.0	10.2	(GP) SANDY GRAVEL, FINE TO MEDIUM GRAVEL, FINE TO COARSE SAND, VERY MOIST, GREY & PALE BLUE

WORK CONSTRUCTION SKETCH



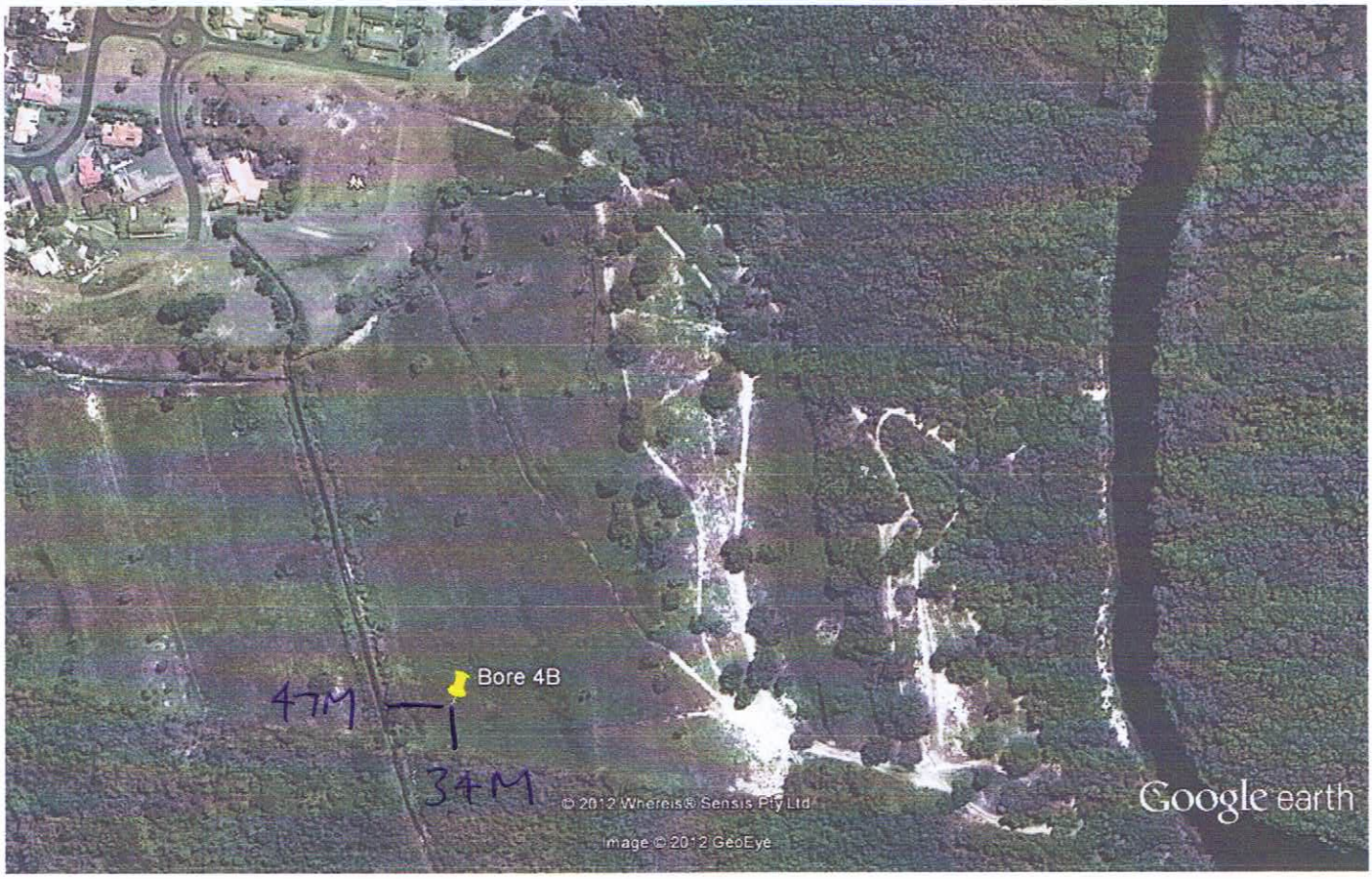
WORK NOT CONSTRUCTED BY DRILLING RIG — 16

Method of excavation: Hand dug ☐ Back hoe ☐ Dragline ☐ Dozer ☐ Other

Depth (m)	Length (m)	Width (m)	Diameter (m)	Lining material	Dimentions of liner (m)	From Depth (m)	To Depth (m)

Please attach copies of the following if available — 17

Geologist log	(Yes/No) ✓	Laboratory analysis of water Sample	(Yes/No) ✓	Pumping test(s)	(Yes/No) ✓
Geophysical log	(Yes/No) ✓	Sieve analysis of aquifer material	(Yes/No) ✓	Installed Pump details	(Yes/No) ✓



Google earth

feet 1000
meters 300

NSW GOVERNMENT Office of Water

Form A Particulars of completed work

BORE 5

Driller's Licence No:	1777	1
Class of Licence:	1	
Driller's Name:	JAMES DICK	
Assistant Driller:	MATTHEW M'CANN	
Contractor:	BORDER TECH / GEOTECH INV.	
New bore	X	
Deepened		
Reconditioned		
Replacement bore		
Enlarged		
Other (specify)		
Final Depth	12.0 m	

Work Licence No:	30BL185992	2
Name of Licensee:	PERPETUITY	
Intended Use:	GROUNDWATER INVESTIGATION	
Completion Date:	14.11.12	

DRILLING DETAILS 3

From (m)	To (m)	Hole Diameter (mm)	Drilling Method See Code 3
0	1.0	110	2
1.0	12.0	100	7

WATER BEARING ZONES 4

From (m)	To (m)	Thickness (m)	S W L (m)	Estimated Yield (L/s) Individual Aquifer	Estimated Yield (L/s) Cumulative	Test method See Code 4		D D L at end of test (m)	Duration Hrs	Duration min	Salinity (Conductivity or TDS) Cond (µS/cm)	Salinity (Conductivity or TDS) TDS (mg/L)
3.0	12	9	3.0									

CASING / LINER DETAILS 5

Material Code 5	OD (mm)	Wall Thickness (mm)	From (m)	To (m)	Method Fixing Code 5
8	50	3	0	10.4	5

Casing support method See Code 5:

Type of casing bottom See Code 5:

Centralisers installed {Yes/No}: N (indicate on sketch)

Sump installed {Yes/No}: N From m To m

Pressure cemented {Yes/No}: N From m To m

Casing Protector cemented in place

WATER ENTRY DESIGN 6

General Material Code 5	OD (mm)	Wall Thickness (mm)	From (m)	To (m)	Opening type See Code 6	Fixing See Code 5	Screen Aperture (mm)	Slot Details Length (mm)	Width (mm)	Alignment See Code 6
8	50	3	10.4	11.9	5	5	0.4	50	5	H

GRAVEL PACK 7

Type	Grade	Grain size (mm) From	Grain size (mm) To	Depth (m) From	Depth (m) To	Quantity Litres	Quantity m^3
Rounded	Graded	3	5	10	12		0.01
Crushed X	Ungraded						
Bentonite/Grout seal (Yes/No) Y				7.9	9.9		0.0075
Method of placement of Gravel Pack See Code 7							

For Departmental use only: GW

NSW GOVERNMENT | Office of Water

Form A Particulars of completed work

BORE 5 **Work Licence No:** 30BL185992

BORE DEVELOPMENT 8

Chemical used for breaking down drilling mud (Yes/No) NO Name:

Method	Bailing/Surging	Jetting	Airlifting	Backwashing	Pumping	Other:
Duration	hrs	hrs	hrs	hrs	hrs	hrs

DISINFECTION ON COMPLETION 9

Chemical(s) used	Quantity applied (Litres)	Method of application

PUMPING TESTS ON COMPLETION 10

Test type		Date	Pump intake depth (m)	Initial Water Level (SWL) (m)	Pumping rate (L/s)	Water Level at end of pumping (DDL) (m)	Duration of Test (hrs)	Recovery: Water level (m)	Recovery: Time taken (hrs)	Recovery: Time taken (mins)
Multi stage (stepped drawdown)	Stage 1									
	Stage 2									
	Stage 3									
	Stage 4									
Single stage (constant rate)										

Height of measuring point above ground level m Test Method See Code 4

WORK PARTLY BACKFILLED OR ABANDONED 11

Original depth of work: m Is work partly backfilled: (Yes/No)

Is work abandoned: (Yes/No) Method of abandonment: Backfilled Plugged Capped

Has any casing been left in the work (Yes/No) From m To m

Sealing / fill type See Code 11	From depth (m)	To depth (m)	Sealing / fill type See Code 11	From depth (m)	To depth (m)

12

Site chosen by: Hydrogeologist Geologist Driller Diviner Client Other

13

Lot No 1 DP No 871039

Work Location Co ordinates Easting Northing Zone

GPS: (Yes/No) YES >> AMG/AGD or MGA/GDA (See explanation)

S 28° 33' 42.1" BORE 5
E 153° 33' 11.4"

Please mark the work site with "X" on the CLID provided map.
Indicate also the distances in metres from two (2) adjacent boundaries, and attach the map to this Form A package.

Signatures:

Driller: .....

Date: 30/11/12

Licensee: .....

Date: .....

NSW GOVERNMENT Office of Water

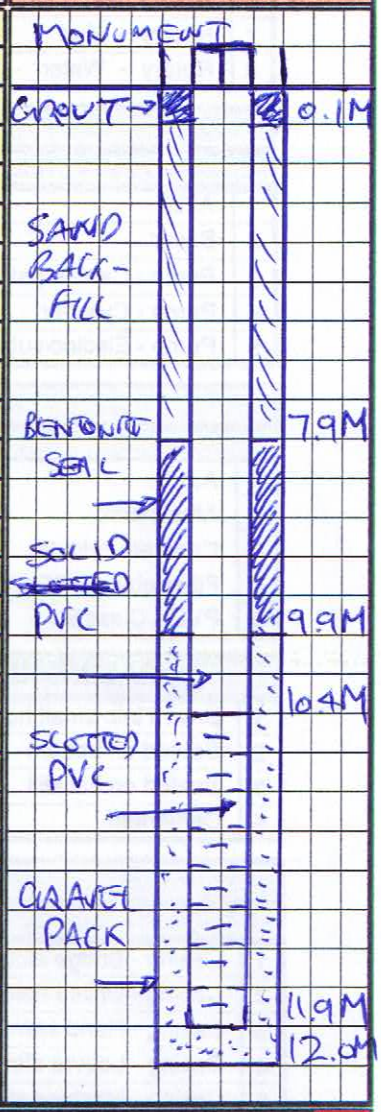
Form A Particulars of completed work

BORE 5 **Work Licence No:** 30BL185992

DRILLER'S ROCK/STRATA DESCRIPTION (LITHOLOGY) — 15

Depth From (m)	Depth To (m)	Description (See Code 15)
0	0.2	(SP) SAND, FINE TO MEDIUM SAND, TRACE OF CLAY, MOIST, PALE BROWN
0.2	5.2	(SP) SAND, FINE TO MEDIUM SAND, VERY MOIST, BROWN,
5.2	10.0	(SP) SAND, FINE TO MEDIUM SAND, VERY MOIST, DARK BROWN,
10.0	12.6	(GP) SANDY GRAVEL, FINE TO MEDIUM GRAVEL, FINE TO COARSE SAND, VERY MOIST, PALE BROWN SAND, GREY & PALE BLUE GRAVELS,

WORK CONSTRUCTION SKETCH



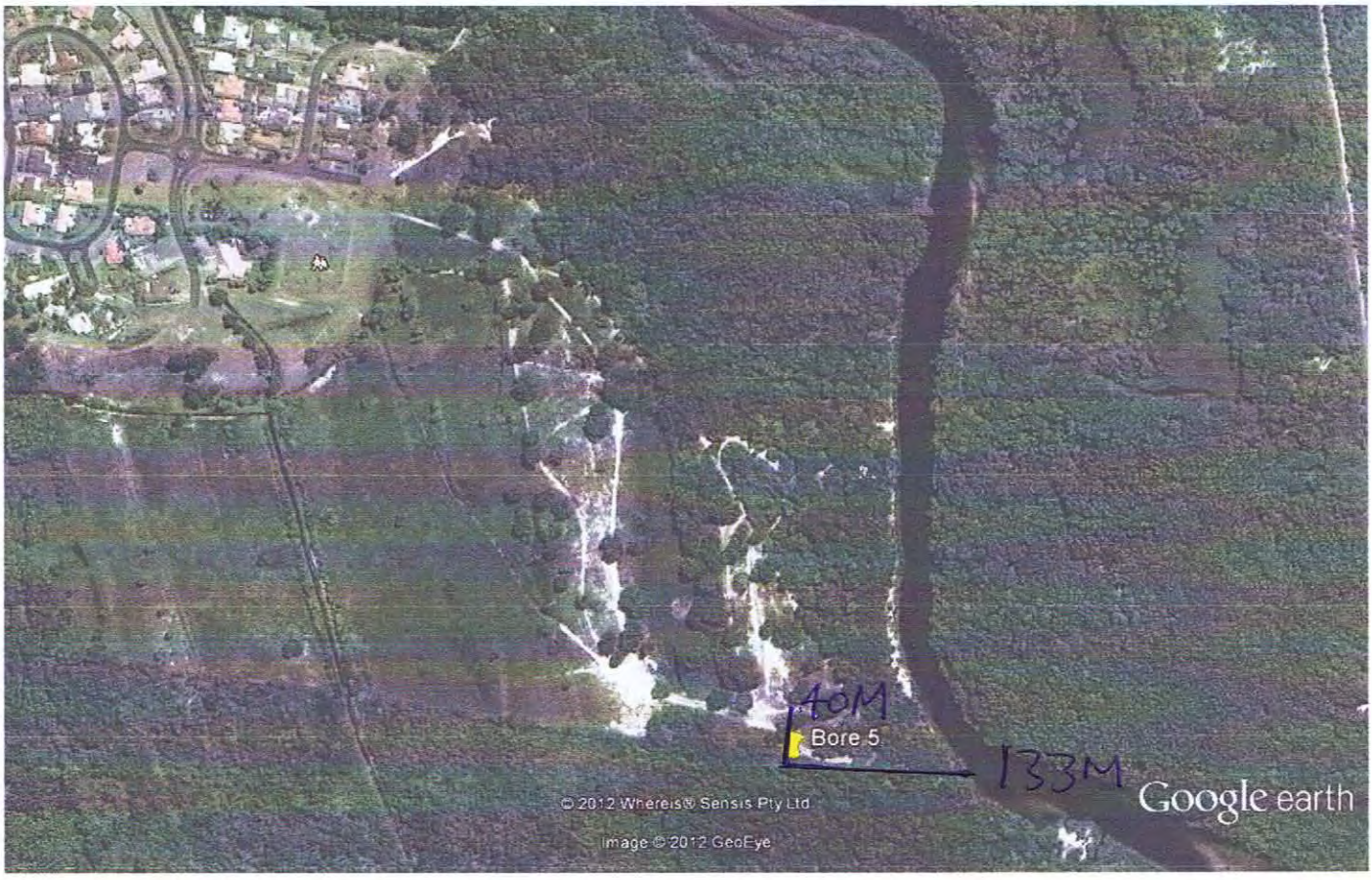
WORK NOT CONSTRUCTED BY DRILLING RIG — 16

Method of excavation: Hand dug ☐ Back hoe ☐ Dragline ☐ Dozer ☐ Other ☐

Depth (m)	Length (m)	Width (m)	Diameter (m)	Lining material	Dimentions of liner (m)	From Depth (m)	To Depth (m)

Please attach copies of the following if available — 17

Geologist log	(Yes/No) ✓	Laboratory analysis of water Sample	(Yes/No) ✓	Pumping test(s)	(Yes/No) ✓
Geophysical log	(Yes/No) ✓	Sieve analysis of aquifer material	(Yes/No) ✓	Installed Pump details	(Yes/No) ✓



Google earth

feet 1000
meters 500

APPENDIX D

FIELD RECORDINGS

Appendix D

Water Quality Purging Information

PROJECT: September / November 2012 Groundwater Monitoring **JOB No.:** W516-4

Bore number : Bore 1			Date: 18/09/2012					
Total depth (m): 3.02			Casing height / radius (m)					
SWL (m): 2.99 Water Level after purge (m):			Purging Method: Bailer Approx. vol. removed (L): -					
Volume (L)	**Flow (L/s)**	**pH**	**EC (µS/cm)**	**T°C**	**Eh (mV)**	**DO (mg/L)**	**TDS**	**NTU**
Observations during purging/sampling: unable to obtain sample								

Bore number : Bore 2			Date: 18/09/2012					
Total depth (m): 2.9			Casing height / radius (m)					
SWL (m): 2.4 Water Level after purge (m): 2.4			Purging Method: Bailer Approx. vol. removed (L): 5L					
Volume (L)	**Flow (L/s)**	**pH**	**EC (µS/cm)**	**T°C**	**Eh (mV)**	**DO (mg/L)**	**TDS**	**NTU**
1L	NR	4.12	119	19.4	+283.6	3.53	77	NR
5L sampled	NR	4.00	65	19.1	+251.1	6.11	42	NR
Observations during purging/sampling: Sampled at 5L. very cloudy, Brown/red, moderate odour, rotten egg gas.								

waste solutions AUSTRALIA PTY LTD

Ph: 07 3366 5778 Fax: 07 3366 7302

Appendix D

Water Quality Purging Information

PROJECT: September / November 2012 Groundwater Monitoring **JOB No.:** W516-4

Bore number : Bore 3A			Date: 11/09/2012					
Total depth (m): 2.1m			Casing height / radius (m)					
SWL (m): 1.00 Water Level after purge (m): NR			Purging Method: Bailer Approx. vol. removed (L): 10L					
Volume (L)	**Flow (L/s)**	**pH**	**EC (µS/cm)**	**T°C**	**Eh (mV)**	**DO (mg/L)**	**TDS**	**NTU**
1	NR	6.82	156	19.8	+191	7.03	100	213
5	NR	4.85	189	19.4	-2.3	6.71	123	967
10 sampled	NR	4.83	204	23.6	-22	5.33	132	912
Observations during purging/sampling: Sampled at 10L. Brown/red highly turbid water. Slight swampy, rotten egg gas smell.								

Bore number : Bore 3A			Date: 14/11/2012					
Total depth (m): 2.1			Casing height / radius (m)					
SWL (m): 0.98 Water Level after purge (m): 1.149			Purging Method: 12V submersible pump Approx. vol. removed (L): 787L					
Time	**Flow (L/s)**	**pH**	**EC (µS/cm)**	**T°C**	**Eh (mV)**	**DO (mg/L)**	**TDS**	**NTU**
11:24am	8.70	5.67	318	23.2	-82	4.19	NR	399
11:28am	Pump off	-	-	-	-	-	-	-
11:34am	Pump on	-	-	-	-	-	-	-
11:35am	12.24	5.19	182	25.5	-73	5.62	NR	490
11:42am	11.76	4.61	204	19.9	-69	6.93	NR	622
11:50am	NR	4.69	214	22.4	-68	6.73	NR	688
11:57am	11.54	4.56	225	20.4	-63	6.24	NR	677
12:10pm	11:54	4.51	232	20.2	-59	5.0	NR	663
12:27pm	10.71	4.49	244	20.3	-65	6.48	NR	643
Observations during purging/sampling: Pumping from 11:23 am to 12:40pm with 6 minutes of break. Average pump rate 11.08L/min. Dirty red/yellow water to clear yellow water, sandy sediment. Bore not sampled.								

Bore number : Bore 3B			Date: 14/11/2012					
Total depth (m): 11.87			Casing height / radius (m)					
SWL (m): 3.033 Water Level after purge (m): NA			Purging Method: 12V submersible pump Approx. vol. removed (L): 1060L					
Time	**Flow (L/s)**	**pH**	**EC (µS/cm)**	**T°C**	**Eh (mV)**	**DO (mg/L)**	**TDS**	**NTU**
08:35am	5.71	6.30	115	22.4	-93	3.25	75	1042
09:04am	6.25	5.18	93	21.4	-181	3.78	61	469
09:20am	NR	5.22	85	21.3	-178	2.97	55	625
09:45am	7.23	5.35	84	21.4	-191	3.33	54	631
10:07am	7.50	5.44	81	21.6	-197	3.25	52	675
10:32am	NR	5.34	81	21.4	-192	3.01	53	654
10:55am	NR	5.29	81	21.5	-196	3.47	52	693
Observations during purging/sampling: Pumping from 8:26am to 11:05am at 6.7L/min. Brown, very dark coloured water at the start, purging to clear, red tea stained water after 30 minutes. Sampled at 09:20 am, duplicate taken.								

