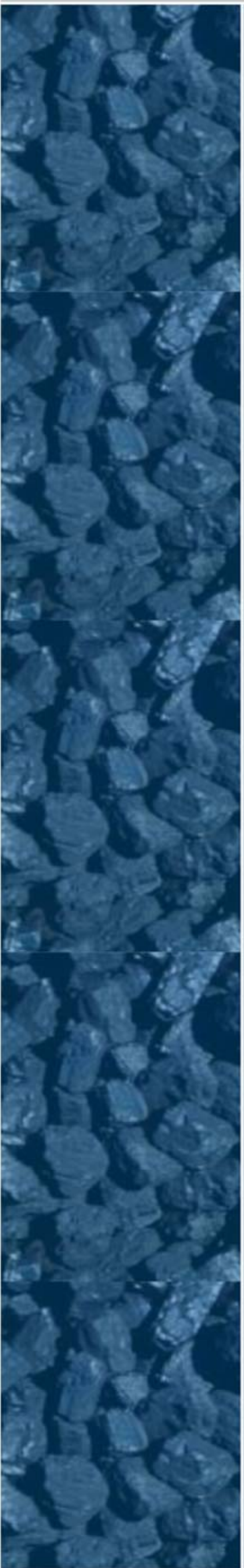
Adani Mining Pty Ltd



Carmichael Coal Mine and Rail Project SEIS

Report for Mine Water Quality

24 October 2013

Executive summary

Adani Mining Pty Ltd (Adani, the Proponent), commenced an Environmental Impact Statement (EIS) process for the Carmichael Coal Mine and Rail Project (the Project) in 2010. On 26 November 2010, the Queensland (Qld) Office of the Coordinator General declared the Project a 'significant project' and the Project was referred to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (referral No. 2010/5736). The Project was assessed to be a controlled action on the 6 January 2011 under section 75 and section 87 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This report provides an update of surface water quality assessment of the Project (Mine) as part of the supplementary environmental impact statement (SEIS). A combination of desktop and field assessments were undertaken to describe the existing surface water resources that may be affected by the Carmichael Coal Mine and Rail Project (the Project (Mine)) in the context of environmental values (EVs) as defined by:

- Queensland Environmental Protection Act 1994 (EP Act)
- Queensland Environmental Protection (Water) Policy 2009 (EPP (Water))
- Australia and New Zealand Guidelines for Fresh and Marine Water Quality 2000 (the ANZECC guidelines) (ANZECC and ARMCANZ, 2000)
- Queensland Water Quality Guidlines 2009 (QWQG) (DERM, 2009a)

In order to characterise the quality of the surface water resources within the Study Area a field-based water and in-stream sediment quality assessment was undertaken from April 2011 to April 2013. Water samples were collected during the dry season from April – September 2011 and the wet season November 2012 – April 2013. Samples were taken during the 2012/2013 wet season to fill gaps identified by the DEHP. Four sites representative of the resources within the Study Area were assessed. These sites were located on the Carmichael River, one on Cabbage Tree Creek and three on Eight Mile Creek. Sampling was also undertaken at four dam locations during the dry season.

The sampling program was comprised of a combination of *in-situ* sampling of physical water quality parameters, collection of water samples for laboratory analysis of basic and broad suites, and collection of sediment samples for laboratory analysis. All sampling was undertaken in accordance with the requirements of the QWQG (DERM, 2009a), the Monitoring and Sampling Manual 2009 (DERM, 2009b), and the Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines (ANZECC and ARMCANZ, 2000).

Physical water quality parameters measured include temperature, turbidity, dissolved oxygen (DO), electrical conductivity (EC) and pH. The basic analytical suite was comprised of nutrients, chlorophyll a, faecal coliforms, total dissolved solids and total suspended solids. The broad analytical suite was comprised of total and dissolved metals, hydrocarbons (total and polycyclic aromatic hydrocarbons (PAHs)), major anions and cations, fluoride, silicon, and hardness.

In-stream sediment samples were analysed once during the monitoring program for physical parameters including grain size, total organic carbon and moisture content, total metals, nutrients, hydrocarbons (total and PAHs) and faecal coliforms. Additional sediment samples were collected from the monitoring sites that did not contain any water during the monitoring program. These samples were subject to a deionised water leach preparation. The resulting supernatant was analysed in order to gain an understanding of the potential for release of contaminants during flow events.

Quality Assurance/Quality Control procedures were undertaken in accordance with the requirements of the Monitoring and Sampling Manual (DERM, 2009b). Similarly, analysis of the data was undertaken in accordance with the various guidelines. Interpretation of results to the nominated water quality objectives (WQOs) was undertaken by comparing:

- Median values for physical parameters and nutrient data (refer to QWQG; DERM 2009a)
- 80^{th} percentile values for toxicant data (refer to the ANZECC guidelines; ANZECC and ARMCANZ, 2000)

Where appropriate, hardness-modified trigger values were calculated for the comparison of metal data, as required by the ANZECC guidelines (ANZECC and ARMCANZ, 2000).

The existing surface water resources within the Study Area include the Carmichael River, two ephemeral creek drainage lines (Cabbage Tree Creek and Eight Mile Creek) and thirteen farm dams. The Carmichael River, designated as a fifth order stream (DERM, 2010), is the major surface water resource within the Study Area. The flow regime of the Carmichael River (further described in Volume 4 Appendix P) is subject to seasonal variability as wet season overland flow drains from the catchment. Late in the dry season the Carmichael River is reduced to a low flow environment, interspersed with deeper pools. The Carmichael River was characterised by a well-established riparian zone that provided extensive shading of the water. Conversely, the farm dam sites and Cabbage Tree Creek all had limited riparian zones, resulting in increased exposure to direct radiance from the sun.

An assessment of the water chemistry of the Carmichael River and nearby groundwater resources, Doongmabulla Springs, identified that it is likely that the surface water quality of the Carmichael River is influenced by the nearby groundwater aquifers. Temporal changes in the surface water chemistry also indicate that the influence of groundwater on the Carmichael River is greater in the dry season than in the wet season when rain water is entering the system.

Parameters analysed as part of the monitoring program displayed both spatial and temporal variations. Spatial patterns were consistently related to the differences between the types of water resources (Carmichael River versus non-flowing environments). Sites sampled along the Carmichael River displayed little spatial variation, indicating that the results obtained from the monitoring program are fairly typical of that stretch of the river.

Temporal patterns at the Carmichael River sites were related to seasonal variability associated with the influx of overland flows prior to the start of the dry season monitoring program, and subsequent drying of the water resources as the season progressed. Water quality showed elevated anions and cations during the dry season sampling program indicating that groundwater had a significant influence on water quality in the River. This was confirmed as the anions, cations and electrical conductivity (EC) decreased during the wet season sampling program as the river was influenced by surface runoff. TSS increased during the wet season sampling program confirming the elevated flows were due to surface runoff. During the dry season all monitoring was undertaken in low-flow conditions with flow progressively decreasing as monitoring progressed. Conversely, flow increased during the wet season, however, the flow was variable due to the influence of rainfall.

The waters of the Carmichael River displayed an alkaline pH throughout the wet and dry season monitoring programs. The soils investigation report associated with this Project (Mine) indicates this is likely linked to the alkalinity of the adjacent soils (refer to EIS Volume 4 Appendix L Soils Report).

Temperature characteristics of the Carmichael River were closely linked to seasonality, whereby higher temperatures were recorded in the warmer months. Effects of shading were also evident; the Carmichael River sites which were shaded had greater buffering capacity against changes in temperature than the exposed sites at the farm dams and Cabbage Tree Creek.

Concentrations of total nitrogen in the Carmichael River were consistently greater than expected ranges, and were primarily derived from concentrations of organic nitrogen. Other nutrients, including total and reactive phosphorus were within expected ranges. Despite the high concentrations of nitrogen, no algal blooms were observed onsite, or from chlorophyll a testing. Faecal coliform testing identified faecal coliforms to be present at all the Carmichael River sites. This has been linked to the ongoing cattle grazing of the Study Area. Hydrocarbons were not present in the waters of the Carmichael River.

The in-stream sediments of the Carmichael River were characterised by sands. Nutrients were present in low concentrations and faecal coliforms were only present in the sediments at only one site. In agreement with the findings from the water quality assessment, hydrocarbons were not present in the in-stream sediments of the Carmichael River.

Metals detected in the waters of the Carmichael River include aluminium, antimony, arsenic, barium, boron, chromium, copper, iron, manganese, nickel, tin and zinc. The majority of these metals were also present in the in-stream sediments of the river. The 90th percentiles of aluminium, copper, chromium and iron in the Carmichael River are above the ANZECC and ARMCANZ (2000) 95 percent species protection trigger values without hardness modification. However, by applying the ANZECC and ARMCANZ (2000) hardness modifying factor, copper and chromium trigger values are not exceeded.

The quality of water in still water bodies was different to the Carmichael River, which is primarily due to the non-flow conditions of those bodies, lack of riparian cover and use of the dam water resources by cattle. The electrical conductivity of the still water bodies was substantially lower than the Carmichael River, indicating that input from the alluvial groundwater aquifer that interacts with the river is unlikely. Given that dams are designed to limit the potential for leaching of waters, the disconnect between these resources and groundwater aquifers is not unexpected.

The concentrations of nutrients were generally higher in the still water bodies than in the Carmichael River. As with the Carmichael River results, concentrations of total nitrogen were attributable to concentrations of organic nitrogen. Some still water bodies also contained moderate concentrations of ammonia. Reactive phosphorus concentrations in the still water bodies were consistently higher than the concentrations found in the Carmichael River.

Chlorophyll a concentrations were also higher in the still water bodies than in the Carmichael River sites, however, no blooms were observed during monitoring. Faecal coliform testing identified that the bacteria were present at all the still water body sites. No distinct spatial patterns between the Carmichael River sites and the still water bodies were observed.

As with the Carmichael River sites, hydrocarbons were not present at the still water bodies. Similarly, a number of metals were present in the waters and sediments of the still water bodies.

These include aluminium, arsenic, barium, boron, chromium, cobalt, copper, iron, lead, manganese, nickel, strontium, vanadium and zinc. The differences in metal concentrations between the Carmichael River and the still water bodies are likely attributable to local soil characteristics and previous farming activities. Total and dissolved aluminium, copper, iron and zinc 95th percentile concentrations exceeded the ANZECC and ARMCANZ (2000) 95 percent species protection trigger values.

The sediments of the still water bodies were comprised of sands, silts and clays. Concentrations of nutrients in the sediments were generally much higher in the still water bodies than in the Carmichael River. These results are consistent with the findings of the water quality assessment, and have been attributed to the lack of flushing of the still water bodies. Faecal coliforms were detected in the sediments of all of the still water bodies, reflecting the findings of the water quality assessment. Hydrocarbons were not present in the sediments of the still water bodies.

Some of the nominated sediment sampling sites located in the north of the Study Area were dry throughout the dry season monitoring program. In order to gain an understanding of the potential contaminants that may be released during flow events, deionised (DI) leach testing was undertaken. Results were generally consistent with the findings of the broader monitoring program, indicating that the sampling sites can be considered to be representative of the water resources present within the Study Area.

Collated information relating to the water resources of the Study Area identified the following EVs of relevance:

- Aquatic ecosystems – slightly to moderately disturbed
- Primary industries – irrigation
- Primary industries – stock watering
- Drinking water supply
- Cultural and spiritual values

As required by the QWQG (DERM, 2009a), WQOs for the protection of the EVs were identified.

Assessment of the potential impacts associated with the construction and operation phases of the Project (Mine) identified that activities have the potential to negatively affect the quality of the water in the region. Measures to mitigate and/or manage potential impacts have been identified, including those that will be implemented through engineering design, management plans and monitoring programs. Implementation of identified measures is considered to substantially reduce the risk of impact to water quality, such that the majority of actions are considered to have no residual risk. Those actions with residual risk to water quality include:

- The mobilisation of pollutants to water resources as a result of a spill outside bunded areas.
- The loss of catchment and alteration of flows associated with the development footprint.
- Potential flow on effects to water quality as a result of changes to the interaction between groundwater and surface water.

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Abbreviations and glossary

Project specific terminology	
Abbreviation	**Term**
the Project SEIS	Carmichael Coal Mine and Rail Project Supplementary Environmental Impact Statement
the Proponent	Adani Mining Pty Ltd
the Project (Mine and Rail)	Carmichael Coal Mine and Rail Project
the Project (Mine)	The mine component of the Project
the Project (Rail)	The rail component of the Project

Generic terminology	
Abbreviation	**Term**
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
BOM	Bureau of Meteorology
cfu	Colony Forming Units
DAFF	Department of Agriculture, Forestry and Fisheries (Queensland)
DEHP	Department of Environment and Heritage Protection
DERM	Former Department of Environment and Resource Management (Queensland)
DI	deionised
DO	Dissolved Oxygen
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities (former DEWHA, Department of Environment, Water, Heritage and the Arts)
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPP (Water)	Queensland Environmental Protection (Water) Policy 2009
EVs	Environmental Values
Ha	Hectares
HD	Highly disturbed
HEV	High ecological / conservation value
HMTV	Hardness-modified trigger value
ISQG	Interim Sediment Quality Guideline
LTV	Long-term trigger value

Generic terminology	
Abbreviation	**Term**
matters of NES	Matters of National Environmental Significance
MAW	Mine affected water
MIA	Mine Infrastructure Area
NATA	National Association of Testing Authorities
NTU	Nephelometric Turbidity Units
NWQMS	National Water Quality Management Strategy
PAHs	Polycyclic Aromatic Hydrocarbons
pH	Measure of acidity (<7) or alkalinity (>7) of a sample
PMEWQCQ	Policy for the Maintenance and Enhancement of Water Quality in Central Queensland
QWQG	Queensland Water Quality Guidelines
SMD	Slightly-moderately disturbed
SQOs	Sediment Quality Objectives
STV	Short-term trigger value
TDS	Total dissolved solids
TOR	terms of reference
TPHs	Total Petroleum Hydrocarbons
TSS	Total suspended solids
WQOs	Water Quality Objectives

1. Introduction

1.1 Project overview

Adani Mining Pty Ltd (Adani, the Proponent), commenced an Environmental Impact Statement (EIS) process for the Carmichael Coal Mine and Rail Project (the Project) in 2010. On 26 November 2010, the Queensland (Qld) Office of the Coordinator General declared the Project a 'significant project' and the Project was referred to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (referral No. 2010/5736). The Project was assessed to be a controlled action on the 6 January 2011 under section 75 and section 87 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The controlling provisions for the Project include:

- World Heritage properties (sections 12 & 15A)
- National Heritage places (sections 15B & 15C)
- Wetlands (Ramsar) (sections 16 & 17B)
- Listed threatened species and communities (sections 18 & 18A)
- Listed migratory species (sections 20 & 20A)
- The Great Barrier Reef Marine Park (GBRMP) (sections 24B & 24C)
- Protection of water resources (sections 24D & 24E)

The Qld Government's EIS process has been accredited for the assessment under Part 8 of the EPBC Act in accordance with the bilateral agreement between the Commonwealth of Australia and the State of Queensland.

The Proponent prepared an EIS in accordance with the Terms of Reference (ToR) issued by the Qld Coordinator-General in May 2011 (Qld Government, 2011). The EIS process is managed under section 26(1) (a) of the *State Development and Public Works Act 1971* (SDPWO Act)*,* which is administered by the Qld Government's Department of State Development, Infrastructure and Planning (DSDIP).

The EIS, submitted in December 2012, assessed the environmental, social and economic impacts associated with developing a 60 million tonne (product) per annum (Mtpa) thermal coal mine in the northern Galilee Basin, approximately 160 kilometres (km) north-west of Clermont, Central Queensland, Australia. Coal from the Project will be transported by rail to the existing Goonyella and Newlands rail systems, operated by Aurizon Operations Limited (Aurizon). The coal will be exported via the Port of Hay Point and the Point of Abbot Point over the 60 year (90 years in the EIS) mine life.

Project components are as follows:

- The Project (Mine): a greenfield coal mine which includes both open cut and underground mining, on mine infrastructure and associated mine processing facilities (the Mine) and the Mine (offsite) infrastructure including a workers accommodation village and associated facilities, a permanent airport site, an industrial area and water supply infrastructure

- The Project (Rail): a greenfield rail line connecting to mine to the existing Goonyella and Newlands rail systems to provide for the export of coal via the Port of Hay Point (Dudgeon Point expansion) and the Port of Abbot Point, respectively including:
  - Rail (west): a 120 kilometre (km) dual gauge portion running west from the Mine site east to Diamond Creek
  - Rail (east): a 69 km narrow gauge portion running east from Diamond Creek connecting to the Goonyella rail system south of Moranbah
  - Quarries: The use of five local quarries to extract quarry materials for construction and operational purposes

Figure 1 shows the project location.