Appendix D

Water Quality Purging Information

PROJECT: September / November 2012 Groundwater Monitoring **JOB No.:** W516-4

Bore number : Bore 4A			Date: 14/11/2012					
Total depth (m): 2.44			Casing height / radius (m)					
SWL (m): 0.719 Water Level after purge (m): NA			Purging Method: 12V submersible pump Approx. vol. removed (L): 220					
Time	**Flow (L/min)**	**pH**	**EC (µS/cm)**	**T°C**	**Eh (mV)**	**DO (mg/L)**	**TDS**	**NTU**
03:37pm	10	4.92	122	22.5	-96	3.38	78	2946
03:43pm	NR	4.53	103	21.5	-98	3.98	66	2423
03:48pm	NR	4.40	99	21.4	-105	3.66	64	1754
03:53pm	NR	4.46	99	21.4	-109	3.06	64	1297
Observations during purging/sampling: Brown, highly turbid water. Pumping from 03:33 to 3:55pm. Pump rate 10L/min. Sampled at 03:53pm.								

Bore number : Bore 4B			Date: 14/11/2012					
Total depth (m): 10			Casing height / radius (m)					
SWL (m): 3.014 Water Level after purge (m): NA			Purging Method: 12V submersible pump Approx. vol. removed (L): 1482					
Time	**Flow (L/min)**	**pH**	**EC (µS/cm)**	**T°C**	**Eh (mV)**	**DO (mg/L)**	**TDS**	**NTU**
12:20pm	NR	5.59	196	25.9	-108	5.34	127	1889
12:26pm	7.14	5.27	198	23.2	-126	3.60	128	507
12:34pm	7.41	5.05	210	22.5	-143	4.12	136	527
01:00pm	NR	5.14	212	22.1	-153	3.06	137	446
01:24pm	8.45	5.07	211	21.9	-149	2.30	137	654
02:01pm	NR	5.23	200	24.5	-145	2.36	130	537
02:20pm	8.22	5.18	204	22.7	-153	2.96	132	582
02:55pm	NR	5.18	203	22.1	-154	3.66	132	681
Observations during purging/sampling: Pumping from 12:18pm to 3:28pm at 7.8L/min. Sampled at 1:2- pm. Brown, highly turbid water, water clearing through purge (10 minutes after pump start).								

Bore number : Bore 5			Date: 14/11/2012					
Total depth (m): 12.68			Pipe height 72cm / Casing height 80cm					
SWL (m): 4.55 Water Level after purge (m): NA			Purging Method: 12V submersible pump Approx. vol. removed (L): 25L					
Time	**Flow (L/s)**	**pH**	**EC (µS/cm)**	**T°C**	**Eh (mV)**	**DO (mg/L)**	**TDS**	**NTU**
4:18	NR	5.20	505	22.7	+93	5.82	328	925
4:20	NR	5.60	141	21.9	+94	6.07	91	699
Observations during purging/sampling: Pumping from 4:13 to 4:22pm. Brown, highly turbid water. Bore going dry? Low flow rate.								

waste solutions AUSTRALIA PTY LTD

Ph: 07 3366 5778 Fax: 07 3366 7302

APPENDIX E

RECOVERY TEST RESULTS

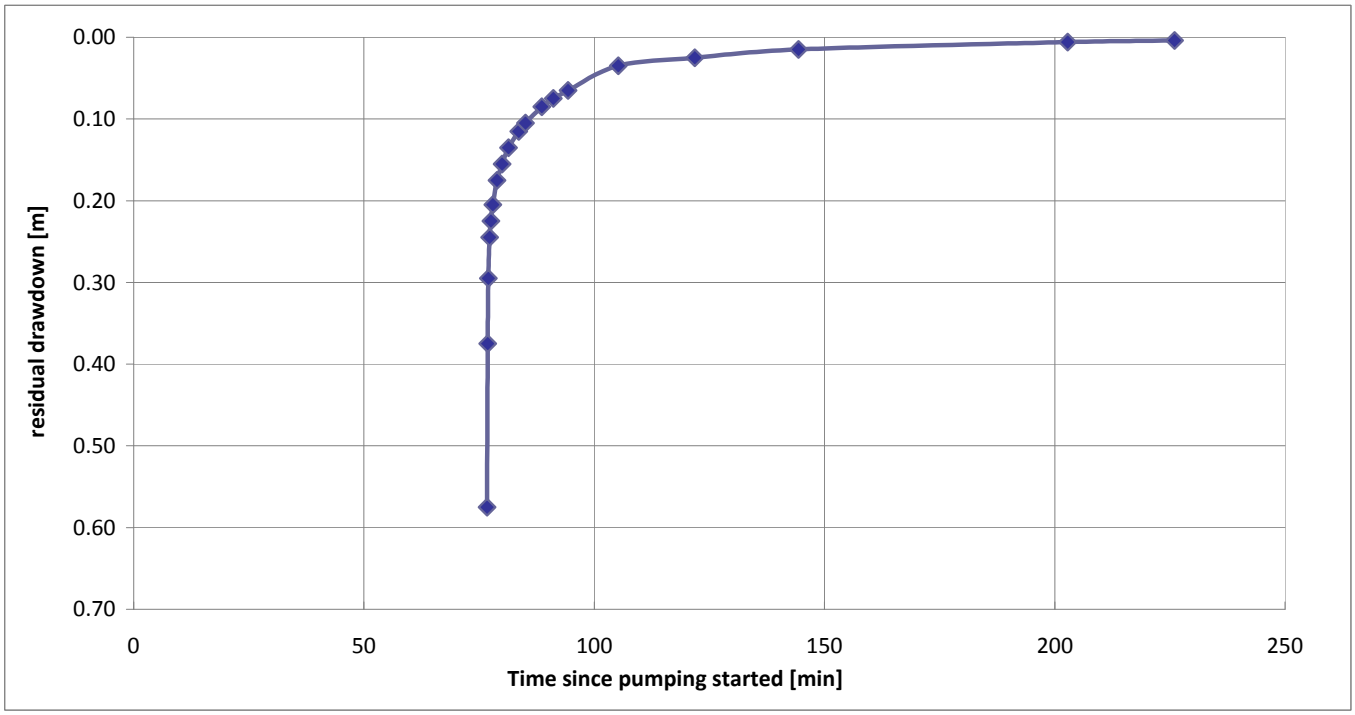
RECOVERY TEST ANALYSIS

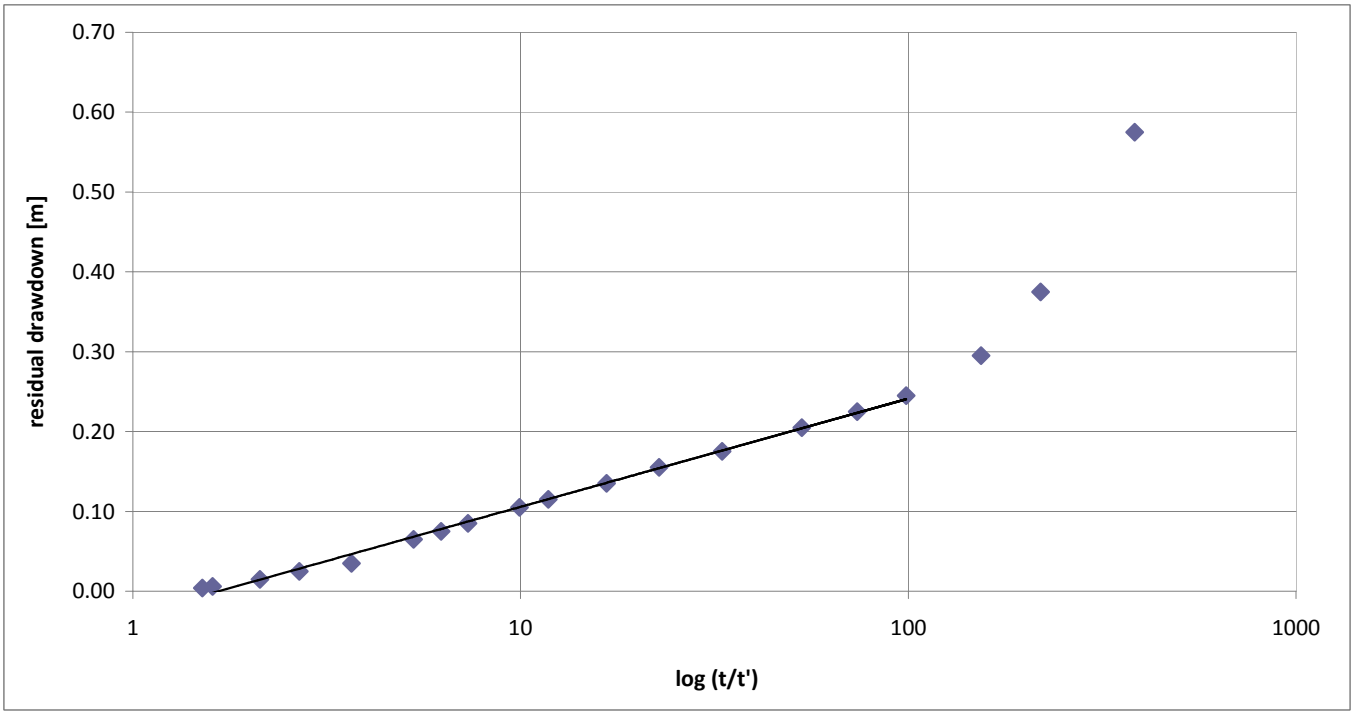
waste solutions AUSTRALIA PTY LTD

Job No.: W516-4 | Pumped Bore No.: Bore 3A | Date: 5/10/2012

Owner : Codlea Pty Ltd | Operator : Patrick Mason

Standing Water Level	1.145 m BTOC
Aquifer thickness	1 m
Pump rate	16.0 m^3/d
Δs	0.14 m
Transmissivity	**21.54 m^2/d**
Hydraulic Conductivity	**21.54 m/d**





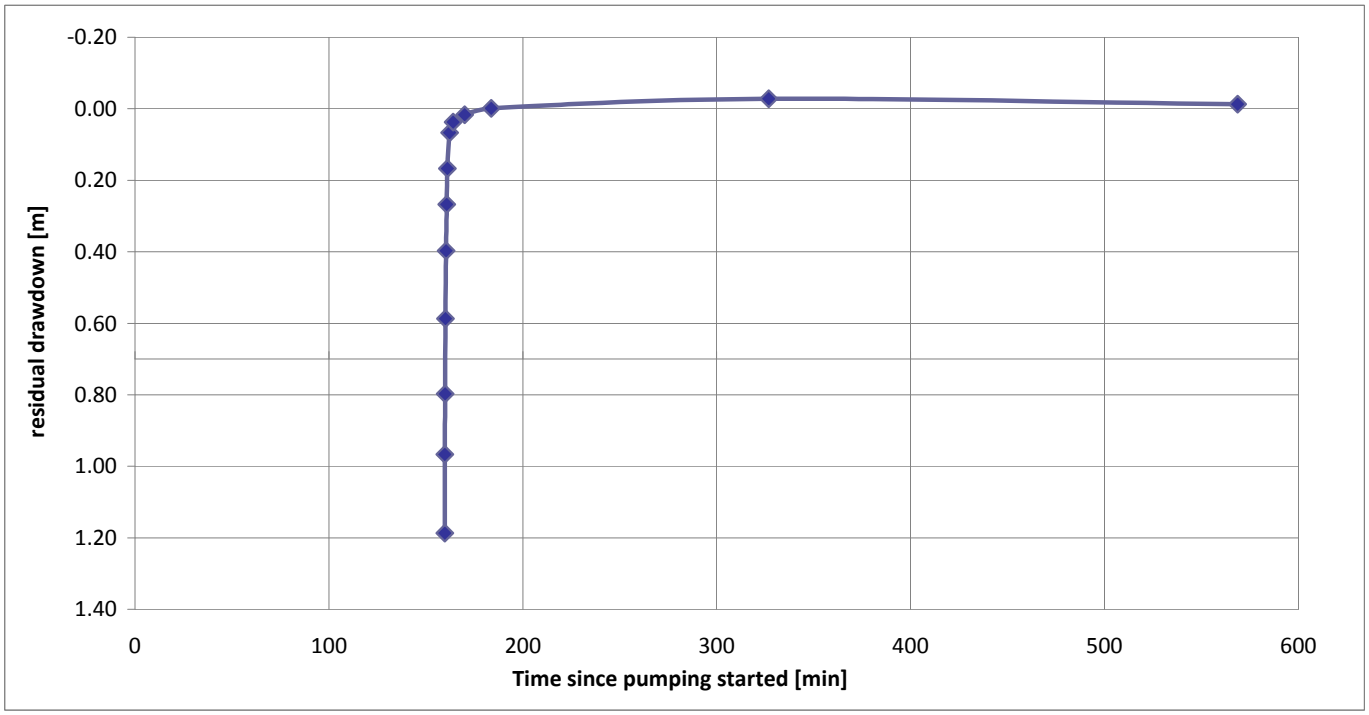
RECOVERY TEST ANALYSIS

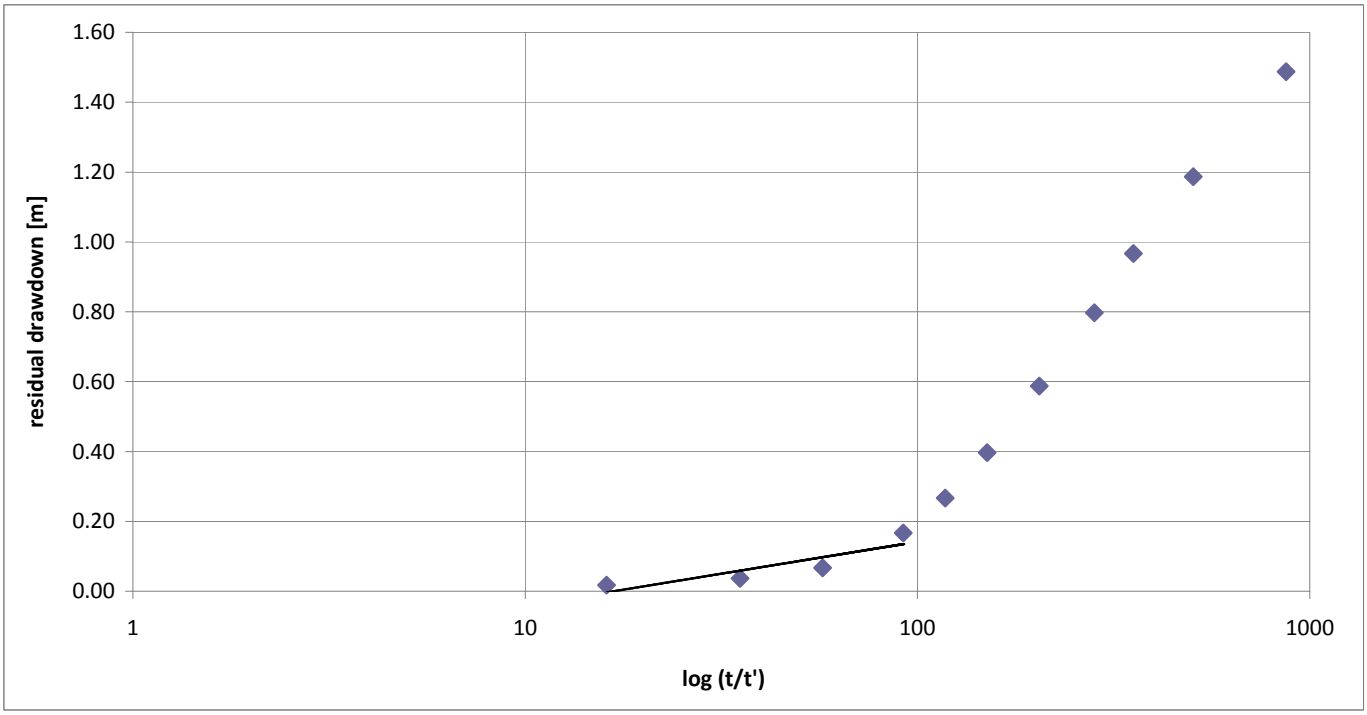
waste solutions AUSTRALIA PTY LTD

Job No.: W516-4 | Pumped Bore No.: Bore 3B | Date: 14/11/2012

Owner : Codlea Pty Ltd | Operator : Patrick Mason

Standing Water Level	3.033 m BTOC
Aquifer thickness	2 m
Pump rate	9.6 m^3/d
Δs	0.18 m
Transmissivity	**9.60 m^2/d**
Hydraulic Conductivity	**4.80 m/d**





RECOVERY TEST ANALYSIS

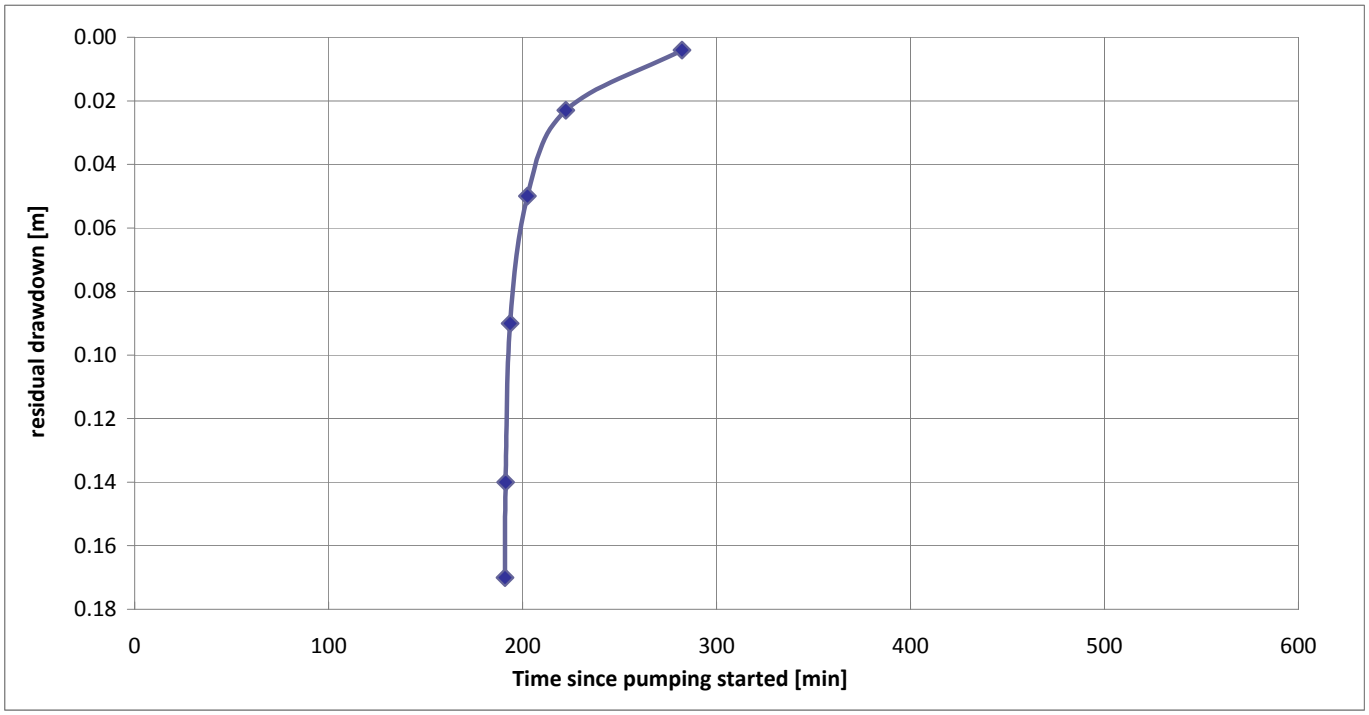
waste solutions AUSTRALIA PTY LTD

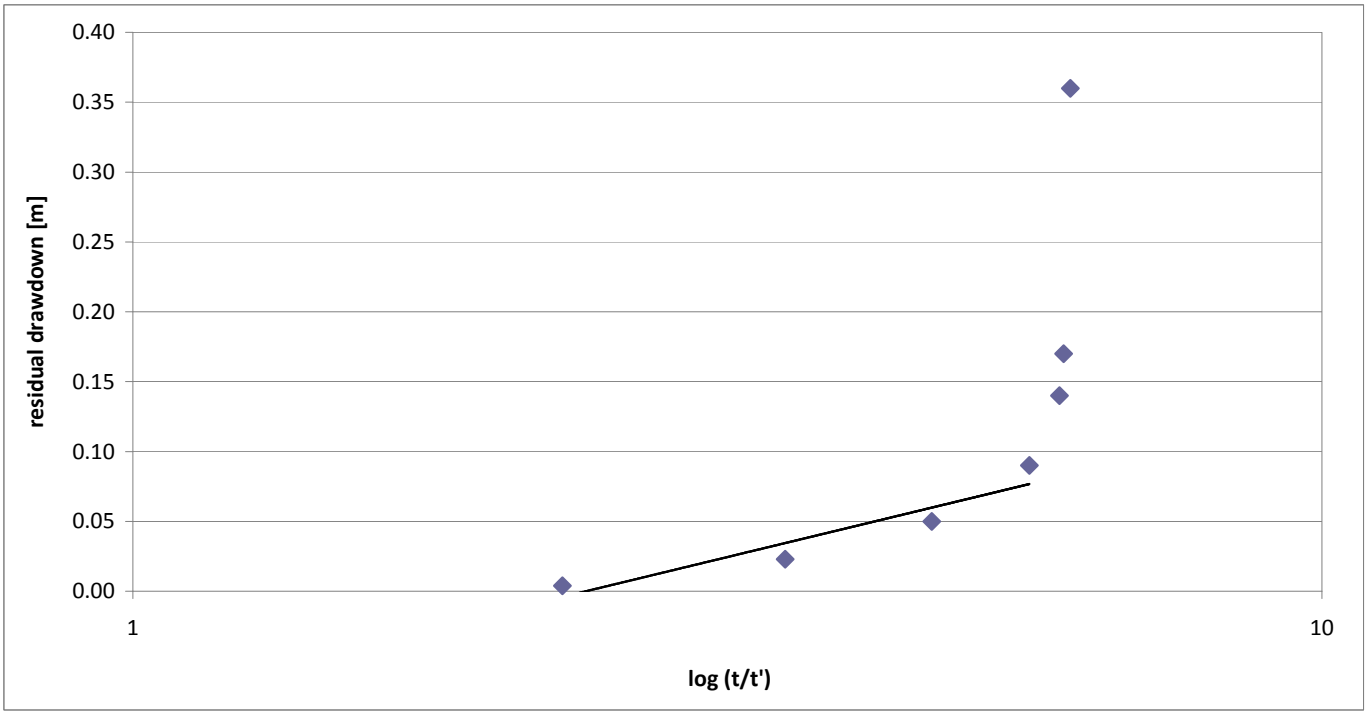
Job No.: W516-4 | Pumped Bore No.: Bore 4B | Date: 14/11/2012

Owner : Codlea Pty Ltd | Operator : Patrick Mason

Standing Water Level*	3.01 m BTOC
Aquifer thickness	2 m
Pump rate	11.2 m^3/d
Δs	0.21 m
Transmissivity	**10.01 m^2/d**
Hydraulic Conductivity	**5.00 m/d**

* standing water level after recovery





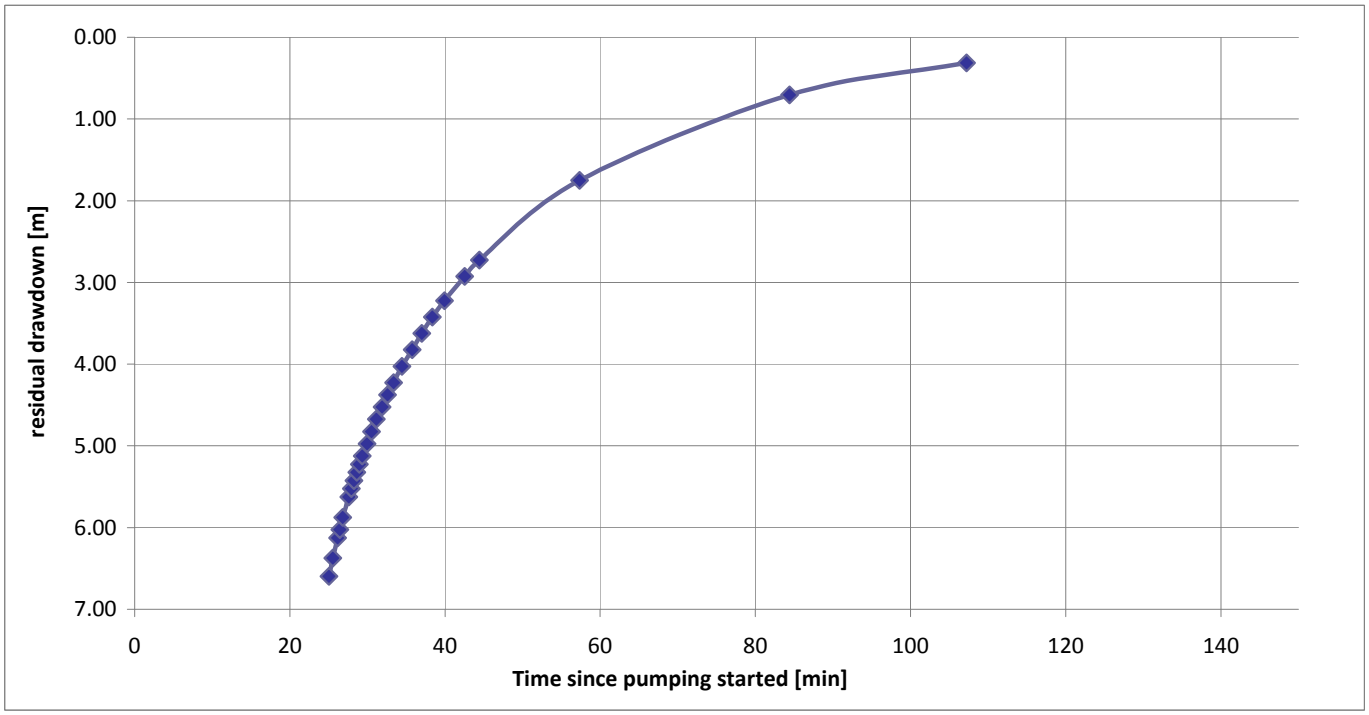
RECOVERY TEST ANALYSIS

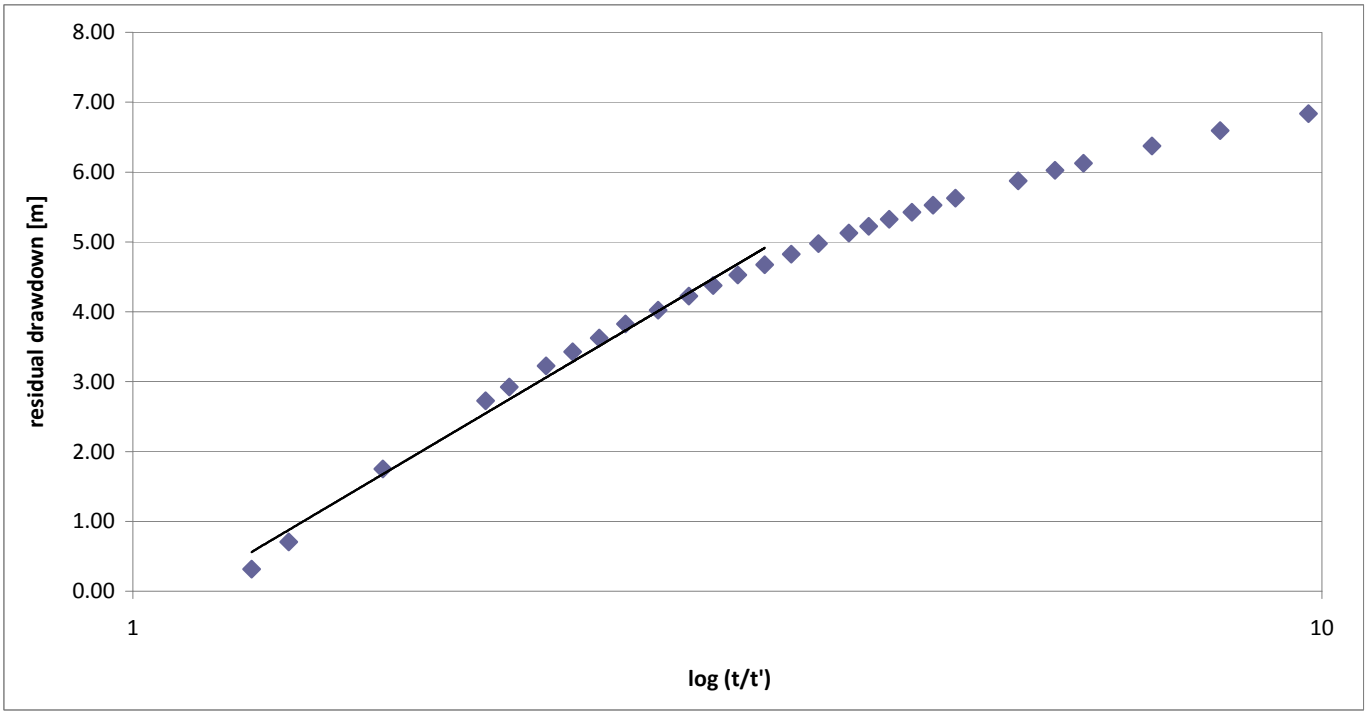
waste solutions AUSTRALIA PTY LTD

Job No.: W516-4 | Pumped Bore No.: Bore 5 | Date: 14/11/2012

Owner : Codlea Pty Ltd | Operator : Patrick Mason

Standing Water Level	4.375 m BTOC
Aquifer thickness	5 m
Pump rate	4.0 m^3/d
Δs	10.08 m
Transmissivity	**0.07 m^2/d**
Hydraulic Conductivity	**0.01 m/d**





APPENDIX F

PERMEABILITY TESTING RESULTS

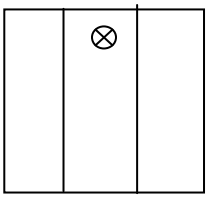
Appendix F Permeability Test

waste solutions AUSTRALIA PTY LTD

Job # : W516-3
Site : Codlea Pty Ltd
Time: 8:34:30 AM

Drain # : Test 1
Operator : PM
Date: 5/10/2012

Location:



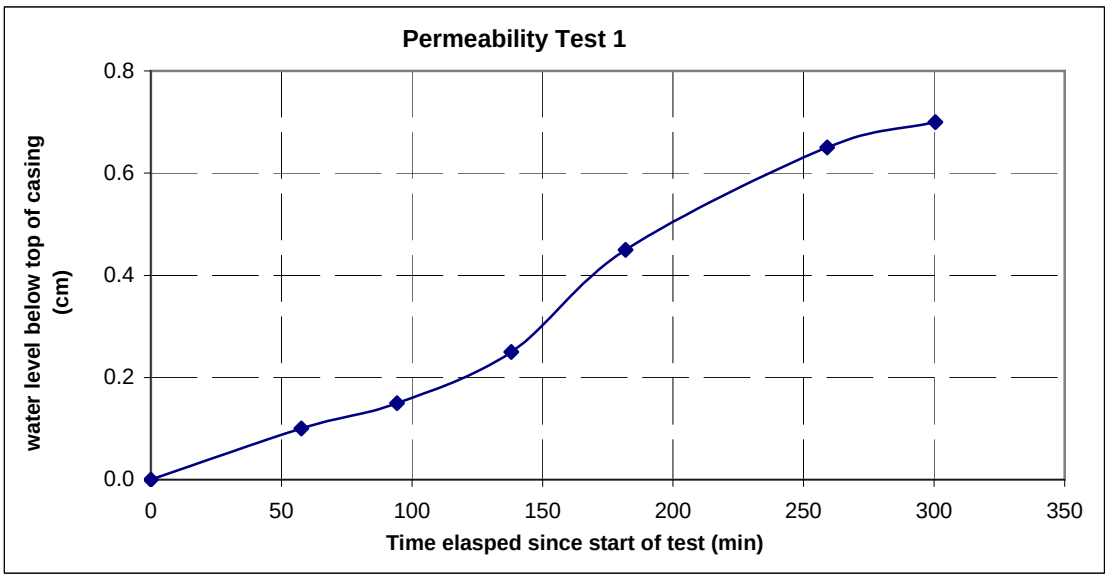
Test Dimensions (m):

Top of Casing
0.43
Diameter
0.102
Distance from Soil Log
NA

Soil Log:

mBGL	Soil type
	Black cemented SAND
	moist

Date	Time	Time Elapsed in since start of test [min]	Water Level from Top of Casing (cm)	Remarks
5/10/2012	10:04:00 AM	0	0	H1
5/10/2012	11:01:35 AM	58	0.1	
5/10/2012	11:38:20 AM	94	0.15	
5/10/2012	12:22:00 PM	138	0.25	
5/10/2012	1:05:47 PM	182	0.5	
5/10/2012	2:23:00 PM	259	0.7	
5/10/2012	3:04:25 PM	300	0.7	H2, End of Test



$$K = \frac{Pi \times R}{4\,(t2-t1)} \ln\left[\frac{H1}{H2}\right]$$

$K = 2.19 \times 10^{-6}$ m/min or
3.65×10^{-8} m/sec

From Oweis and Khera (1998)

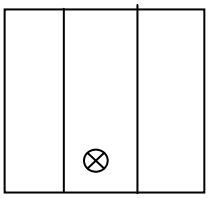
Appendix F Permeability Test

waste solutions AUSTRALIA PTY LTD

Job # : W516-3
Site : Codlea Pty Ltd
Time: 10:45:00 AM

Drain # : Test 2
Operator : PM
Date: 5/10/2012

Location:



Test Dimensions (m):

Top of Casing
0.377

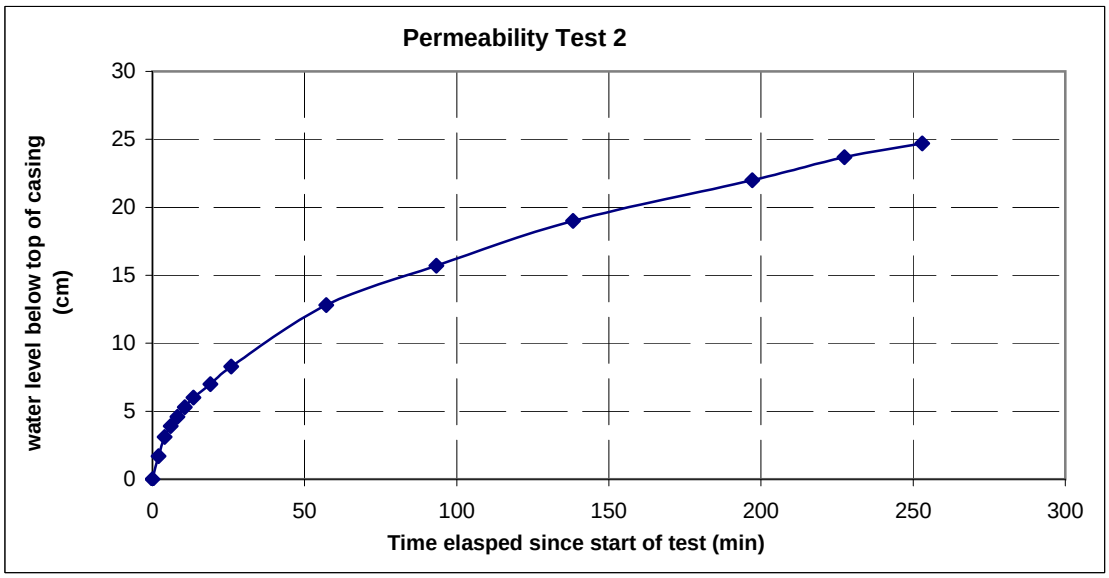
Diameter
0.102

Distance from Soil Log
NA

Soil Log:

mBGL	Soil type
	Black / white loosely cemented SAND
	wet

Date	Time	Time Elapsed in since start of test [min]	Water Level from Top of Casing (cm)	Remarks
5/10/2012	10:45:00 AM	0	0	H1
5/10/2012	10:47:00 AM	2	1.7	
5/10/2012	10:49:00 AM	4	3.1	
5/10/2012	10:51:00 AM	6	3.9	
5/10/2012	10:53:10 AM	8	4.6	
5/10/2012	10:55:40 AM	11	5.3	
5/10/2012	10:58:30 AM	14	6.0	
5/10/2012	11:04:00 AM	19	7.0	
5/10/2012	11:10:50 AM	26	8.3	
5/10/2012	11:42:10 AM	57	12.8	
5/10/2012	12:18:16 PM	93	15.7	
5/10/2012	1:03:13 PM	138	19	
5/10/2012	2:02:09 PM	197	22	
5/10/2012	2:32:23 PM	227	23.7	
5/10/2012	2:57:59 PM	253	24.7	H2, End of Test



$$K = \frac{Pi \times R}{4\,(t2-t1)} \ln\left[\frac{H1}{H2}\right]$$

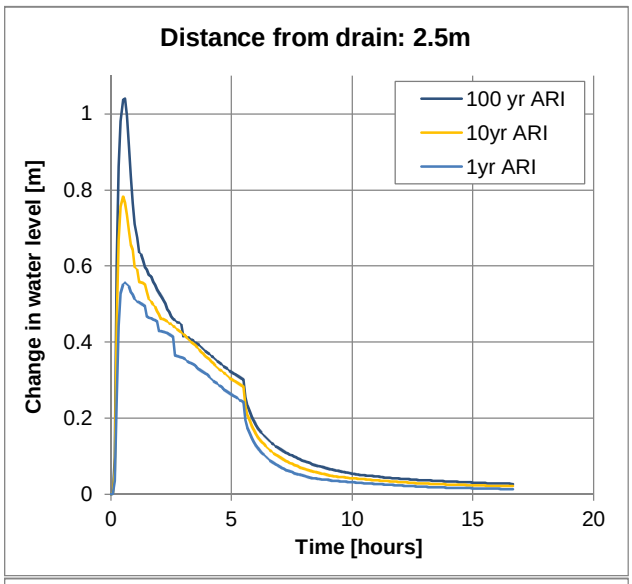
$K = 1.69 \times 10^{-4}$ m/min or 2.81×10^{-6} m/sec

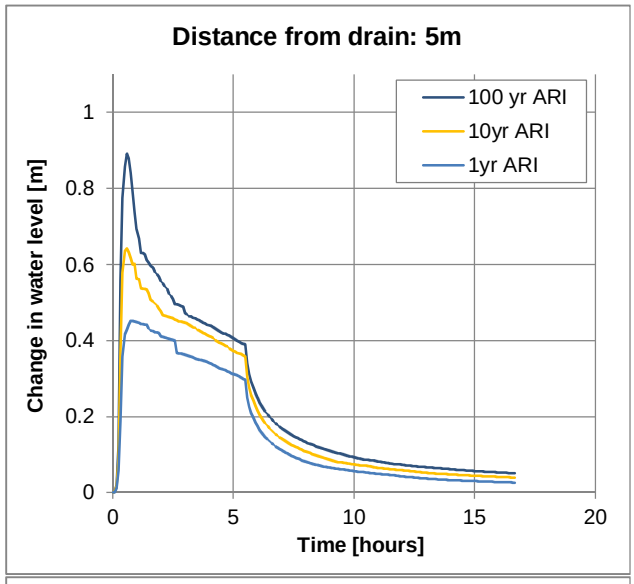
From Oweis and Khera (1998)