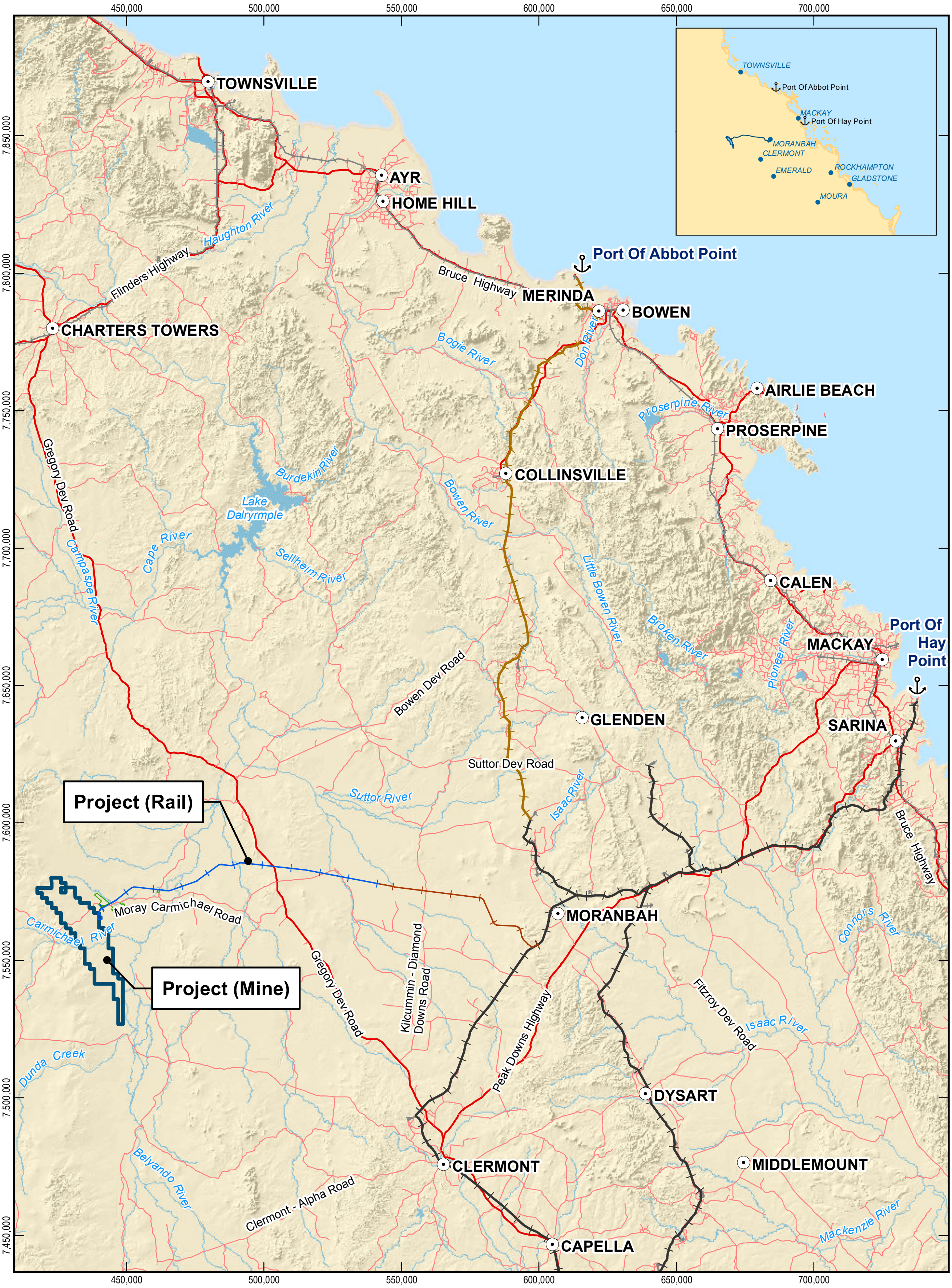
1.2 Assessment and reporting scope

This report provides an update of surface water quality assessment of the Project (Mine) as part of the supplementary environmental impact statement (SEIS). A combination of desktop and field assessments were undertaken to describe the existing surface water resources that may be affected by the Project (Mine) in the context of environmental values (EVs) as defined by:

- Queensland Environmental Protection Act 1994 (EP Act)
- Queensland Environmental Protection (Water) Policy 2009 (EPP (Water))
- Australia and New Zealand Guidelines for Fresh and Marine Water Quality 2000 (the ANZECC guidelines) (ANZECC and ARMCANZ, 2000)
- Queensland Water Quality Guidelines 2009 (QWQG) (DERM, 2009a)

Field assessments were undertaken in accordance with the former Queensland Department of Environment and Resource Management (DERM) *Monitoring and Sampling Manual 2009* (DERM, 2009b). Where appropriate, results have been compared to guidelines and trigger levels, and used to derive subregional WQOs.

The SEIS comprises multiple elements, including sections on the description and assessment of potential impacts on the surface water resources of the Study Area. This document provides a summary of the surface water quality assessments undertaken to date, and recommendations for incorporation into the Project SEIS. Additional assessments that complement this report are the impact assessment (SEIS Volume 4 Appendix K5), the flood assessment (SEIS Volume 4 Appendix K4), the groundwater report (SEIS Volume 4 Appendix K1), and ecological assessment (SEIS Volume 4 Appendix J1).



LEGEND

- Major Port
- Other Rail Network
- Goonyella System
- Newlands System
- Local Road
- Watercourse
- Project (Rail)
  - Rail (West)
  - Rail (East)
- Mine (Offsite)
- Project (Mine)

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number	41-26422
Revision	B
Date	14-10-2013

Project Location

Figure 1

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Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: © Commonwealth of Australia (Geoscience Australia): Town, Railways, Watercourses (2007); DNRM: LGA, (2011), Hillshade (2009); DMR: State Roads (2008); DME: EPC1690 (2010), EPC1080 (2011); Adani: Mine Offsite, Alignment SP1 Opt11 Rev2, SP2 Opt 9 Rev 3 (2013). Created by: MS

1.3 Surface water features in the study area

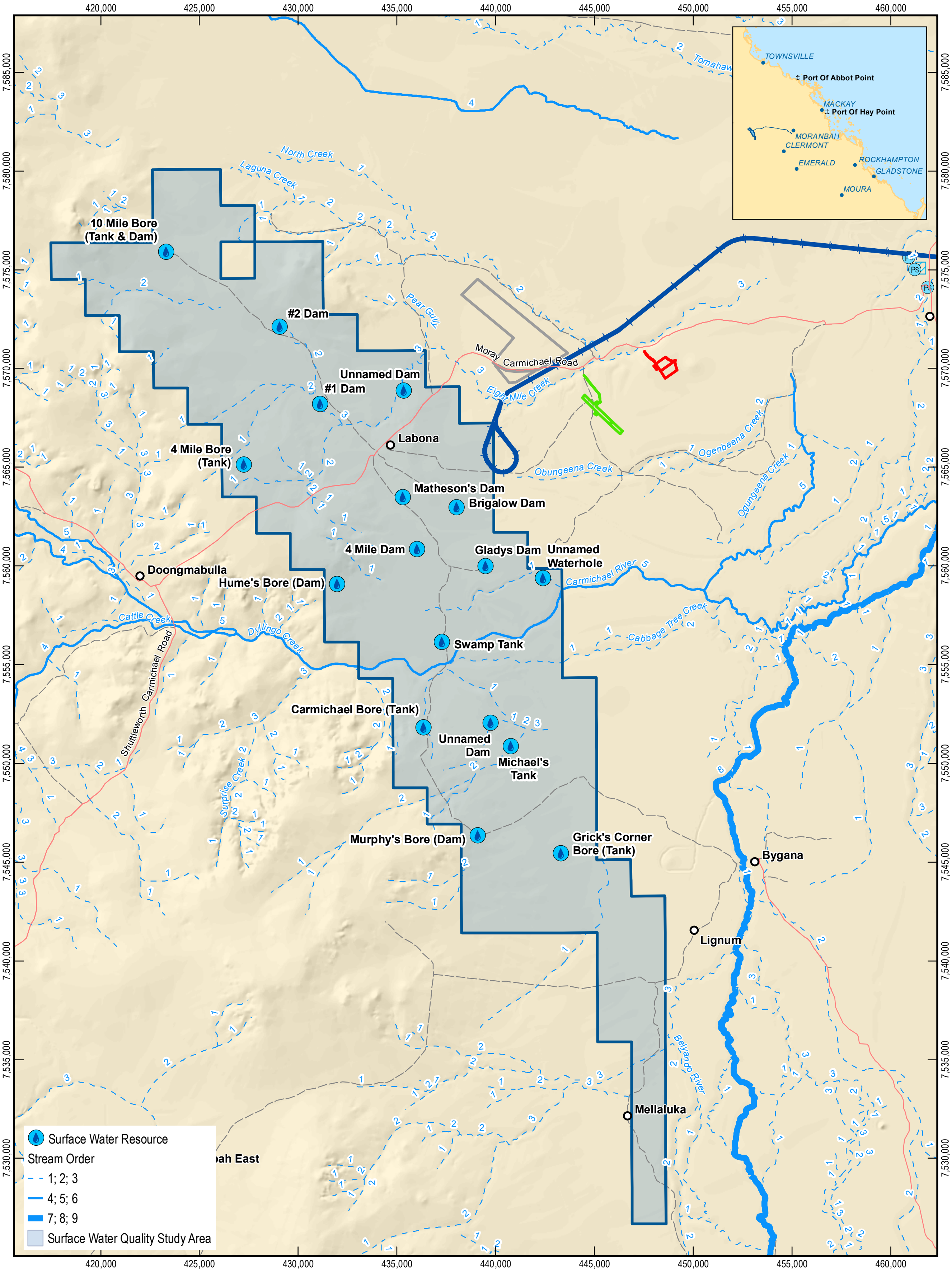
The Study Area for the water quality assessment is defined by the boundaries of the mine area, and the area immediately upstream and downstream of the boundary where the Carmichael River crosses the mine area (refer to Figure 2). This encompasses approximately 26,000 hectares (ha) of predominantly grazing land.

The Study Area contains one major waterway, the Carmichael River, which is designated as a fifth order stream (DERM, 2010). The Carmichael River flows through the southern section of Study Area (refer to Figure 2) joining the Belyando River approximately 20 km to the east. The Belyando Catchment is approximately 35,411 km^2 and is one of the main sub-catchments in the Burdekin Basin (refer to Figure 1).

Other water resources within the Study Area include a number of ephemeral creeks, drainage lines and farm dams. These resources, shown on Figure 2 include:

- Eight Mile Creek, located at the north of the Study Area. Within the Study Area this ephemeral creek is designated as a first and second order stream (DERM, 2010).
- Cabbage Tree Creek, located to the south of the Carmichael River. Within the Study Area this ephemeral creek is designated as a first order stream (DERM, 2010).
- Thirteen farm dams on the mine area, often associated with tanks or bores:
  - Ten Mile Bore (Tank and Dam)
  - Number Two Dam located along a drainage line associated with Eight Mile Creek
  - Number One Dam located along a drainage line associated with Eight Mile Creek
  - Four Mile Bore (Tank)
  - Matheson's Dam located to the north of the Carmichael River
  - Four Mile Dam located to the north of the Carmichael River
  - Humes Bore (Dam) located to the north of the Carmichael River
  - Swamp Tank located to the north of the Carmichael River
  - Carmichael Bore (Tank) located to the south of the Carmichael River
  - Unnamed Dam located to the south of the Carmichael River
  - Michael's Tank located to the south of the Carmichael River
  - Murphy's Bore (Dam) located to the south of the Carmichael River
  - Grick's Corner Bore (Tank), located to the south of the Carmichael River.

Outside of the main Study Area, Doongmabulla Springs and Mellaluka Springs have been sampled to provide a baseline for ongoing analysis and management of this area. The sampling locations for these area are provided in Figure 4 and are reported separately in Section 4.8.



LEGEND

- Homestead
- Local Road
- Track
- Rail (West)
- Mine (Onsite)
- Mine (Offsite)
- Pump Station
- Storage Facility (Offstream)
- Airport
- Industrial Area
- Accommodation Village

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Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project SEIS

Surface Water Quality Study Area

Job Number	41-26422
Revision	E
Date	14-10-2013

Figure 2

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Data Source: DERM: DCDB, Stream Network (2010); DME: EPC 1690 (2010)/EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road (2007); GHD: Surface Water Resources, Study Area(2011); Adani: Alignment (2013) Created by: MS

2. Methods

2.1 Mine site

2.1.1 Overview

A field-based water and in-stream sediment quality assessment of the Study Area was undertaken from April to September 2011 and a field based water quality assessment was conducted from November 2012 to April 2013. The objective of these assessments was to characterise the quality of the existing surface water resources. Survey design was undertaken incorporating the following factors:

- Seasonal constraints regarding sampling and site access, that is, access to the Study Area is limited during the wet season when the Moray Carmichael Road becomes impassable.
- Accessibility to the southern portion of the Study Area was restricted during periods of flood such that not all water bodies, particularly to the south of the Carmichael River have been sampled.

Areas sampled are, however, considered to be representative based on knowledge of land use and catchment inputs that would influence those water bodies.

2.1.2 Surface water resource descriptions

As described in Section 1.3, the Study Area is comprised of a number of different surface water resources. A desktop based assessment of these resources was undertaken to identify defining characteristics. This information was used to supplement observations made by teams that had already visited the site. As such, four types of water resources were identified:

- Major waterways with established riparian zone (the Carmichael River and Belyando River)
- Minor waterways with standing pools (Cabbage Tree Creek, Cattle Creek, Dyllingo Creek and North Creek)
- A minor ephemeral waterway (Eight Mile Creek)
- Farm dams.

Sites representative of the characteristics of the four water resource types were identified for this assessment. With the exception of Cabbage Tree Creek these sites were constrained to the north of the Carmichael River in order to avoid discontinuity in the data sets associated with lack of site access across the river. Sites that were sampled during the field assessment (refer to Figure 3).

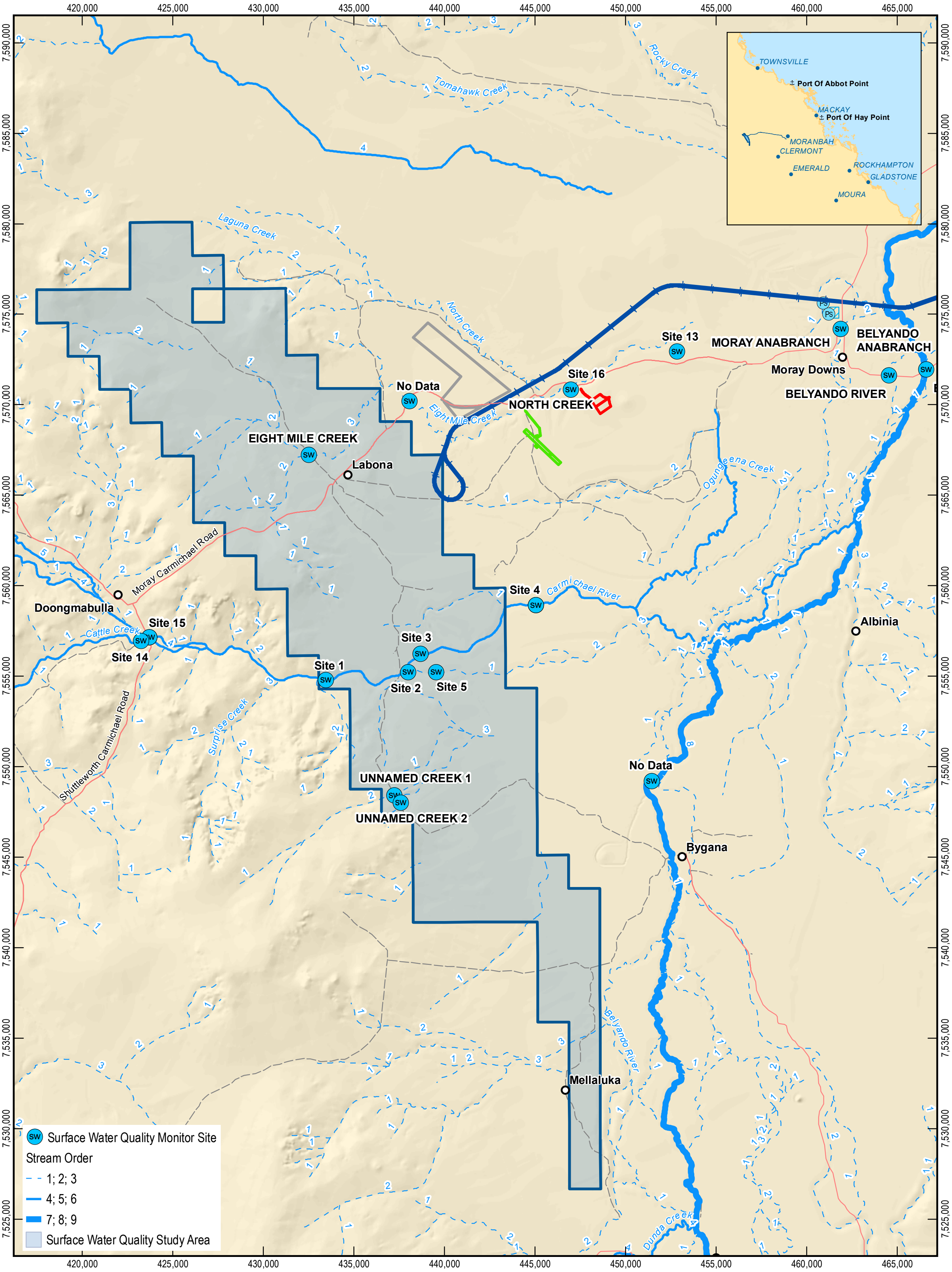
- Four sites at the Carmichael River:
  - Site 1 located immediately upstream of the mine area
  - Site 2, Site 3 and 4 located within the mine area
- One site at Cabbage Tree Creek (Site 5)

- Four sites at farm dams:
  - Site 6 located at Four Mile Dam
  - Site 7 located at Swamp Tank
  - Site 8 located at Number One Dam
  - Site 9 located at Number Two Dam
- Three sites at Eight Mile Creek:
  - Site 10 located downstream boundary of the mine area
  - Site 11 located within the mine area
  - Site 12 located in the upstream portion of the mine area
- One site on the Belyando River:
  - Site 13 located downstream of the Carmichael River confluence
- One site on Cattle Creek
  - Site 14 located on Cattle Creek upstream of the Carmichael River confluence
- One site on Dyllingo Creek
  - Site 15 located on Dyllingo Creek upstream of the Carmichael River confluence
- One site on North Creek
  - Site 16 located located to the north-west of the accommodation village

Detailed information regarding each sampling site is provided in Table 1 with locations shown in Figure 3, including a description of the physical environment at the site, existing pressures and representative photographs taken with a 100 m radius of the sampling location (as indicated by GPS).