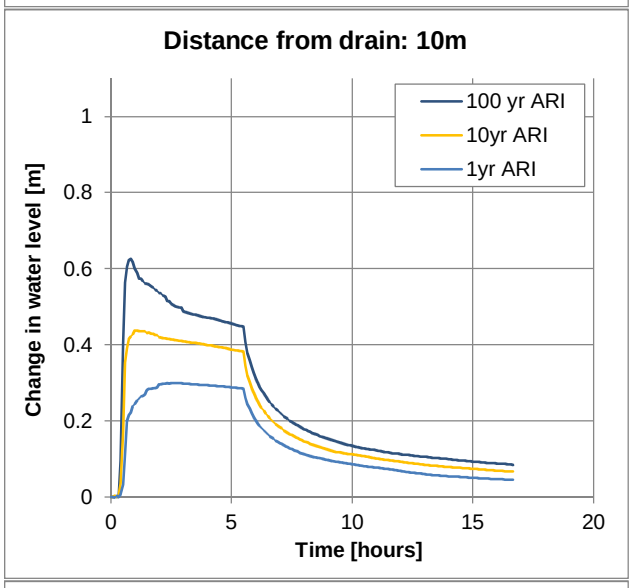
APPENDIX G

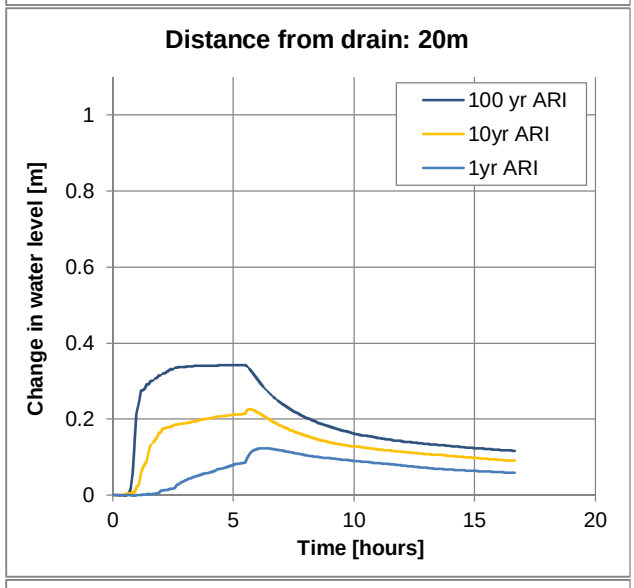
GROUNDWATER MODELLING RESULTS – HYDROGRAPHS

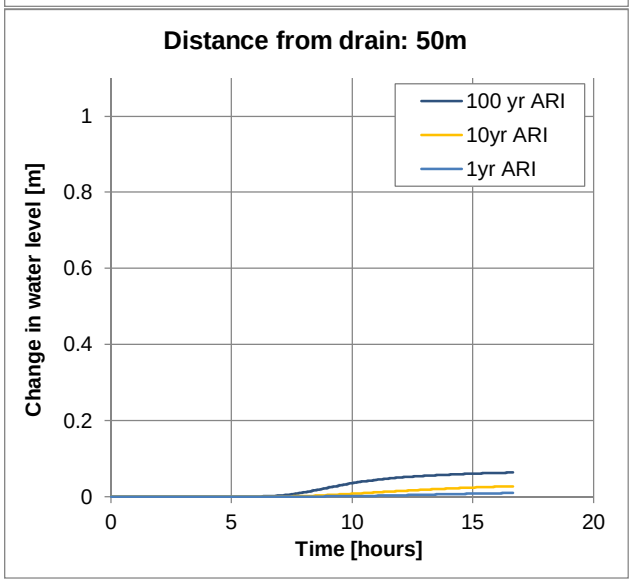
Groundwater modelling results
Scenario 1: dry conditions 1h rainfall event

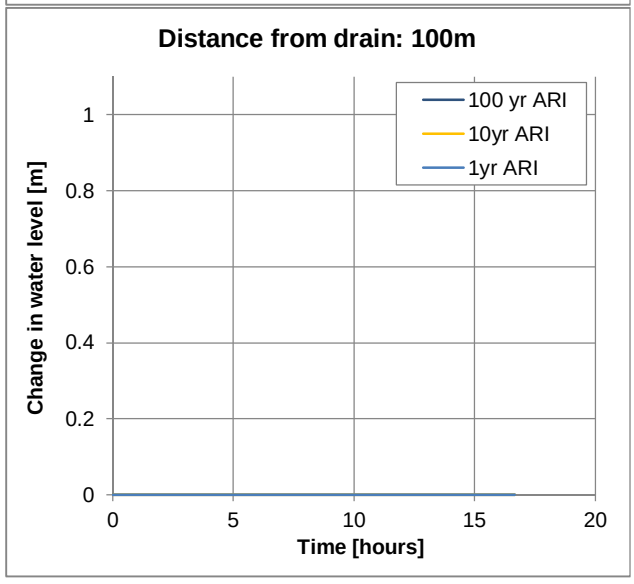




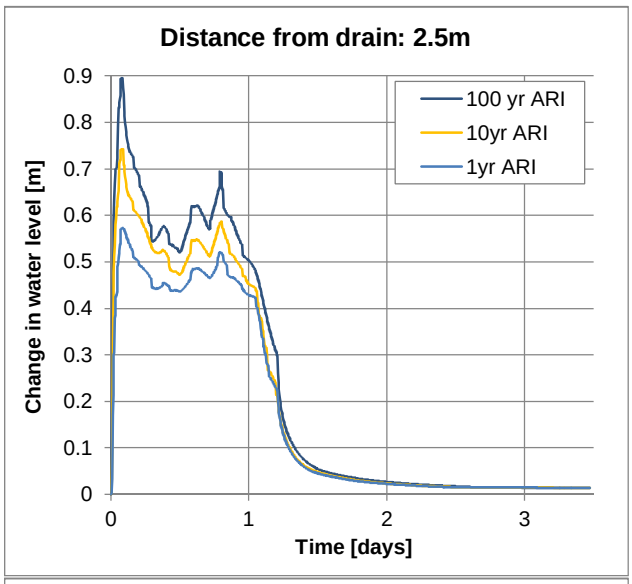


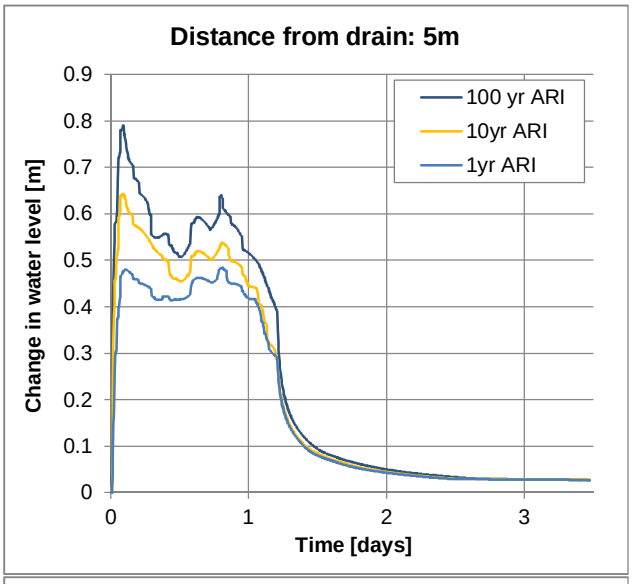


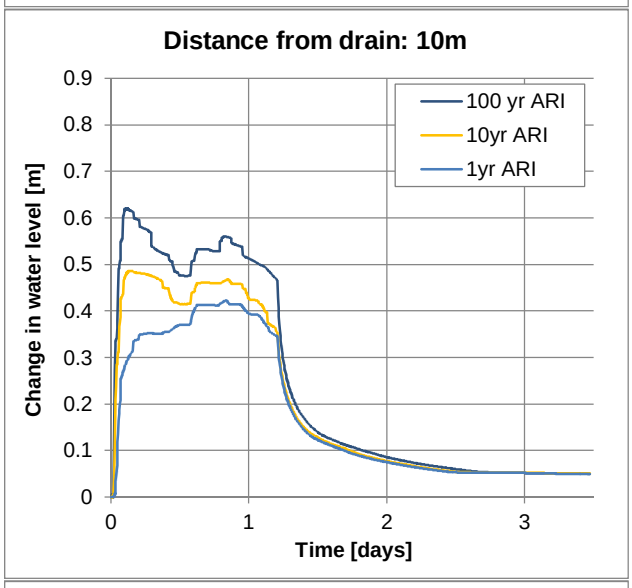


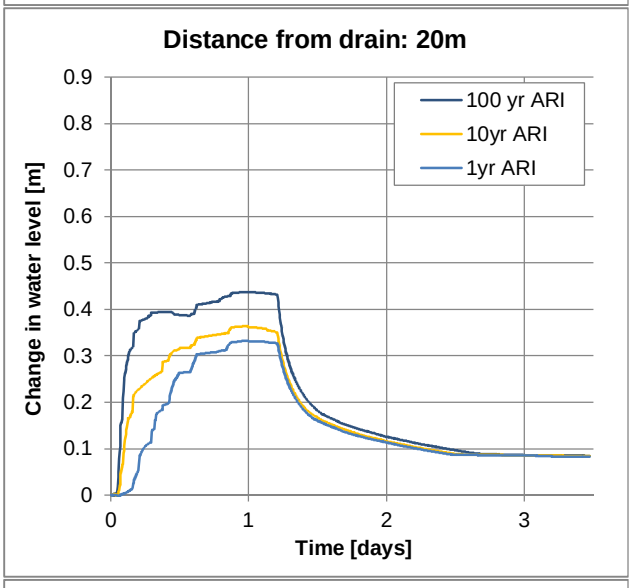


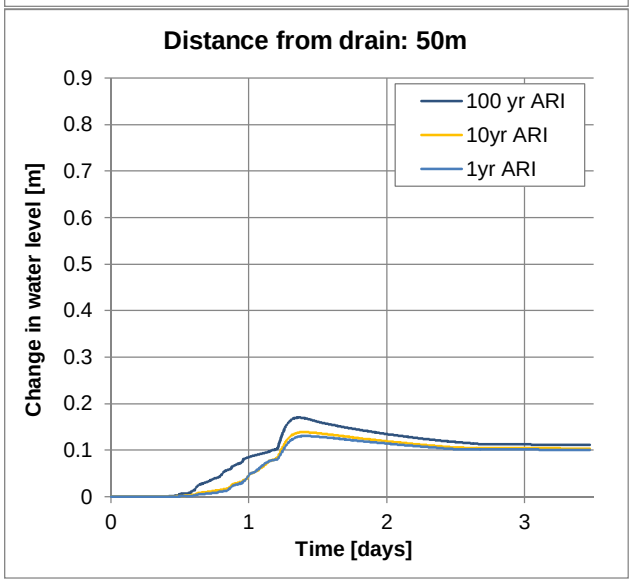
Groundwater modelling results
Scenario 1: dry conditions 24h rainfall event

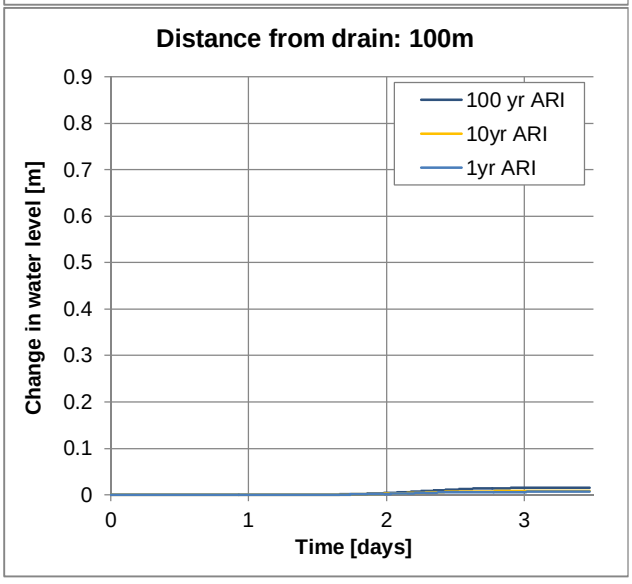




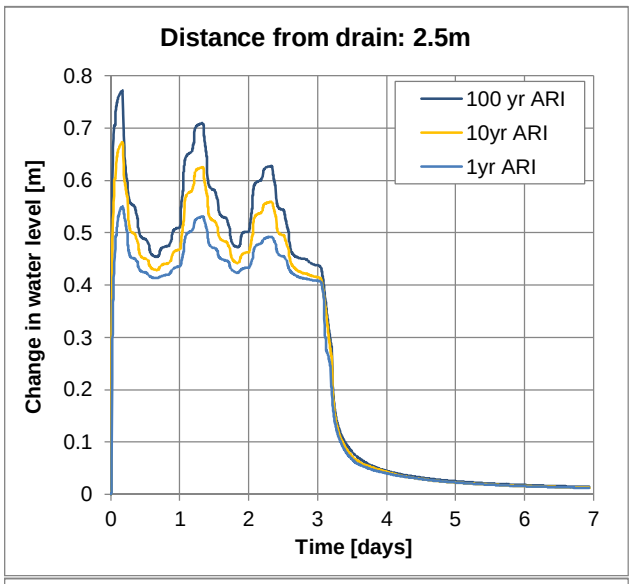


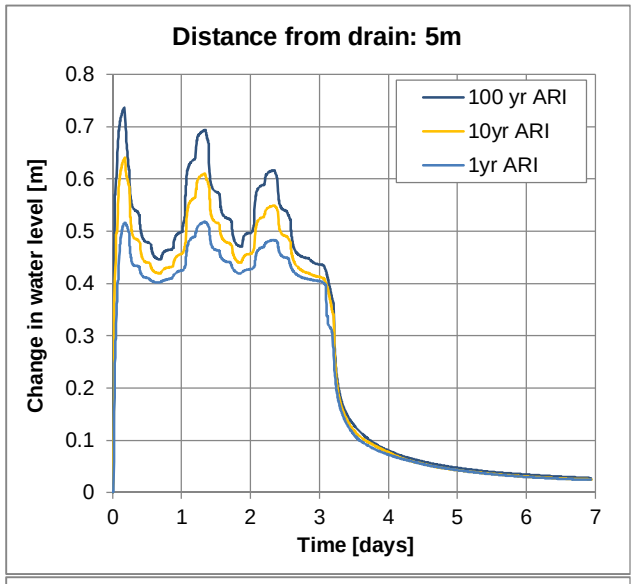


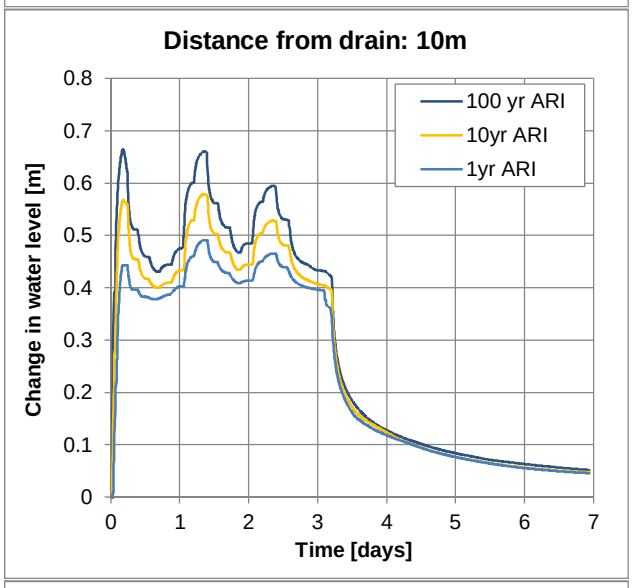


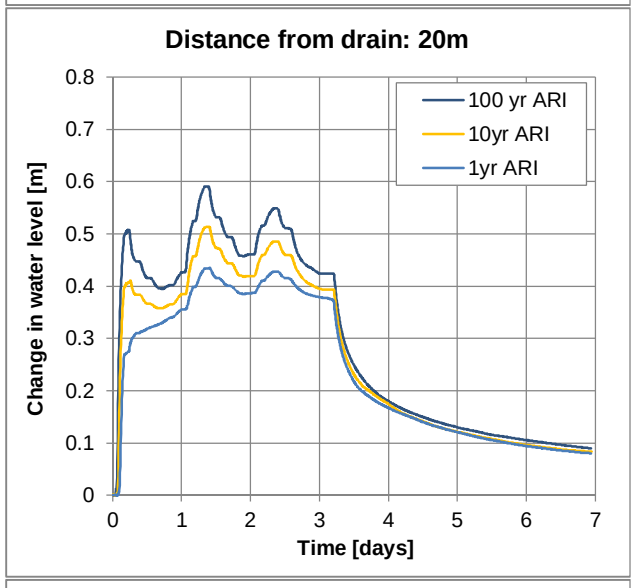


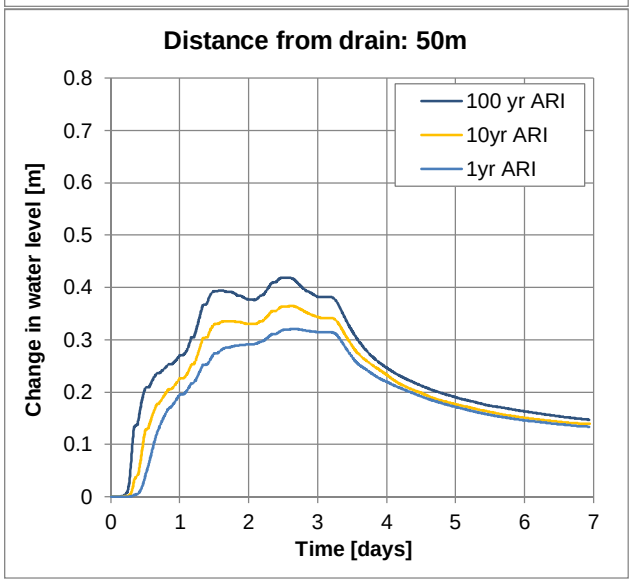
Groundwater modelling results
Scenario 1: dry conditions 72h rainfall event