The sampling program was comprised of a combination of *in-situ* sampling of physical water quality parameters, collection of water samples for laboratory analysis of basic and broad suites, and collection of sediment samples (from the aforementioned sites) for laboratory analysis. Section 1.1.1 and Section 2.1.4 provide information on the methods used to achieve the water and in-stream sediment sampling, respectively. All sampling was conducted in accordance with the following guidelines and standards:

- Monitoring and Sampling Manual 2009 (DERM, 2009b)
- The ANZECC guidelines (ANZECC and ARMCANZ, 2000)
- Australian Standard Number 5667.1.1998 – Water Quality – Sampling – Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples
- Australian Standard Number 5667.6.1998 – Water Quality – Sampling – Guidance on sampling rivers and streams
- Australian Standard Number 5667.12.1999 – Water Quality – Sampling – Guidance on sampling of bottom sediments
- Quality assurance and quality control measures implemented throughout the field assessment are detailed in Section 2.1.5.



LEGEND

- Homestead
- Local Road
- Track
- Rail (West)
- Mine (Onsite)
- Mine (Offsite)
- Pump Station
- Storage Facility (Offstream)
- Airport
- Industrial Area
- Accommodation Village

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Carmichael Coal Mine and Rail Project SEIS

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Revision D
Date 14-10-2013

Field Assessment Sampling Sites

Figure 3

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Table 1 Site descriptions

Site	Location	Comments
1	Location: Carmichael River – upstream of the mine area Waterway type: river Stream type: run (summer, autumn) / sandy pool (spring) 	5th order stream High degree of shading by overhanging paperbark trees (10 m) in the riparian zone Established riparian zone > 20 m wide No algae or macrophytes were visually detected on the substrate or in the water column Sandy substrate Low flow; flow decreased as monitoring progressed from April 2011 to September 2011 Flow increased during wet season monitoring and was influenced by rain events November 2012 to April 2013 Turbid conditions noted at the start (April 2011) and end (September 2011) of the dry season monitoring program Evidence of cattle presence (tracks and manure)
2	Location: Carmichael River – within the mine area Waterway type: river Stream type: run (summer, autumn) / combination of run and sandy pool (spring) 	5th order stream High degree of shading by overhanging paperbark trees (10 m) in the riparian zone Established riparian zone > 20 m wide No algae or macrophytes were observed on the substrate or in the water column during autumn or spring sampling. A small amount of algae was observed on the substrate during spring sampling. Mainly sandy substrate Low flow; flow decreased as monitoring progressed from April 2011 to September 2011 Flow and turbidity increased during wet season monitoring and was influenced by rain events November 2012 to April 2013 Turbid conditions noted at the start (April 2011) and end (September 2011) of the monitoring program Evidence of cattle presence (tracks and manure)

Site	Location	Comments
3	Location: Carmichael River – within the mine area Waterway type: river Stream type: run (summer, autumn) / combination of run and sandy pool (spring) 	5th order stream High degree of shading by overhanging paperbark trees (10 m) in the riparian zone. Established riparian zone at least 10 m wide No algae or macrophytes were observed on the substrate or in the water column during autumn or spring sampling. A small amount of algae was observed on the substrate during spring sampling. Sandy substrate Low flow; flow decreased as monitoring progressed from April 2011 to September 2011 Flow and turbidity increased during wet season monitoring and was influenced by rain events November 2012 to April 2013 Turbid conditions noted at the start (April 2011) and end (September 2011) of the monitoring program Evidence of cattle grazing (tracks and manure)
4	Location: Carmichael River – within the mine area Waterway type: river Stream type: combination of run and riffle (summer, autumn) / sandy pool (spring). 	5th order stream High degree of shading by overhanging paperbark trees (10 m) in the riparian zone Established riparian zone at least 10 m wide No algae or macrophytes were observed on the substrate or in the water column during autumn or spring sampling. A small amount of algae was observed on the substrate during spring sampling. Sandy substrate Moderate flow in autumn and no flow in spring Flow increase during wet season monitoring, November 2012 to April 2013 Turbid conditions noted at the start (April 2011) and end (September 2011) of the dry season monitoring program Evidence of cattle presence (tracks and manure)

Site	Location	Comments
5	Location: Cabbage Tree Creek – within the mine area Waterway type: creek Stream type: silt/clay pool 	Mapped as a 1st order stream Low/moderate degree of shading by overhanging trees Limited riparian zone (2 m width) Submerged, emergent and floating macrophytes Algae on the substrate Silt/clay substrate Isolated pool with no flow Evidence of cattle presence (tracks and manure) and pig disturbance (tracks)
6	Location: Four Mile Dam Waterway type: artificial farm dam Stream type: silt/clay pool 	Approximately 40 m in diameter, drop off from vegetated edge No shading Limited riparian zone consisting of sedges (less than 2 m) Small amounts of macrophytes observed Silt/clay substrate Isolated dam with no flow Turbid conditions across sampling period Cattle disturbance (tracks and manure) along some of the perimeter

Site	Location	Comments
7	Location: Swamp Tank Waterway type: artificial farm dam Stream type: silt/clay pool 	Approximately 50 m across, gently sloping bed No shading Limited riparian zone consisting of grasses (less than 2 m) Some floating and emergent macrophytes and algae (on substrate) observed during autumn sampling No macrophytes observed during spring sampling Silt/clay substrate Isolated dam with no flow Cattle (tracks and manure) disturbance along the perimeter
8	Location: Number One Dam Waterway type: artificial farm dam Stream type: silt/clay pool 	Dam is approximately 20 m across with a gently sloping bed No shading Limited riparian zone consisting of grasses (less than 2 m) Some macrophytes and algae (in water column) observed during sampling Silt/clay substrate Isolated dam with no flow Cattle disturbance (tracks and manure) along the perimeter

Site	Location	Comments
9	Location: Number Two Dam Waterway type: artificial farm dam Stream type: silt/clay pool 	Dam is approximately 30 m across with a gently sloping bed No shading Limited riparian zone consisting of grasses (less than 2 m) Some macrophytes (emergent) and algae (on substrate) observed during sampling Silt/clay substrate Isolated dam with no flow Cattle and pig disturbance (tracks and manure) around the perimeter
10	Location: Eight Mile Creek – within the mine area Waterway type: drainage line Stream type: dry stream bed 	Physical environment: Mapped as a 3rd order stream Moderate degree of shading by overhanging trees No aquatic vegetation within the stream bed Minimal terrestrial vegetation within the streambed Sandy/silty substrate No permanent water, facilitates flash flows only Evidence of cattle grazing disturbance (tracks and manure)

Site	Location	Comments
11	Location: Eight Mile Creek – within EPC 1690 Waterway type: drainage line Stream type: dry stream bed 	2nd order stream Limited shading No aquatic vegetation within the stream bed Minimal terrestrial vegetation within the streambed Sandy substrate No permanent water, facilitates flash flows only Evidence of cattle grazing and pig disturbance (tracks and manure)
12	Location: Eight Mile Creek – within the mine area Waterway type: drainage line Stream type: dry stream bed 	1st order stream Limited shading No aquatic vegetation within the stream bed Minimal terrestrial vegetation within the streambed Sandy/silty substrate No permanent water, facilitates flash flows only Evidence of pig disturbance (tracks and manure)

Site	Location	Comments
13	Location: Belyando River downstream of Carmichael River confluence Waterway type: river Stream type: run (summer, autumn) / combination of run and sandy pool (spring)	8th order stream High degree of shading by overhanging paperbark trees (10 m) in the riparian zone Established riparian zone at least 10 m wide Moderate flow in summer and autumn and low flow in spring Flow increase during wet season monitoring, November 2012 to April 2013
14	Location: Cattle Creek – upstream of the mine area Waterway type: creek Stream type: run (summer, autumn) / sandy pool (spring)	1st order stream Limited shading
15	Location: Dyllingo Creek – upstream of the mine area Waterway type: creek Stream type: run (summer, autumn) / sandy pool (spring)	1st order stream Limited shading
16	Location: North Creek – North-west of accommodation village Waterway type: creek Stream type: run (summer, autumn) / sandy pool (spring)	1st order stream Limited shading

2.1.3 Water quality sampling

All water quality sampling was undertaken in accordance with the requirements of the Monitoring and Sampling Manual 2009 (DERM, 2009b), ANZECC Guidelines (ANZECC and ARMCANZ 2000) and the Australian Standards mentioned above. Quality assurance and quality control measures implemented throughout the field assessment are detailed in Section 2.1.5.