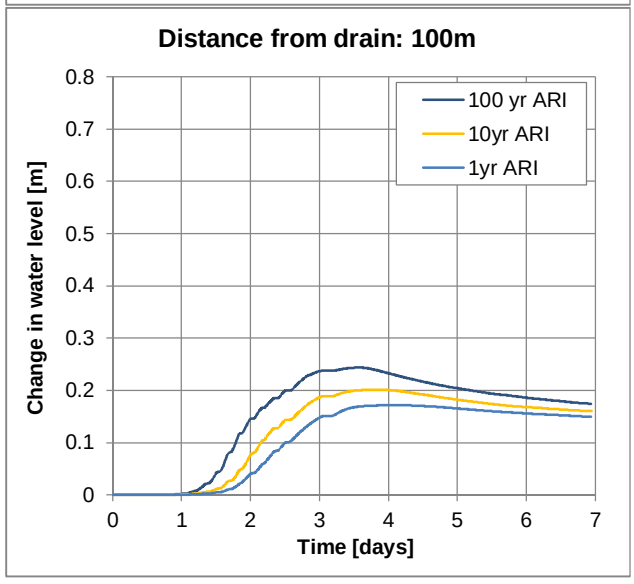




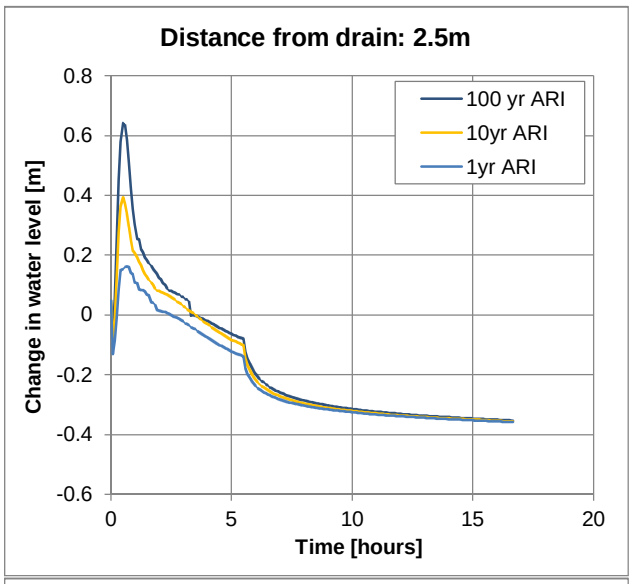


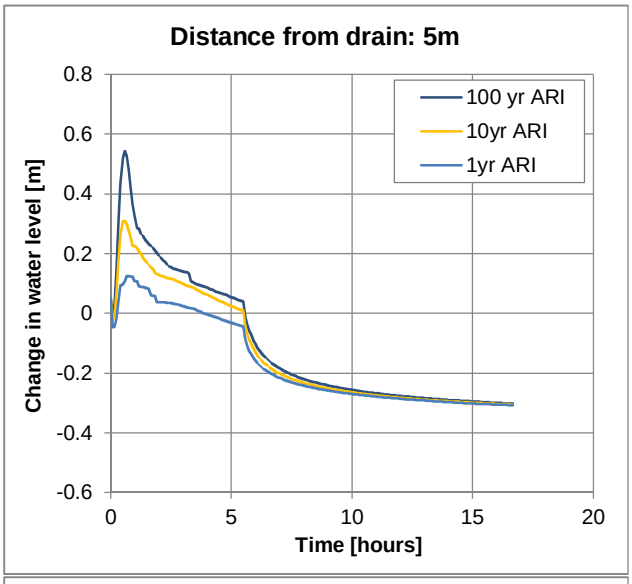


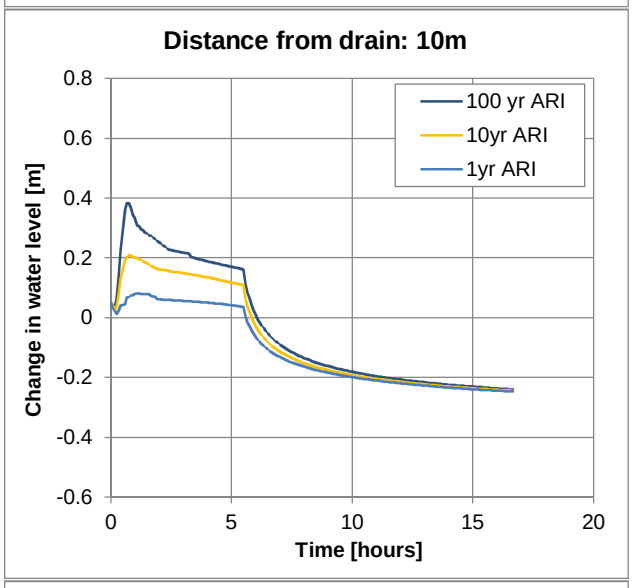


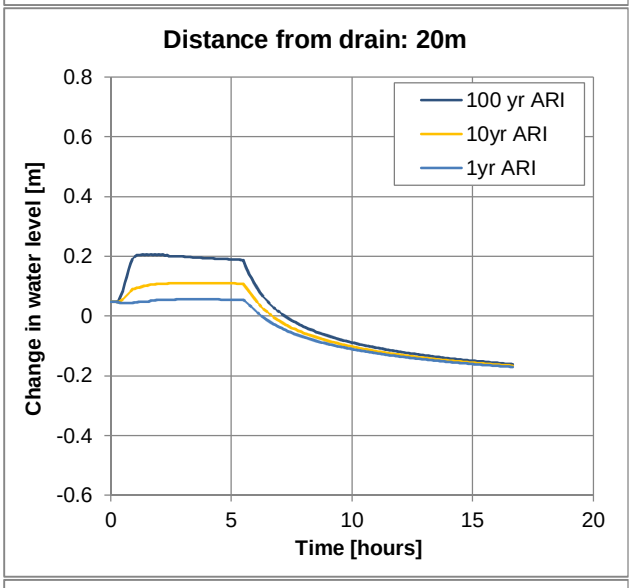


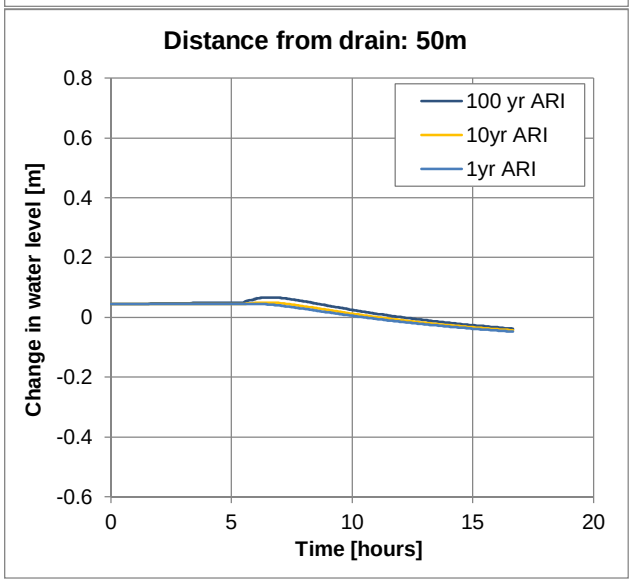
Groundwater modelling results
Scenario 2: average conditions 1h rainfall event

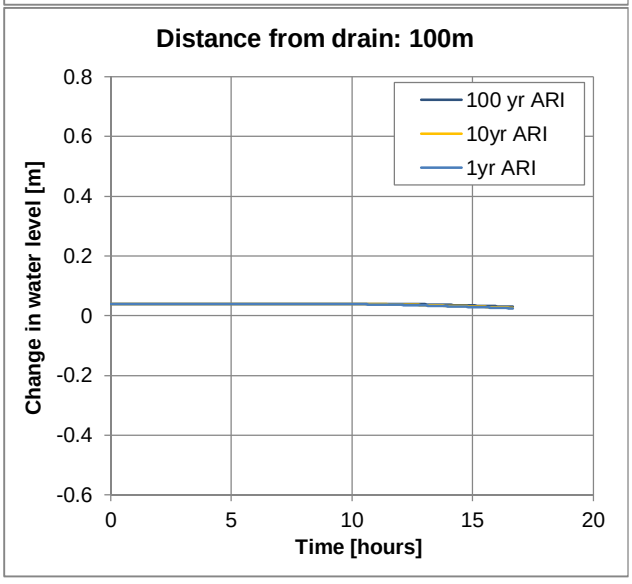




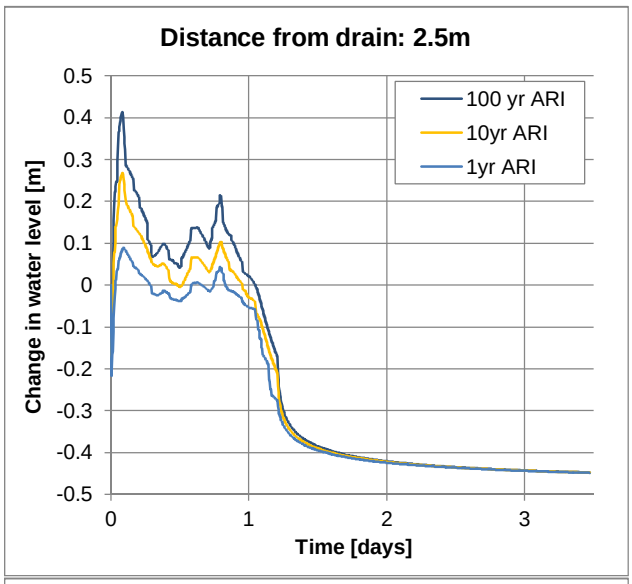


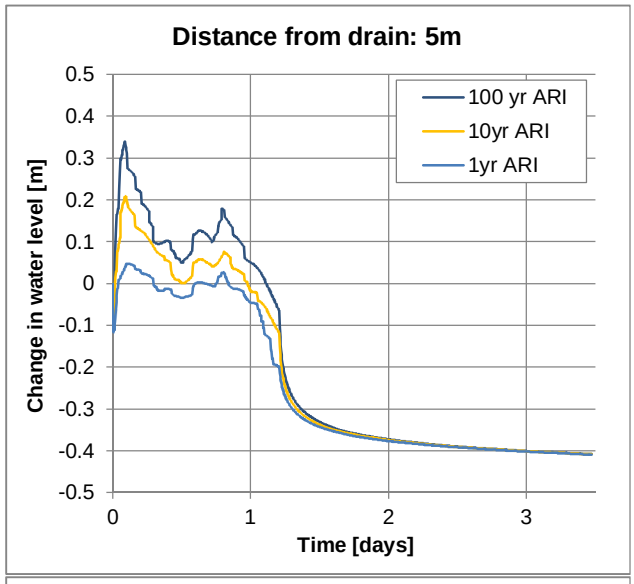


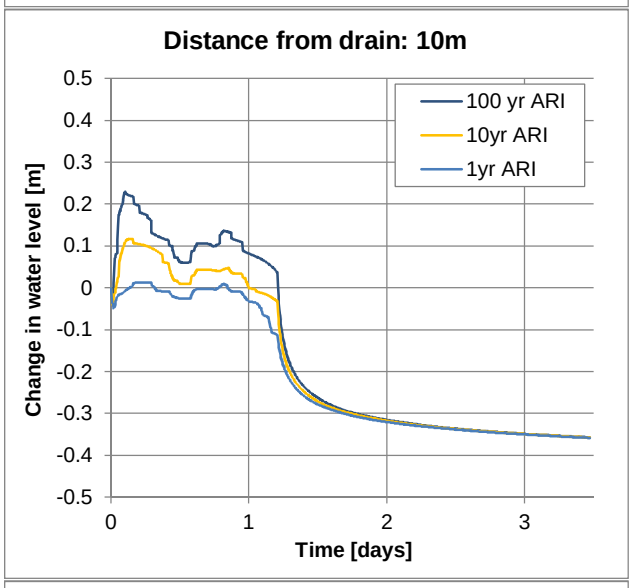


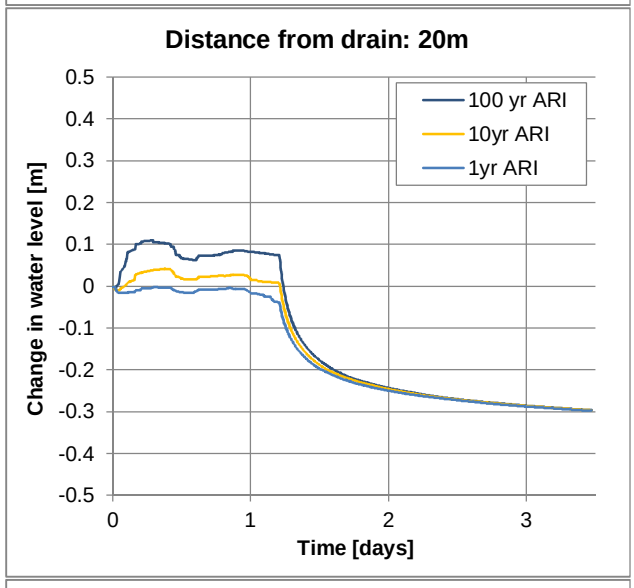


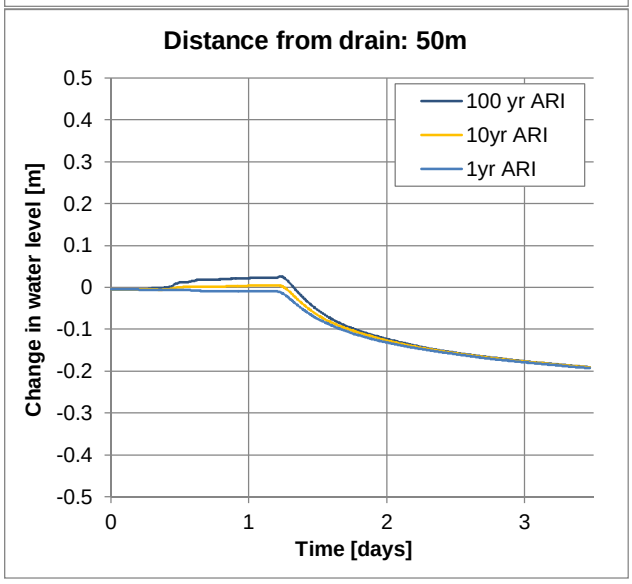
Groundwater modelling results
Scenario 2: average conditions 24h rainfall event

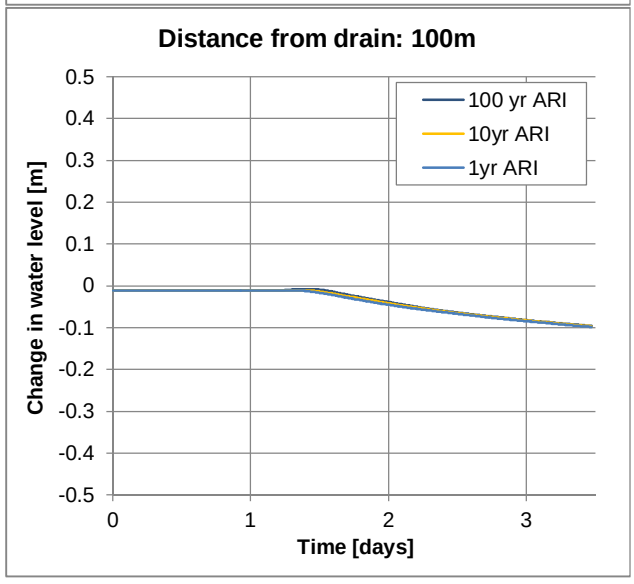




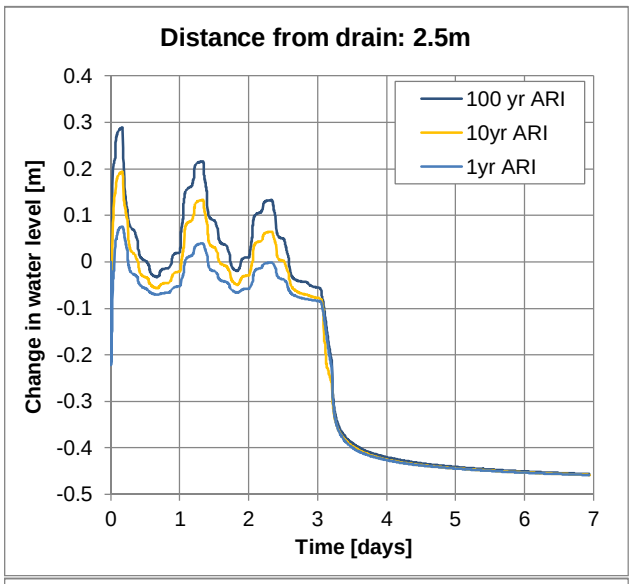


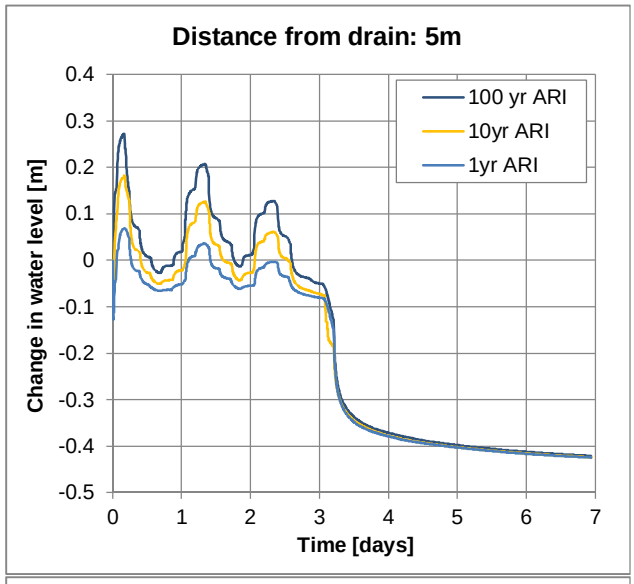


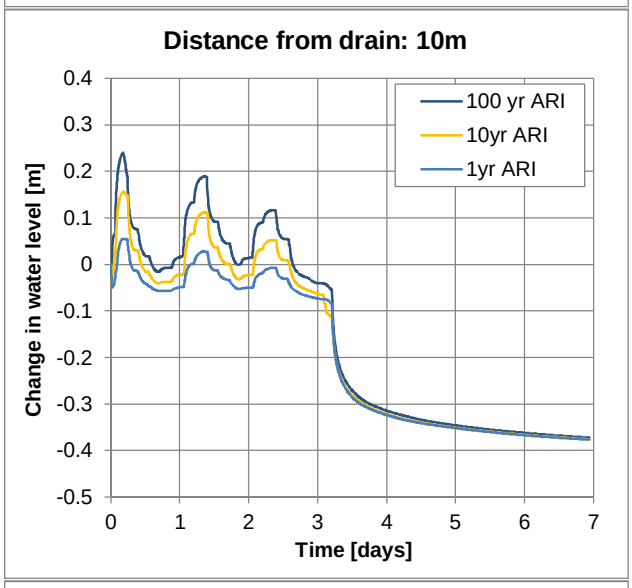


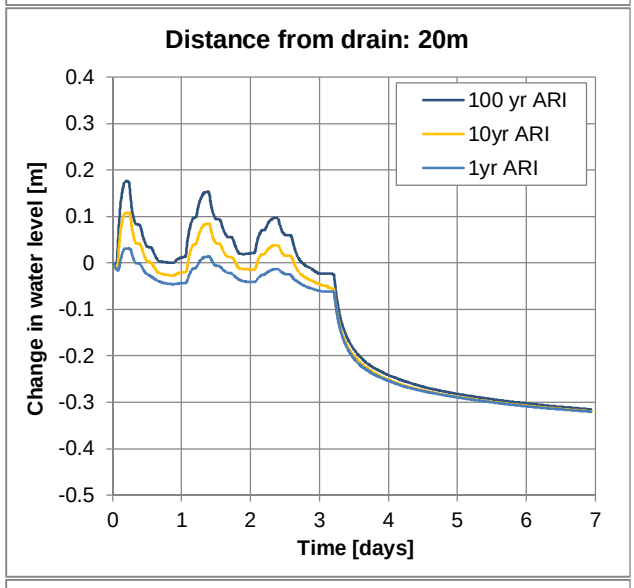


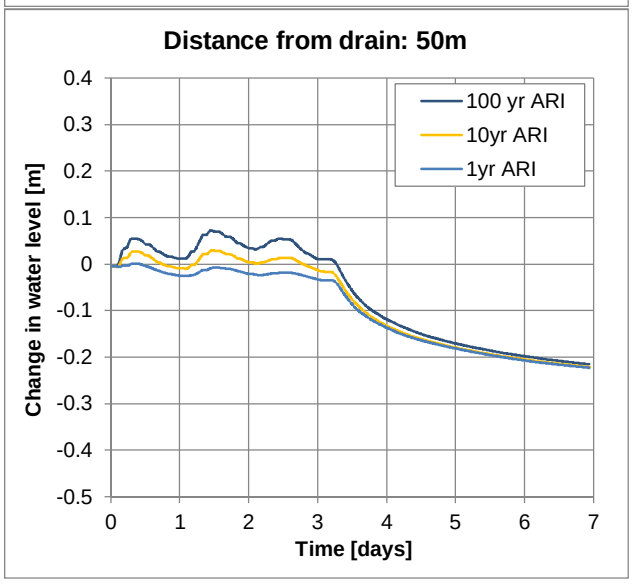
Groundwater modelling results
Scenario 2: average conditions 72h rainfall event

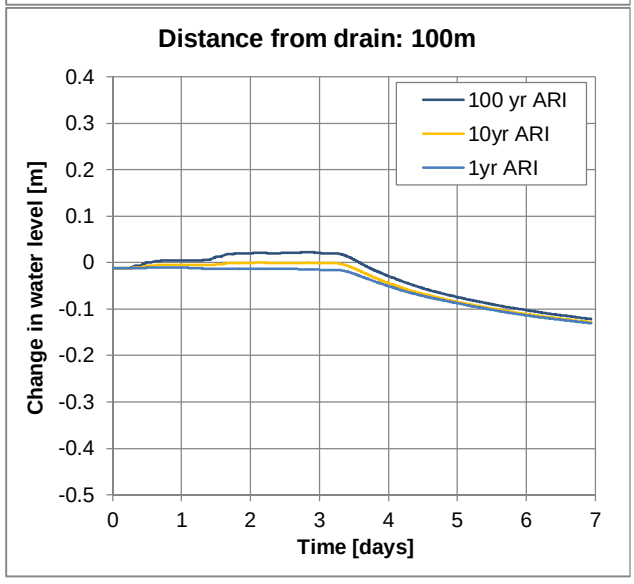




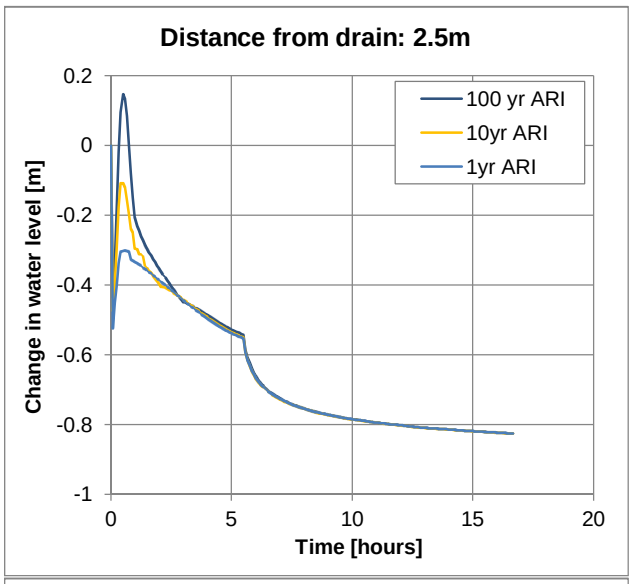


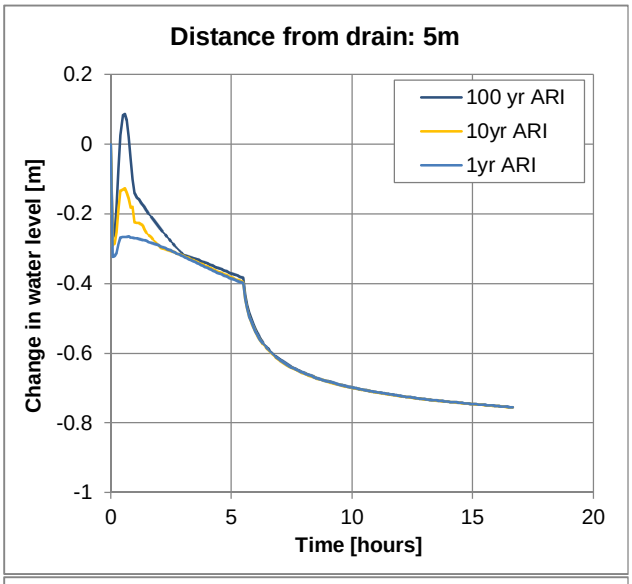


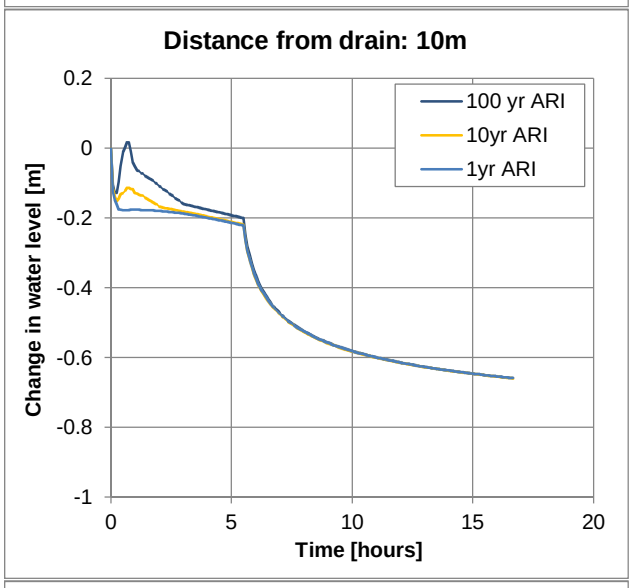


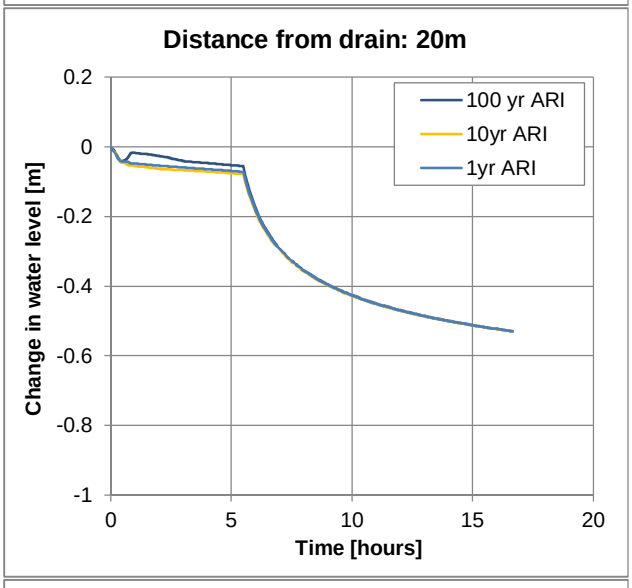


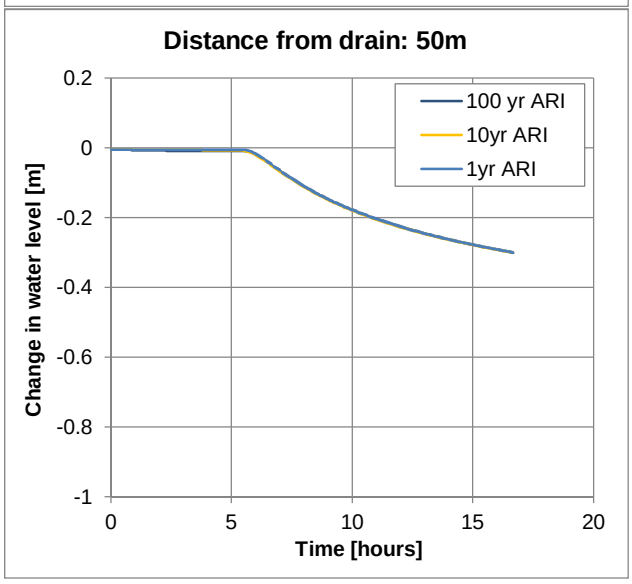
Groundwater modelling results
Scenario 3: wet conditions 1h rainfall event

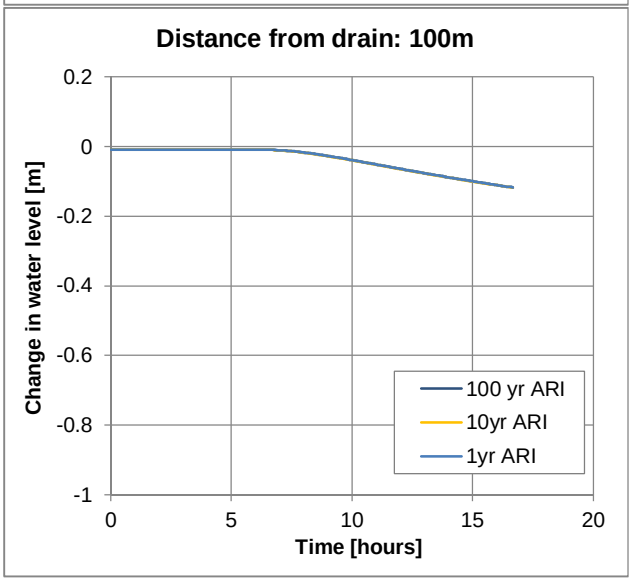




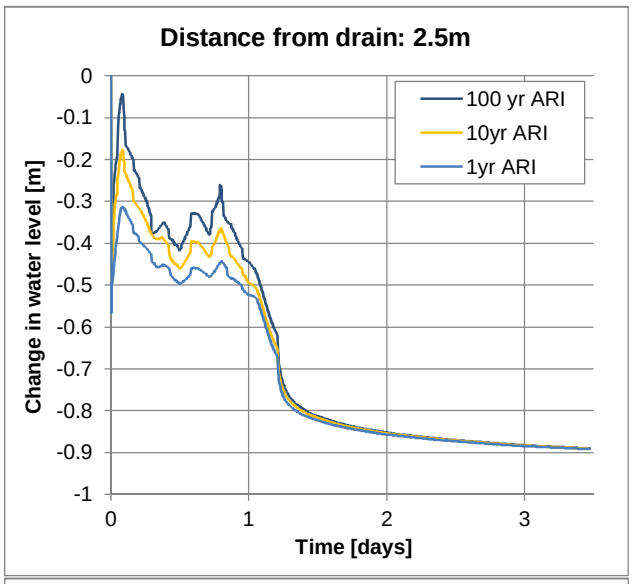


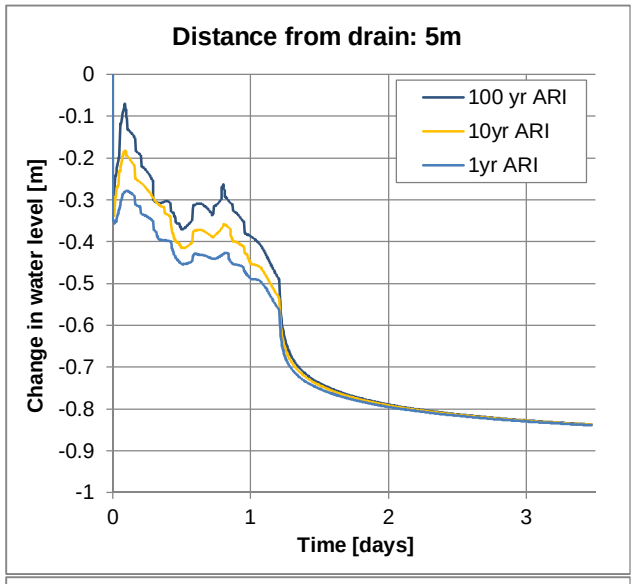


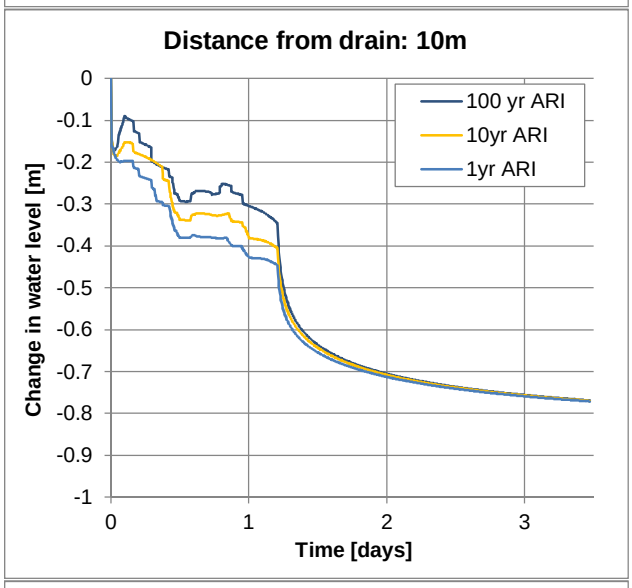


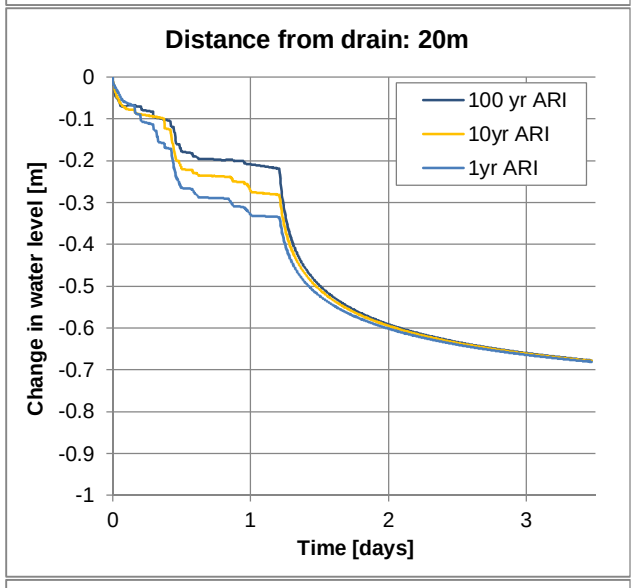


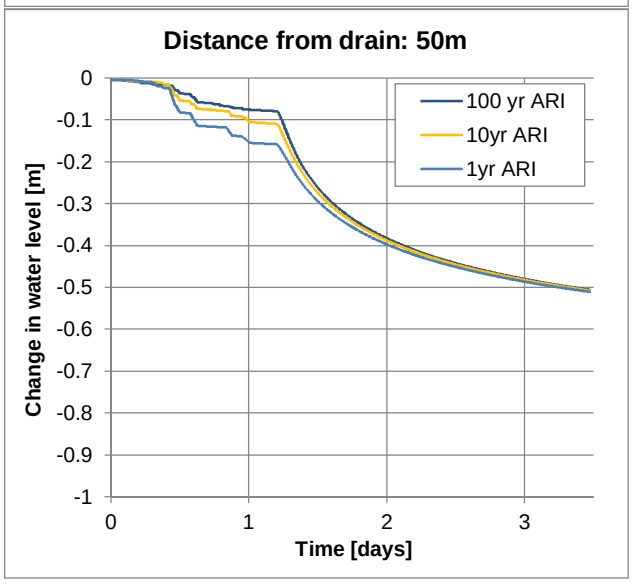
Groundwater modelling results
Scenario 3: wet conditions 24h rainfall event

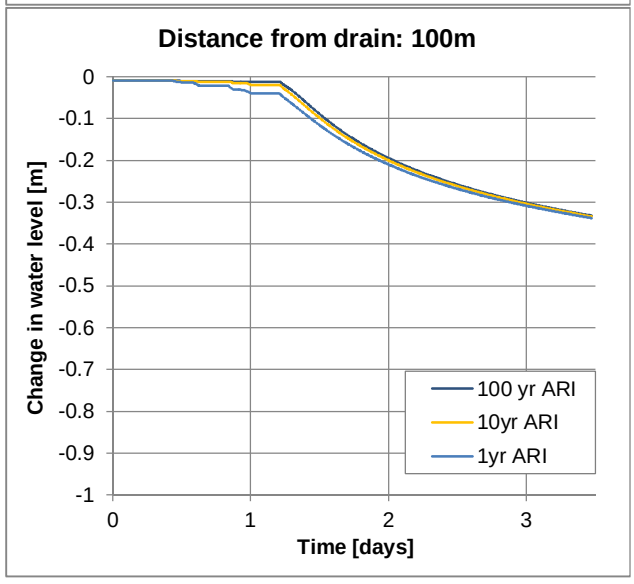




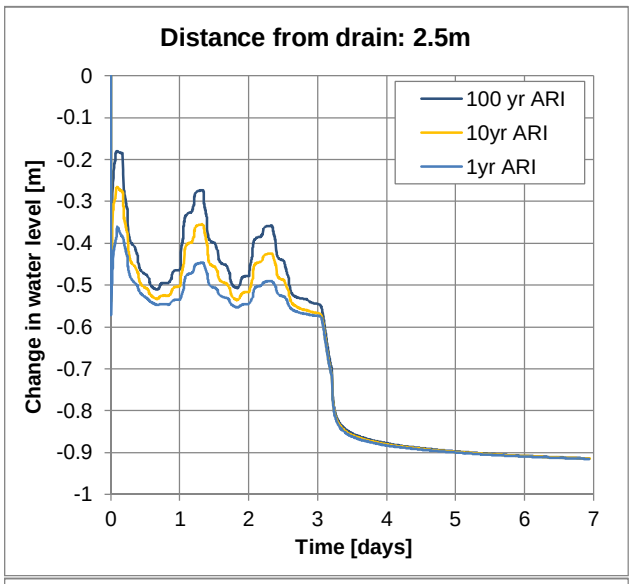


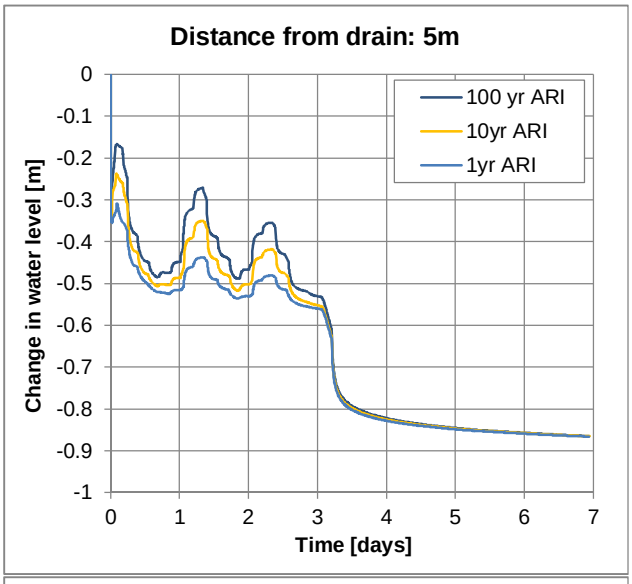


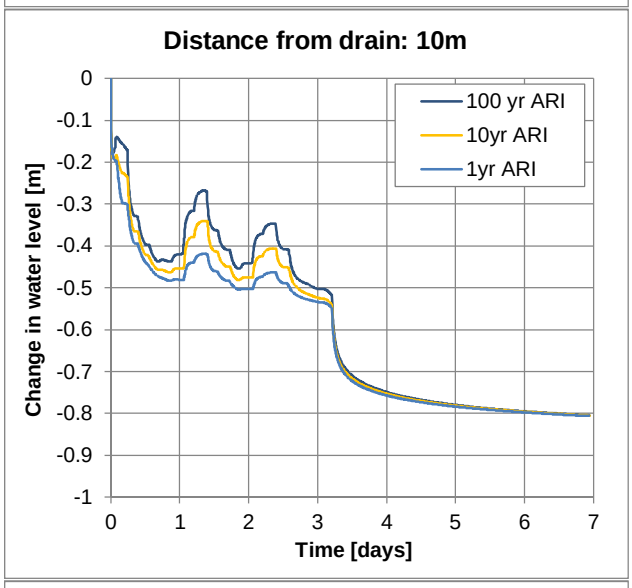


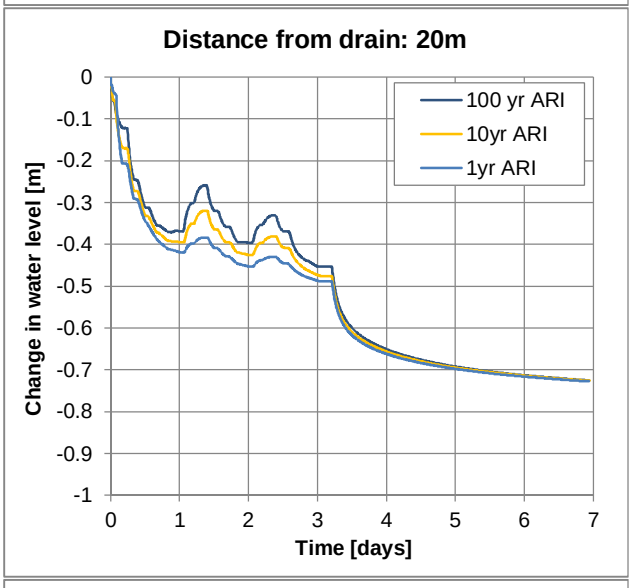


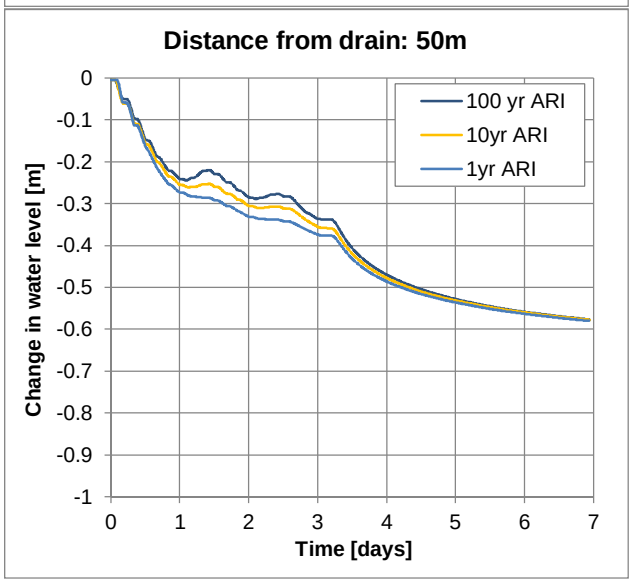
Groundwater modelling results
Scenario 3: wet conditions 72h rainfall event