Physio-chemical water quality parameters (as indicated by in Table 3) were sampled *in-situ* using a hand held multi-parameter water quality meter with logging capacity for:

- Turbidity (NTU)
- Dissolved oxygen (DO) (percent saturation)
- pH
- Temperature (°C)
- Electrical conductivity (EC) (µS/cm)

Ten replicate samples from each site were stored on the logger and downloaded at the end of each sampling event.

Water samples were collected for laboratory analysis of the basic (as indicated by) and / or broad (as indicated by) analytical suites (refer to Table 2). In conjunction with sampling, observational data was collected during each event using a standard pro-forma data sheet adapted from those provided in the Monitoring and Sampling Manual 2009 (DERM, 2009b). Information including weather conditions, localised disturbances, surface oils, foaming, colour and aquatic vegetation were noted to assist in interpretation of data.

Table 2 Basic and broad analytical suites

Basic analytical suite	Broad analytical suite
Nutrients Chlorophyll a Faecal (thermotolerant) coliforms Total dissolved solids (TDS) Total suspended solids (TSS)	Major cations and anions Total hardness as $CaCO_3$ Total petroleum hydrocarbons (TPH): C6-C9 fraction, C10-C14 fraction, C15-C28 fraction and C29-C36 fraction Polycyclic aromatic hydrocarbons (PAH) Total and dissolved metals (aluminium, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, tin, uranium, vanadium and zinc) Dissolved silicon Fluoride

2.1.4 In-stream sediment quality sampling

In-stream sediments (represented by in Table 3) were collected for laboratory analysis of:

- Grain size
- Total organic carbon and moisture content
- Nutrients
- Faecal (thermotolerant) coliforms
- PAHs
- TPHs (C6-C9, C10-C14, C15-C28 and C29-C36 fractions)
- Total metals (aluminium, arsenic, barium, beryllium, boron, cadmium, chromium, copper, iron, lead, manganese, molybdenum, nickel, selenium, silver, strontium, uranium, vanadium, mercury and zinc)

Sediment samples were also collected at sites where water was not present (represented by in Table 3). Site 10, Site 11 and Site 12 are sites that are ephemeral. These sites did not contain any water during the monitoring program and were analysed differently to sediment samples collected at sites with water. Additional sediment samples were collected from the stream bed at these sites during the July 2011 sampling event. These samples were subject to a deionised (DI) water leach preparation. Testing of the DI leachate was undertaken in order to gain an understanding of the potential for the release of contaminants into surface waters during flow events. DI leachate testing was only undertaken once during the monitoring program as sampled parameters were not expected to display large temporal variability. The DI water leachate was analysed for:

- Ultra-trace nutrients
- PAHs
- TPHs (C6-C9, C10-C14, C15-C28 and C29-C36 fractions)
- Metals (aluminium, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, selenium, silver, strontium, uranium, vanadium and zinc)

A summary of the field assessment effort for each sampling location per event is provided in Table 3 and reflects the colour coding symbols used above to identify each of the sampling types completed per event.

Table 3 Summary of field assessment effort 2011 to 2013

	Event 1 13-14 April 2011	Event 2 4-5 May 2011	Event 3 21-22 June 2011	Event 4 26-27 July 2011	Event 5 23-24 Aug 2011	Event 6 20-21 Sept 2011
Site 1	🔵 🟢	🔵 🟢 🔴	🔵 🟢	🔵 🟢 🔴 🟡	🔵 🟢	🔵 🟢 🔴
Site 2	🔵 🟢	🔵 🟢 🔴	🔵 🟢	🔵 🟢 🔴 🟡	🔵 🟢	🔵 🟢 🔴
Site 3	🔵 🟢	🔵 🟢 🔴	🔵 🟢	🔵 🟢 🔴 🟡	🔵 🟢	🔵 🟢 🔴
Site 4	🔵 🟢	🔵 🟢 🔴	🔵 🟢	🔵 🟢 🔴 🟡	🔵 🟢	🔵 🟢 🔴
Site 5	🔵 🟢	Site not accessible	🔵 🟢	Site not accessible	🔵 🟢	🔵 🟢 🔴
Site 6	🔵 🟢	🔵 🟢 🔴	🔵 🟢	🔵 🟢 🔴 🟡	🔵 🟢	🔵 🟢 🔴
Site 7	🔵 🟢	🔵 🟢 🔴	🔵 🟢	🔵 🟢 🔴 🟡	🔵 🟢	🔵 🟢 🔴
Site 8	🔵 🟢	🔵 🟢 🔴	🔵 🟢	🔵 🟢 🔴 🟡	🔵 🟢	🔵 🟢 🔴
Site 9	🔵 🟢	🔵 🟢 🔴	🔵 🟢	🔵 🟢 🔴 🟡	🔵 🟢	🔵 🟢 🔴
Site 10	No water	No water	No water	🟡 🟣	No water	No water
Site 11	No water	No water	No water	🟡 🟣	No water	No water
Site 12	No water	No water	No water	🟡 🟣	No water	No water

KEY: 🔵 In-situ water suite 🟢 Basic analytical suite (water) 🔴 Broad analytical suite (water) 🟡 Sediment sampling suite 🟣 DI leach suite

	Event 7 31 October 2012	Event 8 29 November 2012	Event 9 19 December 2012	Event 10 10 January 2013	Event 11 20 February 2013	Event 12 14 March 2013	Event 13 10 April 2013
Site 1	🔵 🟢 🔴	🔵 🟢 🔴	No flow	Low flow	No flow	No Flow	🟢 🔵 🔴
Site 2	🔵 🟢 🔴	🔵 🟢 🔴	No Flow	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🟢 🔵 🔴
Site 3	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🟢 🔵 🔴
Site 4	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🟢 🔵 🔴
Site 5	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🟢 🔵 🔴
Site 13	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	No Flow	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴
Site 14	🔵 🟢 🔴	🔵 🟢 🔴	No Flow	🔵 🟢 🔴	🔵 🟢 🔴	No Flow	🔵 🟢 🔴
Site 15	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴
Site 16	🔵 🟢 🔴	No Flow	🔵 🟢 🔴	No Flow	🔵 🟢 🔴	🔵 🟢 🔴	🔵 🟢 🔴

KEY: 🔵 In-situ water suite 🟢 Basic analytical suite (water) 🔴 Broad analytical suite (water)

2.1.5 Quality assurance and quality control

All samples were collected, preserved and transported in accordance with the requirements of the *Monitoring and Sampling Manual 2009* (DERM, 2009b) and the analytical laboratory, under chain of custody documentation (refer to Appendix A). In addition to the internal laboratory quality assurance procedures, quality assurance replicates were collected at two separate sampling locations per event and tested as per the primary samples. Replicates were marked as QA01 or QA02 and noted on the corresponding field sheet. Upon receipt of laboratory results, Quality Assurance/Quality Control (QA/QC) results were checked and the results reviewed for anomalies. Validation of the laboratory data and quality assurance samples were undertaken in accordance with the requirements of the *Monitoring and Sampling Manual 2009* (DERM, 2009). A summary of the QA/QC results are provided in Appendix A.