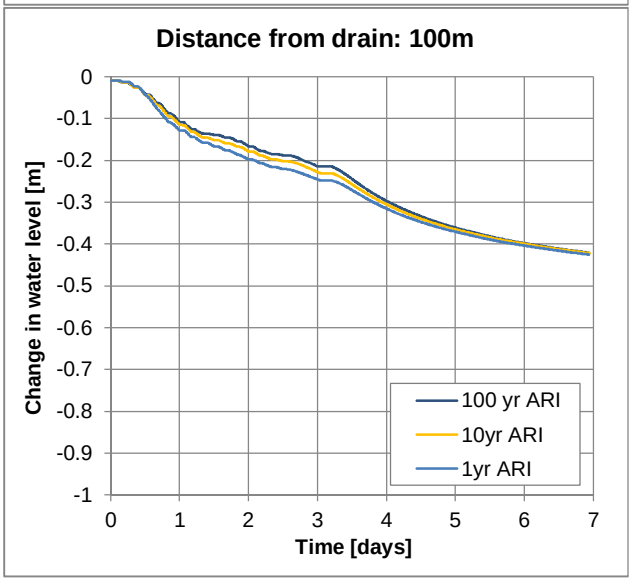






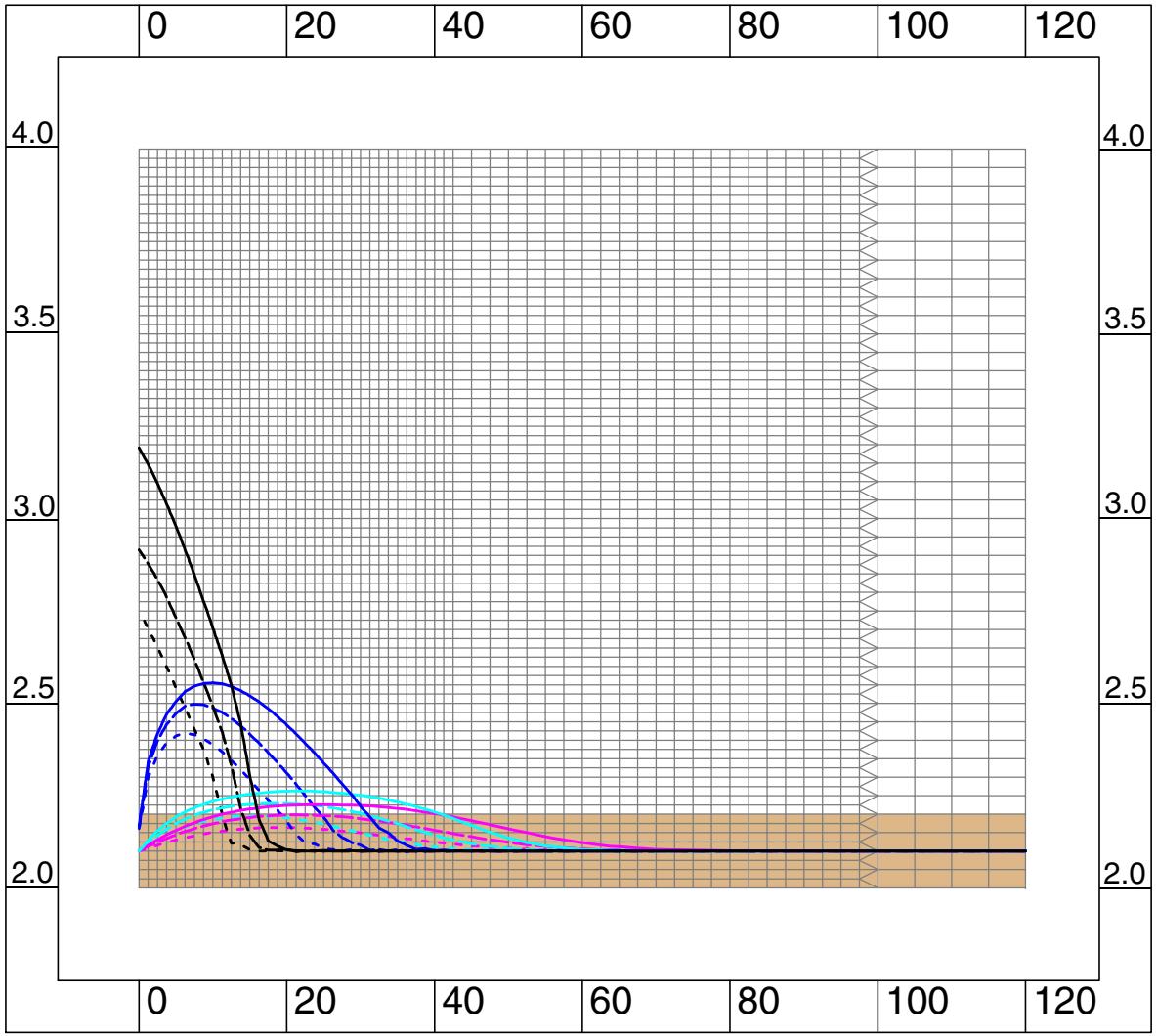






APPENDIX H

GROUNDWATER MODELLING RESULTS – PLOTS



LEGEND

Coffee Rock

FE mesh

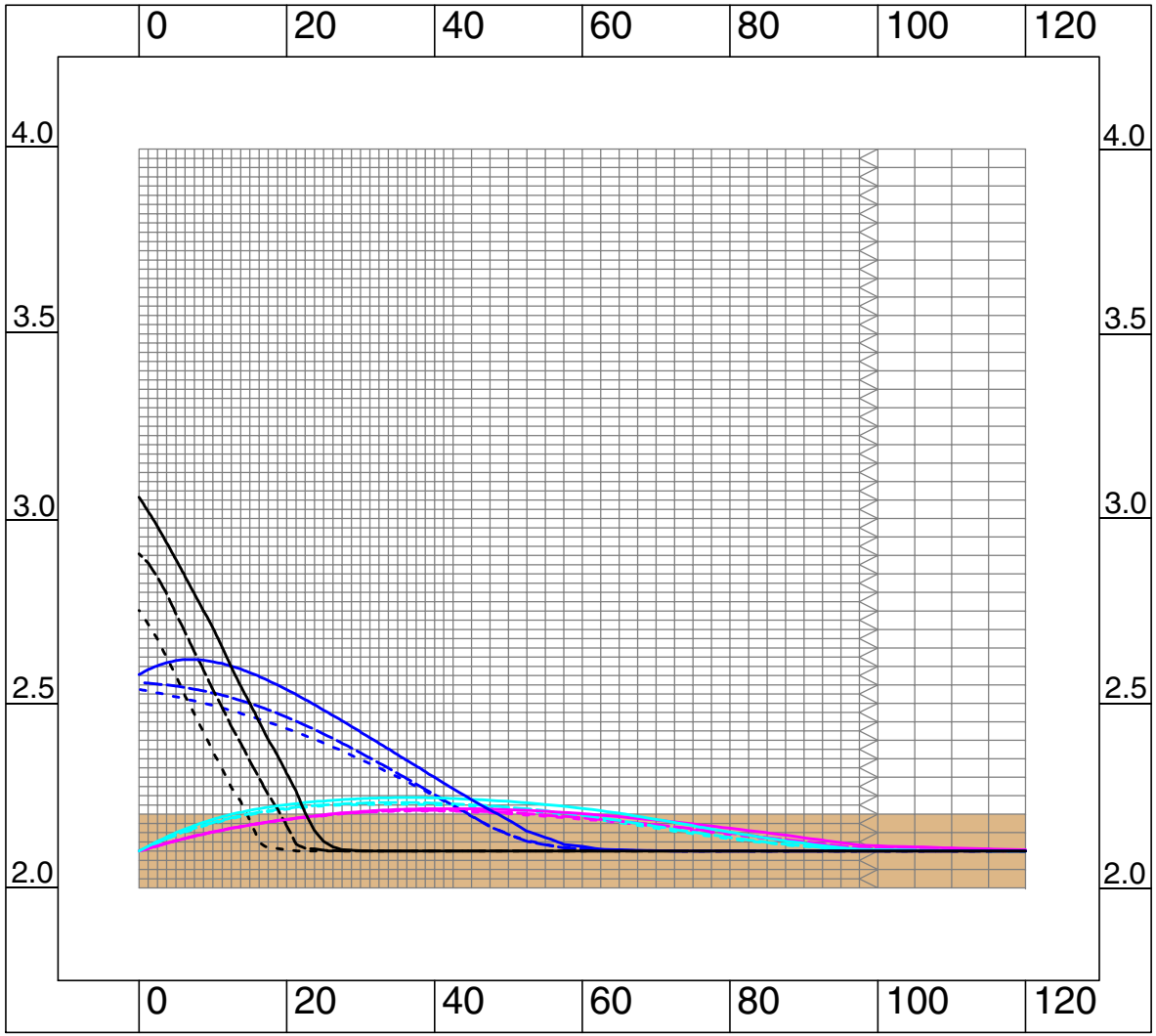
Groundwater Level after

- 40 minutes
- 5 hours
- 10 hours
- 15 hours

- 100 years ARI
- 10 years ARI
- 1 year ARI

waste solutions AUSTRALIA PTY LTD

Codlea Pty Ltd		W516-4
Groundwater Investigation, Aquifer Modelling and Sampling Report		
Groundwater Modelling Results *Scenario 1: dry conditions* 1 hr rainfall event		
Drawn by / Approved by IR / PS	Date December 2012	**Appendix H**



LEGEND

Coffee Rock

FE mesh

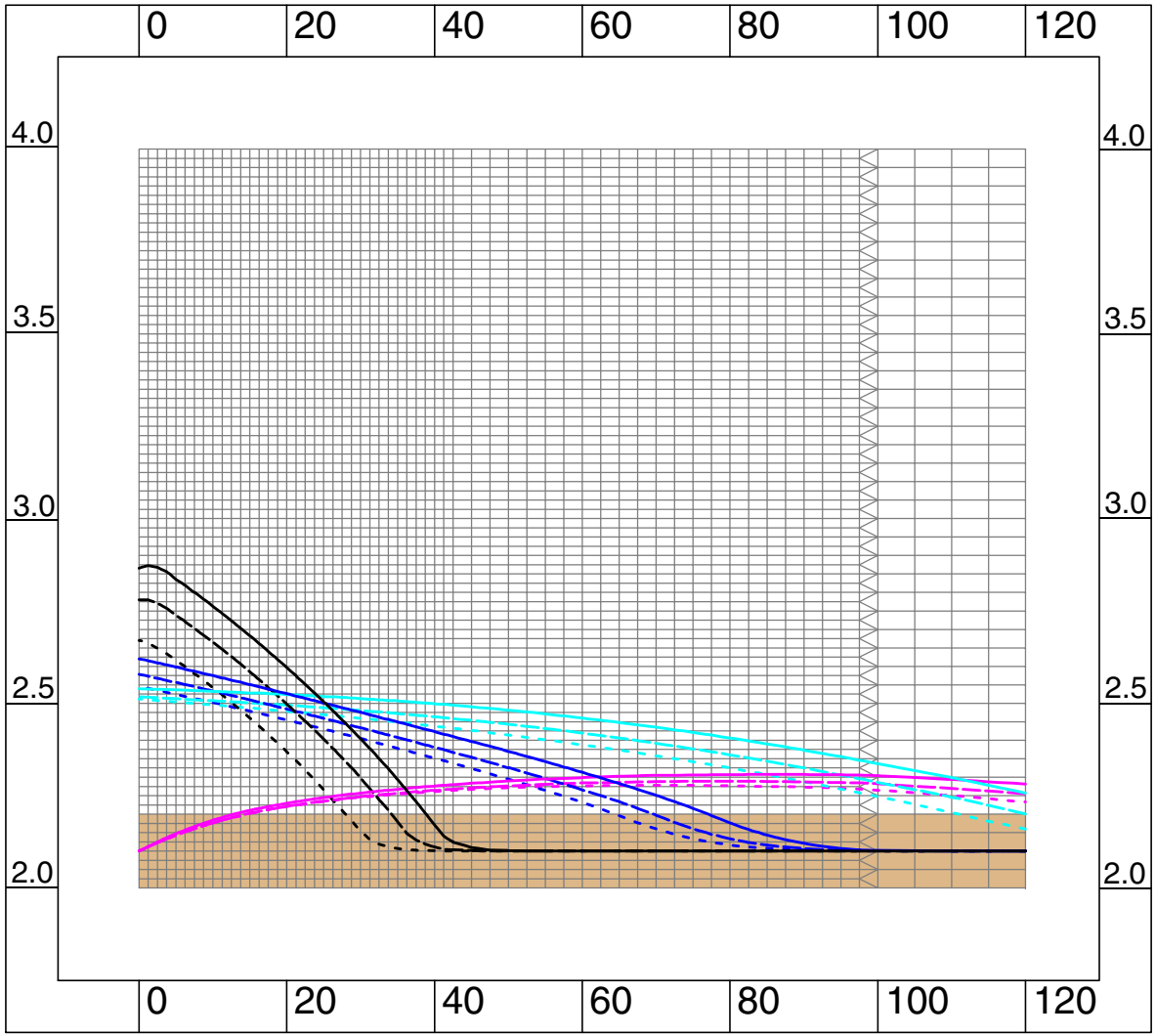
Groundwater Level after

- 2.2 hours
- 1 day
- 2 days
- 3 days

- 100 years ARI
- 10 years ARI
- 1 year ARI

waste solutions AUSTRALIA PTY LTD

Codlea Pty Ltd	W516-4
Groundwater Investigation, Aquifer Modelling and Sampling Report	
Groundwater Modelling Results *Scenario 1: dry conditions* 24 hr rainfall event	
Drawn by / Approved by: IR / PS	Date: December 2012
Appendix H	



LEGEND

Coffee Rock

FE mesh

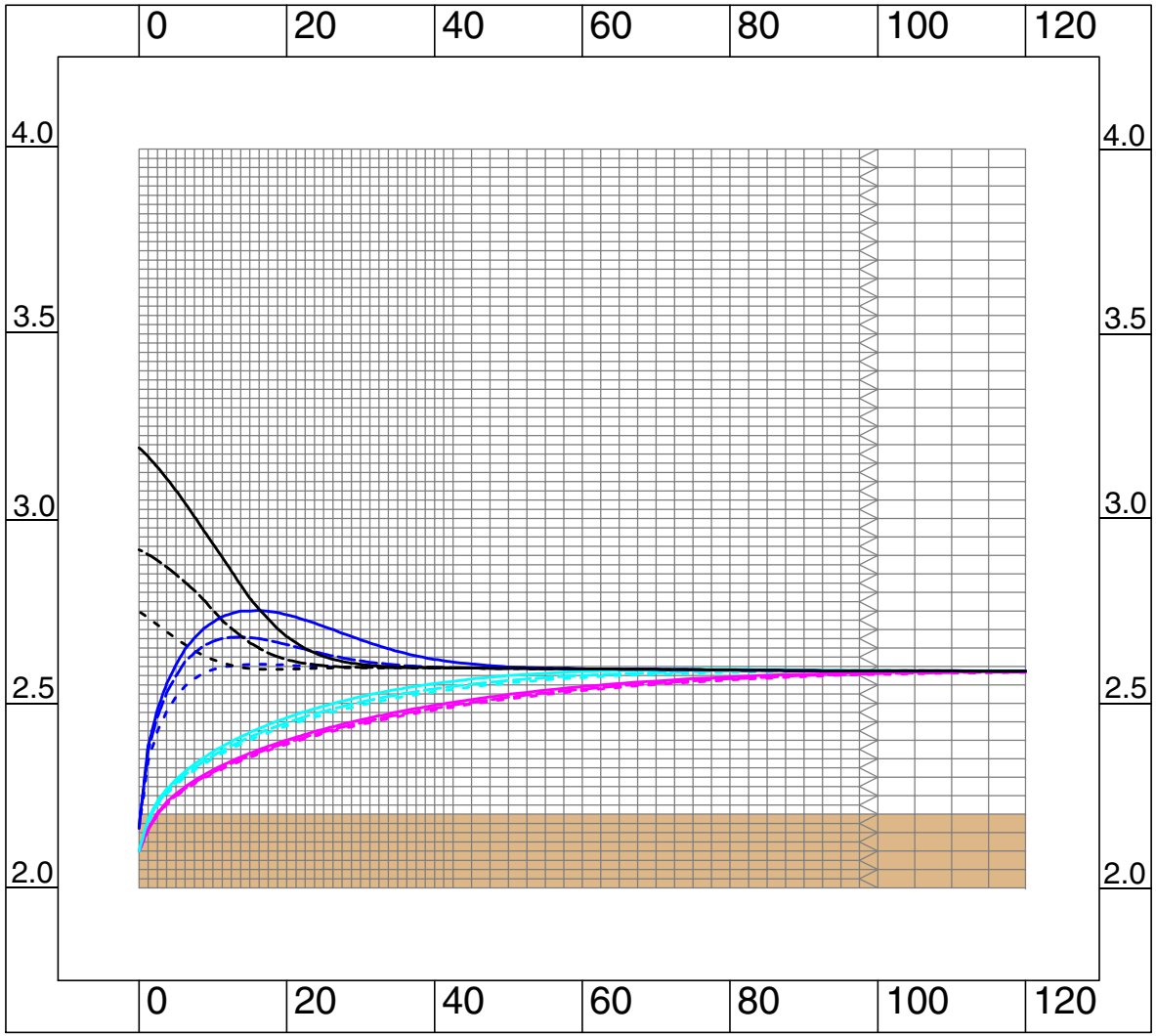
Groundwater Level after

- 4 hours
- 1 day
- 3 days
- 5 days

- 100 years ARI
- 10 years ARI
- 1 year ARI

waste solutions AUSTRALIA PTY LTD

Codlea Pty Ltd	W516-4
Groundwater Investigation, Aquifer Modelling and Sampling Report	
Groundwater Modelling Results *Scenario 1: dry conditions* 72 hr rainfall event	
Drawn by / Approved by: IR / PS	Date: December 2012
Appendix H	



LEGEND

Coffee Rock

FE mesh

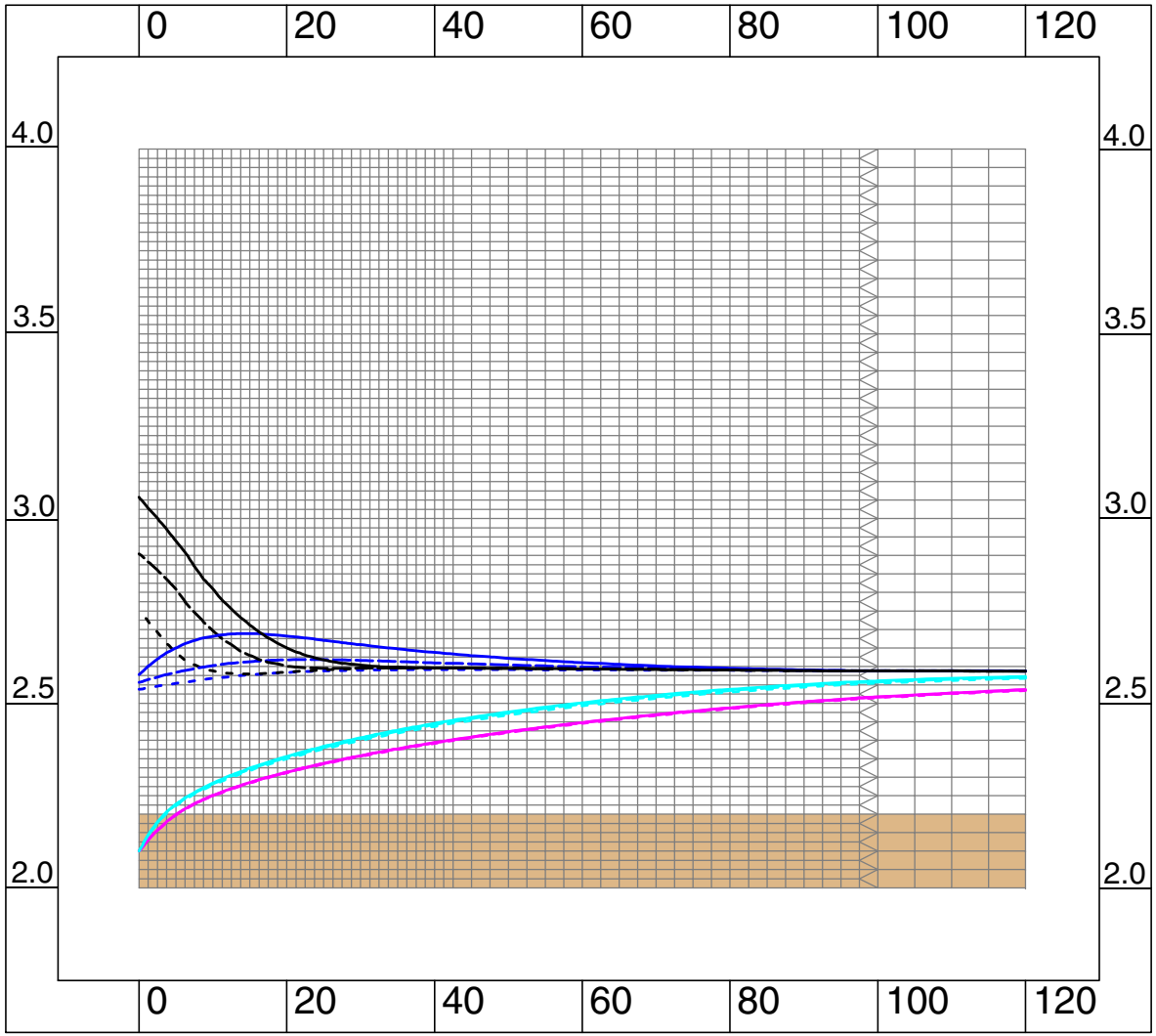
Groundwater Level after

- 40 minutes
- 5 hours
- 10 hours
- 15 hours

- 100 years ARI
- 10 years ARI
- 1 year ARI

waste solutions AUSTRALIA PTY LTD

Codlea Pty Ltd	W516-4
Groundwater Investigation, Aquifer Modelling and Sampling Report	
Groundwater Modelling Results *Scenario 2: average conditions* 1 hr rainfall event	
Drawn by / Approved by: IR / PS	Date: December 2012
Appendix H	



LEGEND

Coffee Rock

FE mesh

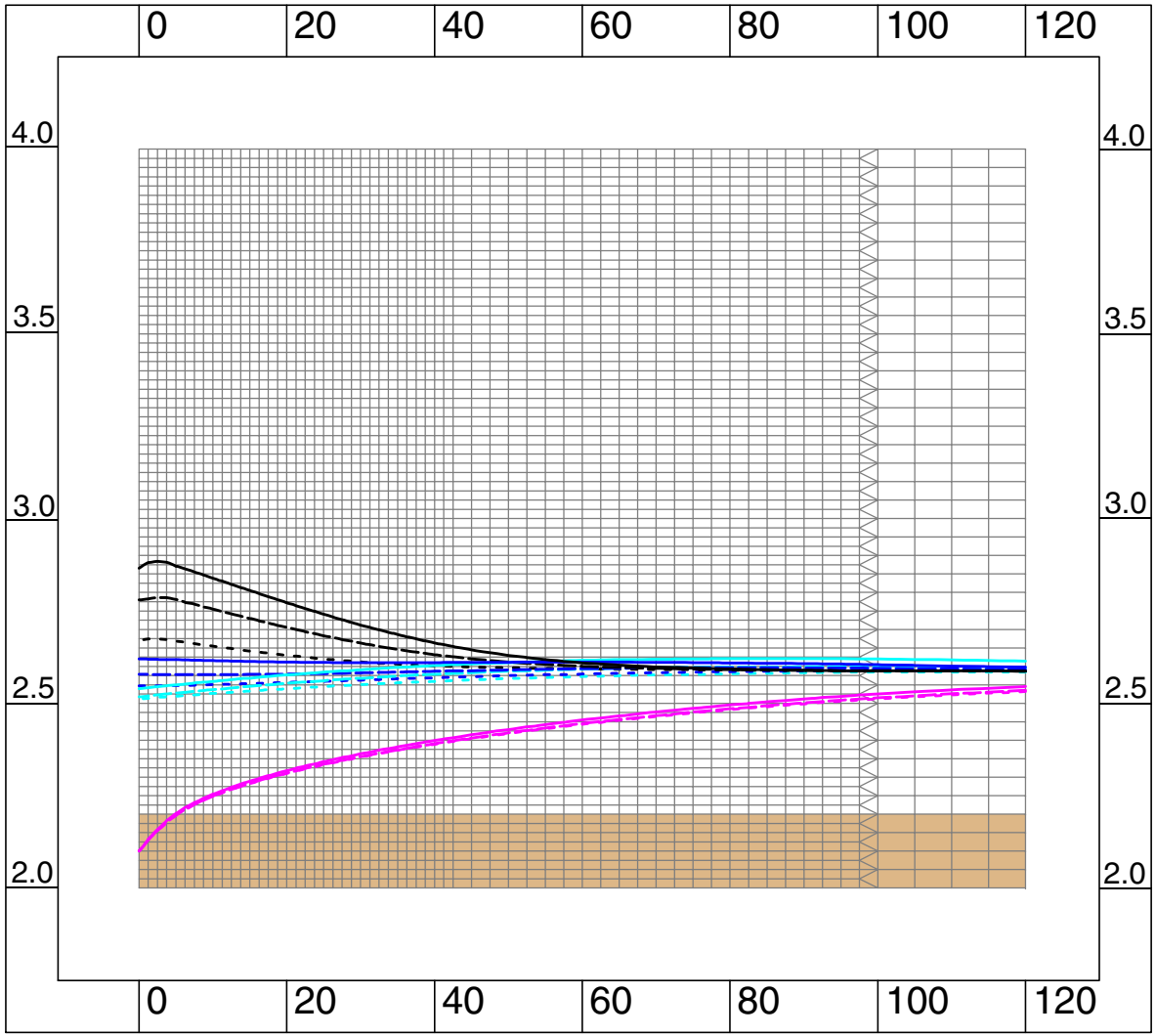
Groundwater Level after

- 2.2 hours
- 1 day
- 2 days
- 3 days

- 100 years ARI
- 10 years ARI
- 1 year ARI

waste solutions AUSTRALIA PTY LTD

Codlea Pty Ltd	W516-4
Groundwater Investigation, Aquifer Modelling and Sampling Report	
Groundwater Modelling Results *Scenario 2: average conditions* 24 hr rainfall event	
Drawn by / Approved by: IR / PS	Date: December 2012
Appendix H	



LEGEND

Coffee Rock

FE mesh

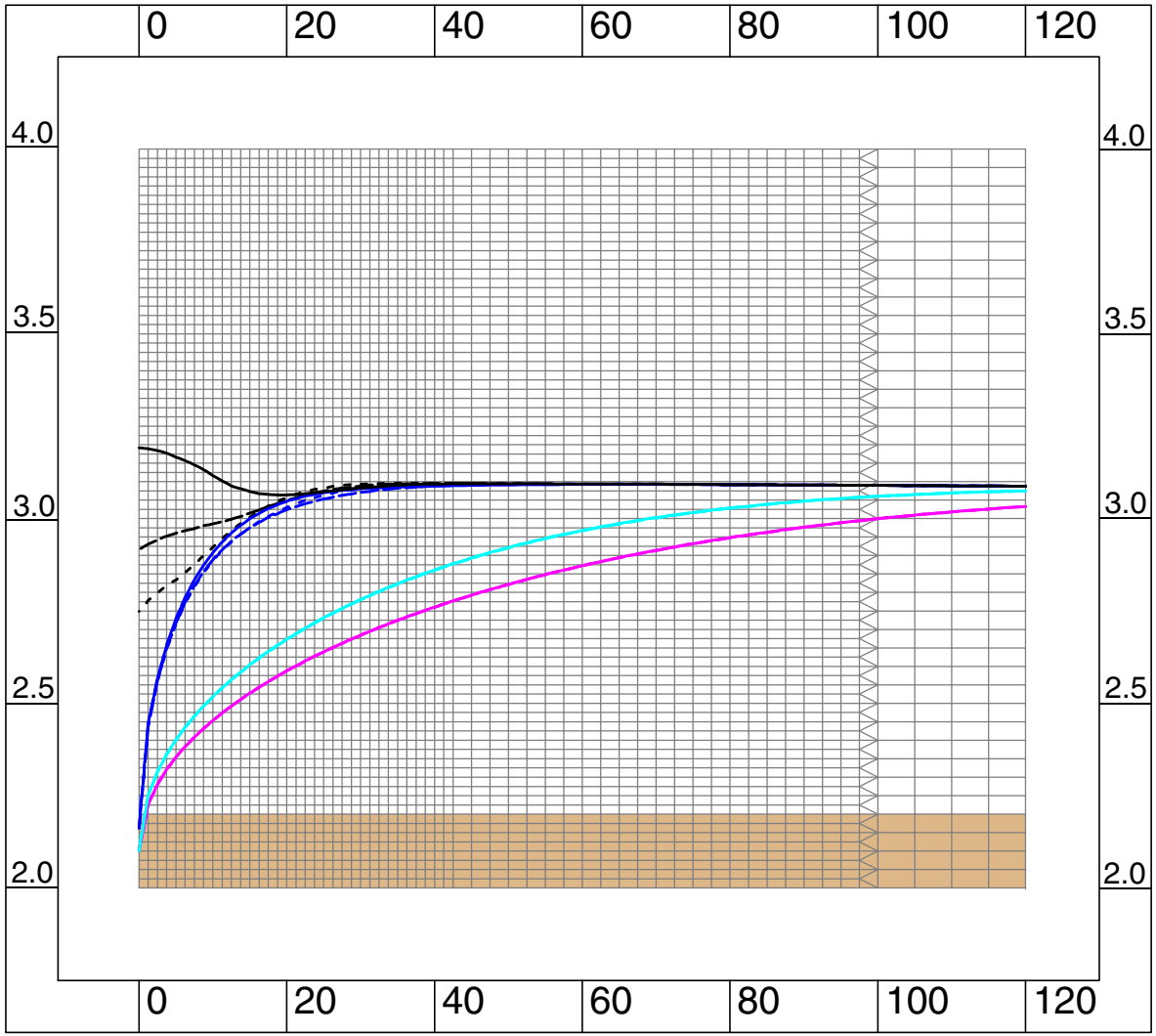
Groundwater Level after

- 4 hours
- 1 day
- 3 days
- 5 days

- 100 years ARI
- 10 years ARI
- 1 year ARI

waste solutions AUSTRALIA PTY LTD

Codlea Pty Ltd	W516-4
Groundwater Investigation, Aquifer Modelling and Sampling Report	
Groundwater Modelling Results *Scenario 2: average conditions* 72 hr rainfall event	
Drawn by / Approved by: IR / PS	Date: December 2012
Appendix H	



LEGEND

Coffee Rock

FE mesh

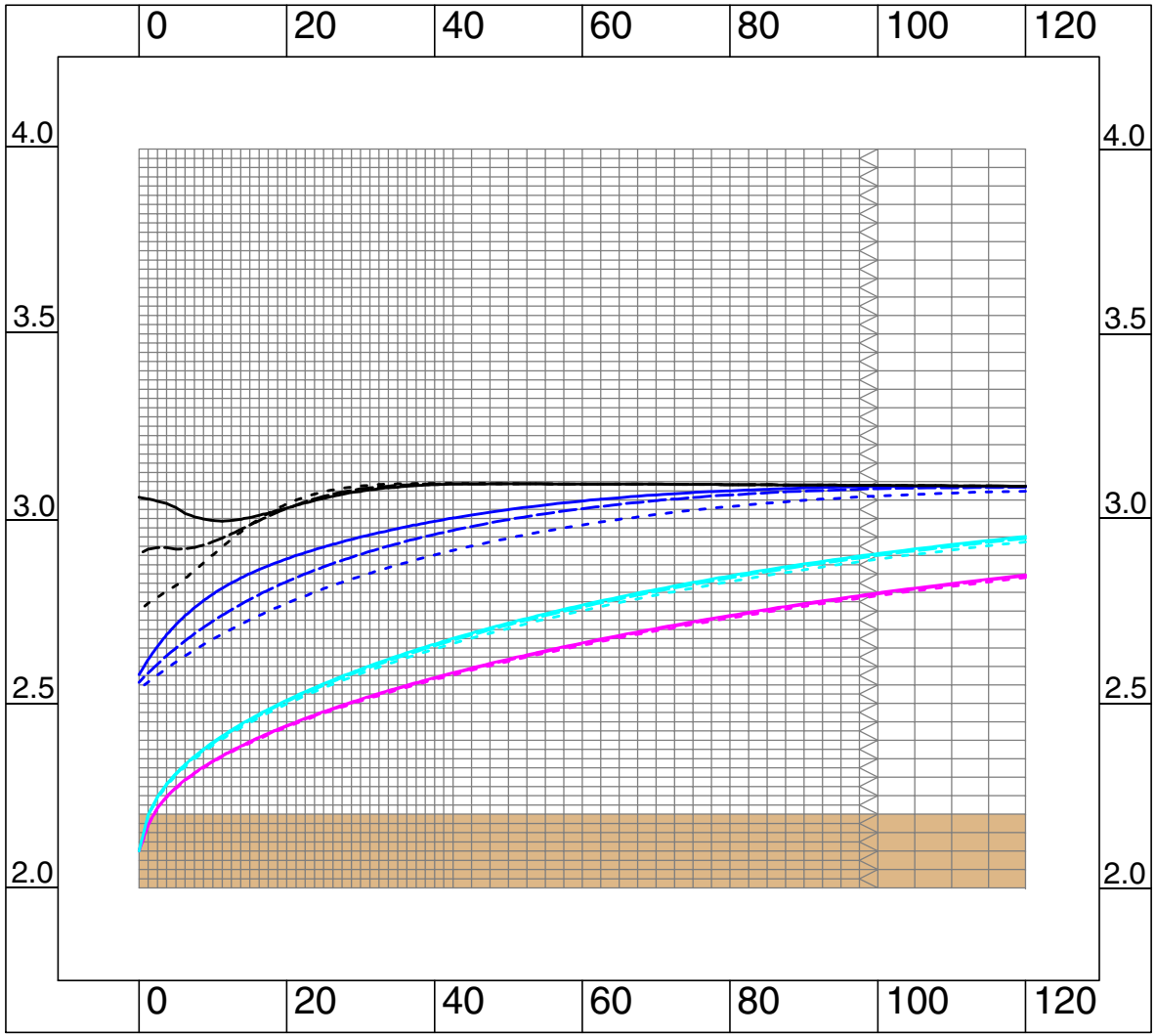
Groundwater Level after

- 40 minutes
- 5 hours
- 10 hours
- 15 hours

- 100 years ARI
- 10 years ARI
- 1 year ARI

waste solutions AUSTRALIA PTY LTD

Codlea Pty Ltd	W516-4
Groundwater Investigation, Aquifer Modelling and Sampling Report	
Groundwater Modelling Results *Scenario 3: wet conditions* 1 hr rainfall event	
Drawn by / Approved by: IR / PS	Date: December 2012
Appendix H	



LEGEND

Coffee Rock

FE mesh

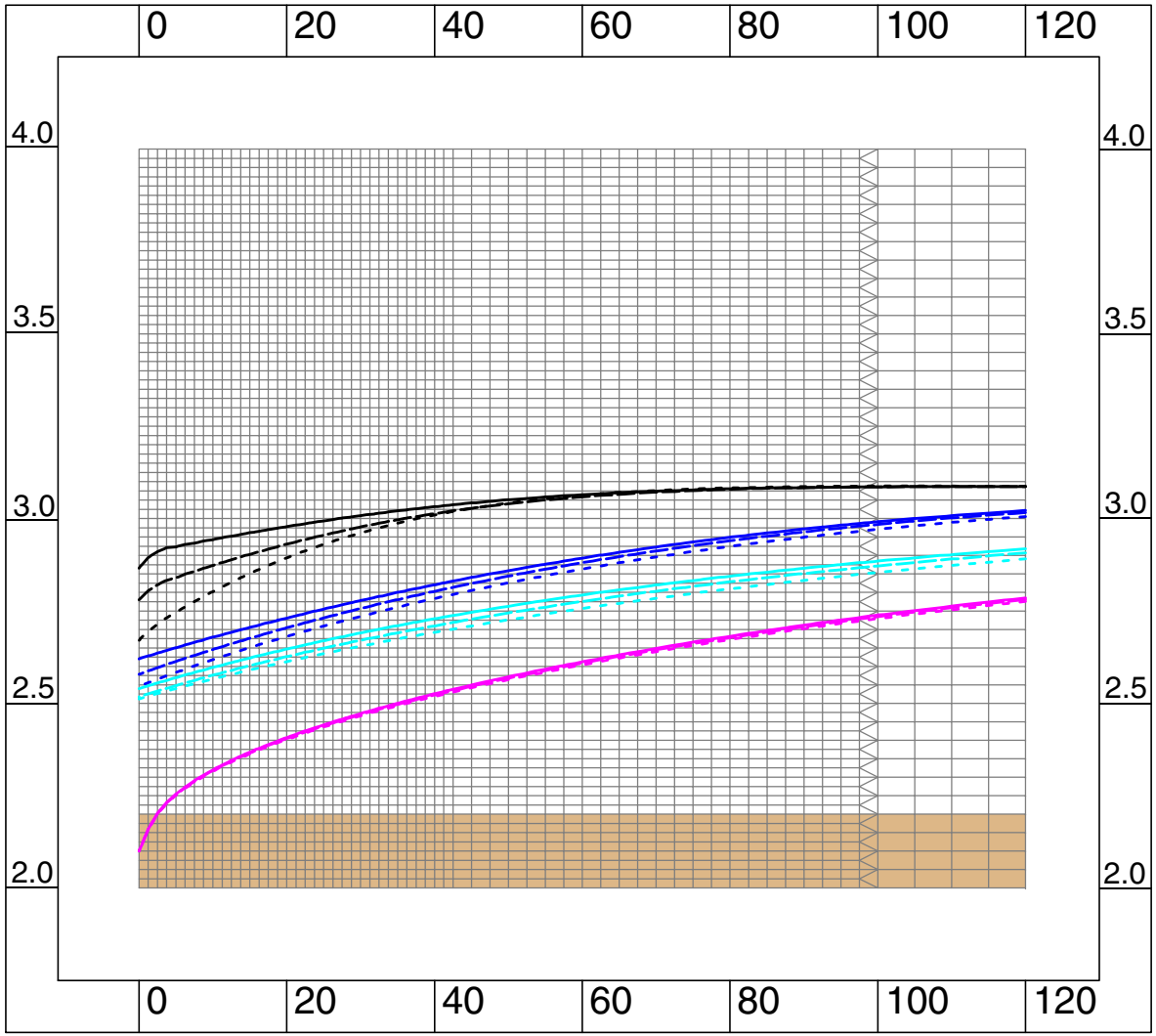
Groundwater Level after

- 2.2 hours
- 1 day
- 2 days
- 3 days

- 100 years ARI
- 10 years ARI
- 1 year ARI

waste solutions AUSTRALIA PTY LTD

Codlea Pty Ltd	W516-4
Groundwater Investigation, Aquifer Modelling and Sampling Report	
Groundwater Modelling Results *Scenario 3: wet conditions* 24 hr rainfall event	
Drawn by / Approved by IR / PS	Date December 2012
Appendix H	



LEGEND

Coffee Rock

FE mesh

Groundwater Level after

- 4 hours
- 1 day
- 3 days
- 5 days

- 100 years ARI
- 10 years ARI
- 1 year ARI

waste solutions AUSTRALIA PTY LTD

Codlea Pty Ltd	W516-4
Groundwater Investigation, Aquifer Modelling and Sampling Report	
Groundwater Modelling Results *Scenario 3: wet conditions* 72 hr rainfall event	
Drawn by / Approved by: IR / PS	Date: December 2012
Appendix H	