2.2 Doongmabulla Springs field survey

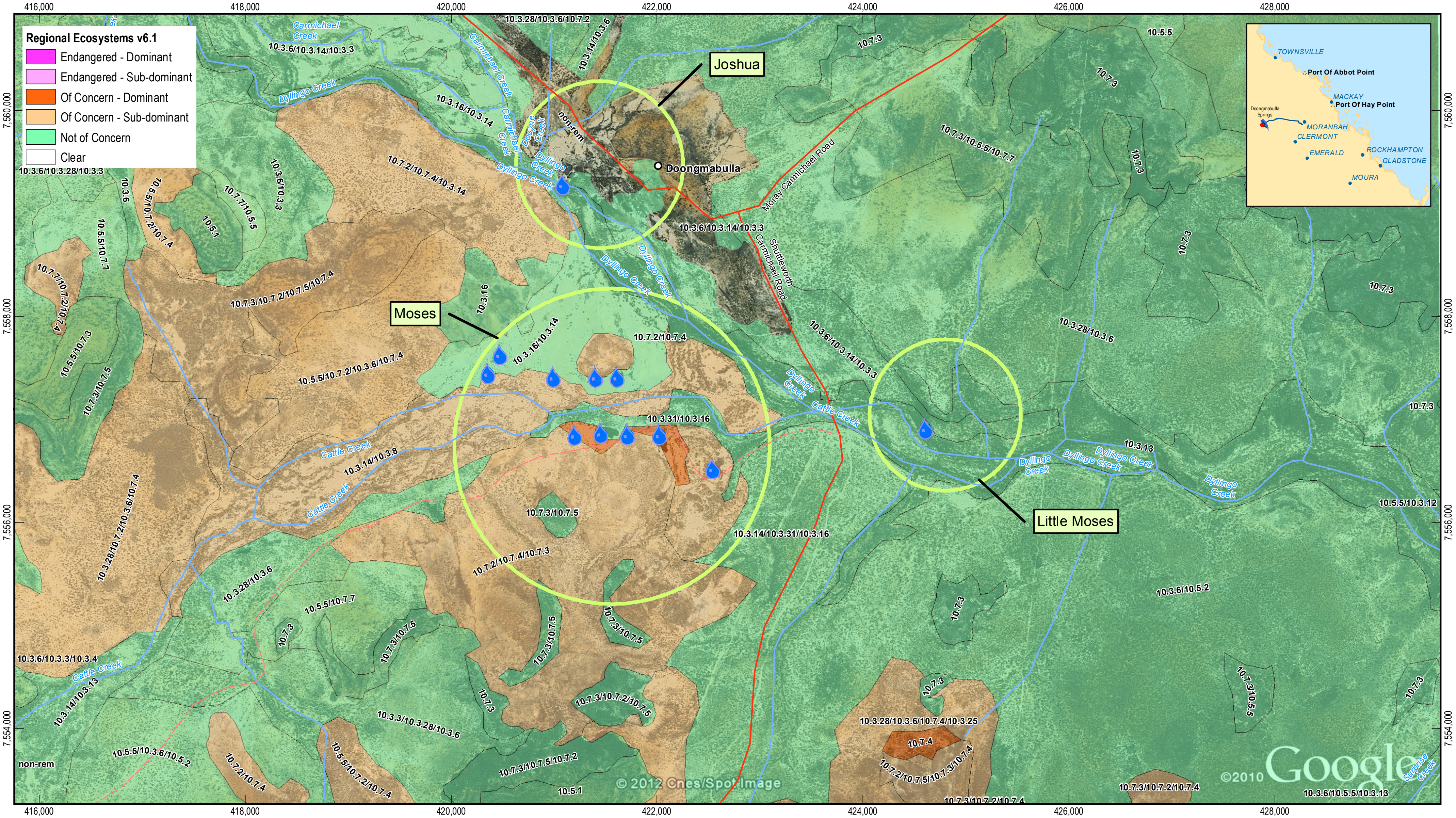
2.2.1 Sample collection

In order to characterise the quality of the surface water resources within the Doongmabulla Springs area water samples were collected from four springs during a three day ecology field inspection of the complex between 22 and 24 May 2012. Following on from this initial sampling, water samples were collected on 22 and 24 June 2012 from 14 of the springs that were located during the field inspection and two creeks. The sampled locations are summarised in Table 4 and their locations are shown in Figure 4. Where there was insufficient standing or flowing water for collection directly into a laboratory sample bottle, it was collected using a single use sterile plastic syringe (dedicated to each spring) and then decanted into the laboratory sample bottle. All water samples were stored on ice in an insulated container immediately after collection and sent under chain of custody to a National Association of Testing Authorities (NATA) accredited laboratory, Australian Laboratory Services (ALS) in Sydney and Brisbane, for analysis.

Table 4 Summary of sampled locations

GHD location ID	Sampled	Sample collection point
Doon Spring 1	May and June 2012	Directly from the spring
Doon Spring 2A	June 2012	Water collected into shallow hole dug adjacent to the vegetation
Location 3A	June 2012	Water draining from grassed wetland area, approximately 40 m west of Doon Spring 3. No water to collect at Doon Spring 3.
Doon Spring 4	June 2012	Water ponded adjacent to the mound spring vegetation
Doon Spring 5	June 2012	Water ponded amongst the mound spring vegetation
Doon Spring 5A	June 2012	Water ponded adjacent to the mound spring vegetation
Doon Spring 5B	May and June 2012	Water ponded amongst the mound spring vegetation
Doon Spring 6	June 2012	Water ponded amongst the mound spring vegetation

GHD location ID	Sampled	Sample collection point
Doon Spring 7	June 2012	Water ponded amongst the mound spring vegetation
Doon Spring 8	June 2012	Water ponded adjacent to the mound spring vegetation
Doon Spring 8A	June 2012	Water ponded adjacent to the mound spring vegetation
Doon Spring 9A	June 2012	Water ponded adjacent to the mound spring vegetation
Doon Spring 10	May and June 2012	Directly from the spring
Doon Spring 11C	May 2012	Water ponded amongst the mound spring vegetation
Dyllingo Creek crossing (Shuttleworth Carmichael Road)	June 2012	Directly from the creek
Cattle Creek crossing (Shuttleworth Carmichael Road)	June 2012	Directly from the creek



1:50,000 (at A4)

0 500 1,000 1,500 2,000

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Homestead
- Springs
- Minor Road
- Track
- Watercourse
- Spring Groups

GHD adani

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number 41-26422
Revision C
Date 30-07-2013

Visited spring locations

Figure 4

G:\41\26422\GIS\Maps\MXD\0300_Hydrology\41-26422_352_rev_a.mxd Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: GHD: Spring Complex/2012, Springs/2012; GA: Watercourses, Roads, Homesteads (2007); DNRM: Regional Ecosystems Version 6.1 (2011); DME: Carmichael Mine Site; Google: Imagery (2012). Created by:SB

2.2.2 Sample analysis

The Doongmabulla Springs samples were tested for the parameters summarised in Table 5.

Table 5 Summary of sample analysis – Doongmabulla Springs

	Parameters
Field measurements	
Measured at the sample location, prior to collection of sample for laboratory testing	pH, temperature, EC, DO, TDS
Laboratory analysis	
Major ions and alkalinity	Calcium, magnesium, potassium, sodium, chloride, sulphate, alkalinity (carbonate, bicarbonate and hydroxide as CaCO3), total alkalinity as CaCO3 and hardness as CaCO3
Inorganics	Silica, fluoride, EC, pH
Selected dissolved metals	Arsenic, barium, beryllium, cadmium, cobalt, chromium, copper, nickel, lead, vanadium, zinc and iron

2.3 Mellaluka Springs

2.3.1 Sample collection

Sampling was undertaken on a one-off basis for springs in the Mellaluka Springs complex and nearby selected groundwater bores between the 1st April 2013 and 9th April 2013..

Prior to collection of samples from the groundwater bores, purging was undertaken to remove 'stagnant' groundwater so that groundwater representative of the surrounding aquifer was obtained (see Table 6). Sampling commenced once the bore had been purged for at least 10 minutes and was undertaken using the pre-existing groundwater pump infrastructure at each location. The depth to groundwater in each bore could not be measured due to the presence of the pump infrastructure.

The spring and groundwater sampling locations are summarised in Table 6 in shown in Figure 3.

Table 6 Mellaluka sampling locations

Site Type	Site Name	Site Number	Site Code	Water Source	Easting (MGA)	Northing (MGA)
Groundwater bore	Mellaluka homestead bore	1 (and 2*)	1-MSHB	Bore		
Spring	Mellaluka homestead dam	3	3-MSHD	Spring	446740	7531884
Spring	Mellaluka homestead pool	4 (and 5*)	4-MSHP	Spring	446822	7531900
Spring	Lignum Spring	6	6-LS	Spring	445879	7537853

Site Type	Site Name	Site Number	Site Code	Water Source	Easting (MGA)	Northing (MGA)
Spring	Stories Spring	7	7-SS	Spring	446606	7534256
Groundwater bore	Blue's bore #2	8	8-BB2	Bore	444270	7542867
Groundwater bore	3 Mile bore	9	9-3MB	Bore	441717	7532436
Groundwater bore	Stories bore	10	10-SB	Bore	446258	7534429
Groundwater bore	Ironbark bore	11	11-IB	Bore	441487	7528898
Groundwater bore	Middle bore	12	12-MB	Bore	443924	7534892
Groundwater bore	Blue's bore #1	13	13-BB1	Bore	446121	7549416

*Indicates the site code of a duplicate sampling

Water quality sampling techniques for both the bores and springs were based on GHD's field and sampling procedures, which are outlined below:

1. Site photographs were taken, and a GPS coordinate was recorded. Relevant field notes and observations of the site were made. Descriptions of the visual and olfactory characteristics of the water were recorded for each sampling location, and included details such as colour, turbidity, odour and sheen.

2. Nitrile gloves were donned prior to any handling of equipment to prevent contamination of the sample.

3. In situ water quality measurements were taken from each bore and spring from ~10 cm below the surface. Where the site was a bore, a representative water sample was collected in a bucket to allow for proper immersion of instruments. For Stories Spring and Lignum Spring, the total water depth was less than 10 cm. In these instances, *in situ* measurements were made at 50 per cent of the total depth. Parameter measurements were recorded at regular intervals using a calibrated water quality meter (TPS 90 FL-T Field Lab). The parameters were considered stable when three consecutive readings were within 0.05 for pH, ±3 percent for EC, ±10 percent for DO, ±0.2°C for temperature and ±10 mV for ORP. Ten replicate measurements were recorded for each site.

4. Sampling bottles were supplied by the laboratory. Water quality samples were collected from as closely as possible to the source. For the springs, samples were taken from the centre of pools. Where pool depth was too shallow to submerge the sample bottles, a sterile syringe was used to aspirate surface water which was then transferred to a sample bottle. For the bores, a bucket was used to collect water from the immediate bore outlet. Sampling bottles were then filled from the bucket. Where a sample was required for the analysis of dissolved metals, the water quality sample was filtered using a sterile syringe fitted with a 0.45 μm filter.

5. Once collected, spring and groundwater samples were labelled and stored in ice chilled cooler boxes). Samples were submitted to ALS laboratory under chain of custody (CoC) documentation, with verified copies of the CoC retained (Appendix A). Due to travel

restrictions holding times for nitrate, nitrite and pH were exceeded as shown in Appendix A.

Table 7 Water quality sampling and submission schedule

Site	Date of sample collection	Date of sample submission to ALS
Mellaluka homestead bore	1 April 2013	2 April 2013
Mellaluka homestead dam	1 April 2013	2 April 2013
Mellaluka homestead pool	1 April 2013	2 April 2013
Lignum Spring	1 April 2013	2 April 2013
Stories Spring	1 April 2013	2 April 2013
Blues bore #2	7 April 2013	9 April 2013
3 mile bore	7 April 2013	9 April 2013
Stories bore	7 April 2013	9 April 2013
Ironbark bore	7 April 2013	9 April 2013
Middle bore	7 April 2013	9 April 2013
Blues bore #1	7 April 2013	9 April 2013

2.3.2 Sample analysis

Laboratory services were undertaken by ALS Environmental (ALS). This laboratory is National Association of Testing Authorities (NATA) accredited for the testing programs conducted. Appendix C shows the ALS laboratory results. A tabulated version of the results has been presented in Appendix A.

The laboratory testing program comprised analysis of water samples for an appropriate analytical suite to characterise groundwater and spring water quality in the Mellaluka Springs complex. The parameters analysed within this investigation are consistent with the previous investigations undertaken for the Doongmabulla Springs. The schedule of analysis and suite of parameters analysed are outlined in Table 7 and Table 8.

Analytical results obtained from the spring and groundwater quality investigation were compared to the following environmental guidelines to identify anomalous results:

- Australian Drinking Water Guidelines (ADWG) (2011) – Health.
- ANZECC/ARMCANZ (2000) Freshwater Ecosystem 95 percent Species Protection Guidelines.

Quality control (QC) samples were also collected during the sampling program for QA purposes. In accordance with the relevant Australian Standards and industry practice, QC samples were collected at a rate of 10 percent of primary samples collected and comprised field duplicate samples. A summary of the QA/QC results is provided in Appendix A as Field Duplicate Results.

Table 8 Laboratory analysis schedule

Parameter	Springs		Groundwater bores	
	No. Samples	*No. Duplicate Samples*	*No. Samples*	*No. Duplicate Samples*
pH, electrical conductivity, total dissolved solids	4	1	7	1
Major ions (calcium, magnesium, potassium, sodium, chloride, sulphate), alkalinity	4	1	7	1
Fluoride	4	1	7	1
Total metals (aluminium, arsenic, boron, cadmium, cobalt, copper, chromium, iron, manganese, mercury, molybdenum, nickel, lead, selenium, silver, uranium, vanadium, zinc)	4	1	7	1
Dissolved metals (aluminium, arsenic, boron, cadmium, cobalt, copper, chromium, iron, manganese, mercury, molybdenum, nickel, lead, selenium, silver, uranium, vanadium, zinc)	4	1	7	1
Nutrients: ammonia as N, NOX (nitrate + nitrite as N), NO2, NO3, TKN, total phosphorus as P	-	-	7	1
Total petroleum hydrocarbons (TPH) (C6 to C40), BTEX (benzene, toluene, ethyl benzene, xylene)	-	-	7	1

Summary tables of the water quality analytical results are included in Appendix A.

Groundwater

Field measurements were collected from each of the groundwater bore locations and the results summarised as follows:

- Groundwater pH ranged from 5.6 to 6.78 pH units, averaging 6.35 pH units across all sites.
- Dissolved oxygen ranged from 2.24 mg/L (Blues Bore #2) to 6.51 mg/L (Ironbark Bore).
- Electrical conductivity (EC) ranged from 291 µS/cm (Ironbark Bore) to 1,982 µS/cm (Blues Bore #2).
- Temperature between all locations averaged 28.71 degrees Celsius. The difference in temperature between the sites showed a variance of 1 degree Celsius.
- The oxygen redox potential (ORP) ranged from -21 mV (Blues Bore #2) to 101 mV (Stories Bore).

Springs

Field measurements were collected from each of the spring locations sampled and the results summarised as follows:

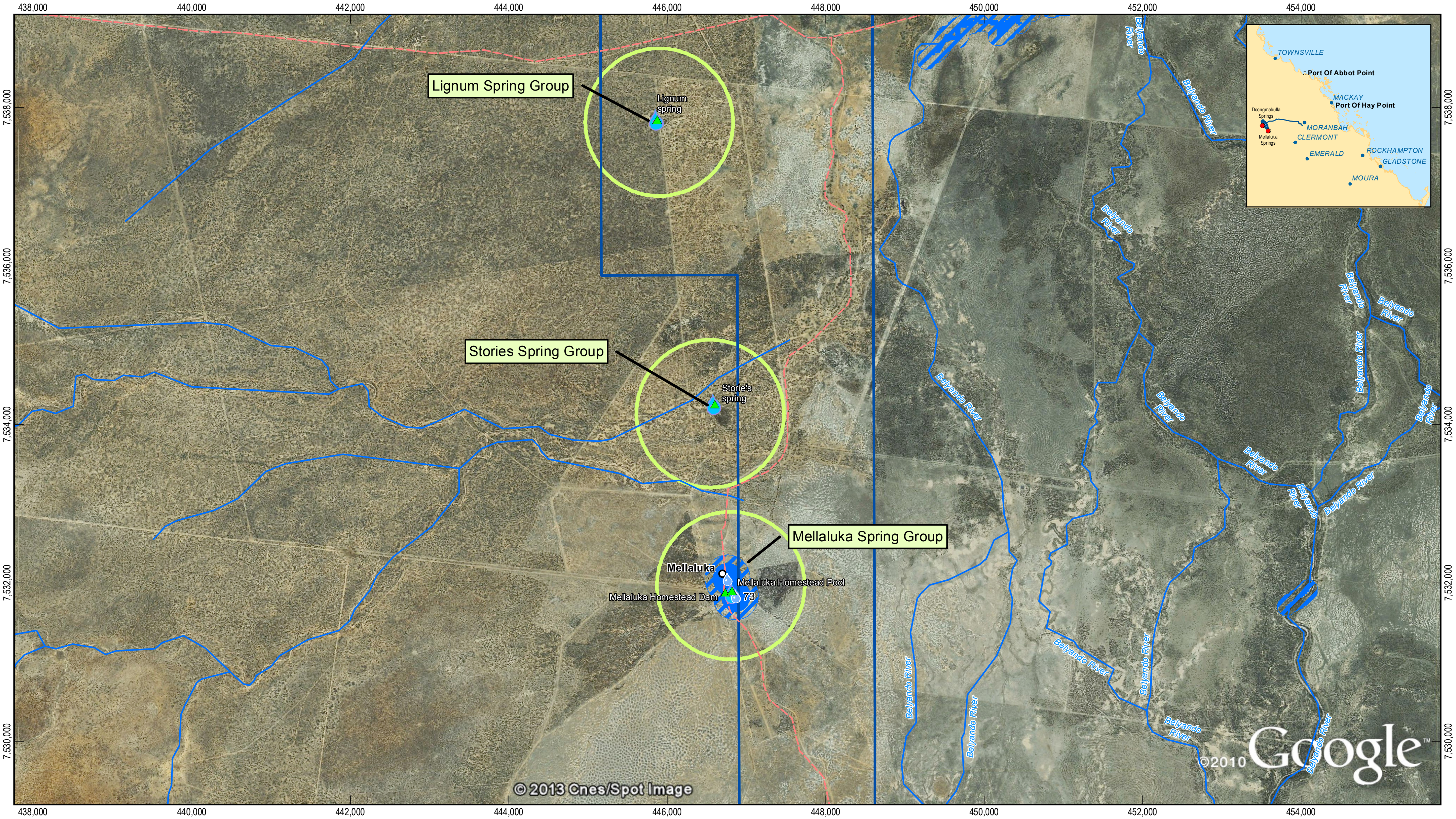
- Spring water pH ranged from 5.73 to 7.36 pH units, averaging at 6.57 pH units.
- Dissolved oxygen measured at the Lignum and Stories springs was relatively low (0.04 and 0.65 mg/L respectively) in comparison to Mellaluka Homestead Dam (7.84 mg/L).

- Mellaluka Homestead Pool and Dam locations reported lower EC values (1,497 µS/cm and 681 µS/cm respectively) than measured at Lignum and Stories Springs (11,850 µS/cm and 3,500 µS/cm respectively).
- Temperature between the sites varied from 26.2 degrees Celsius to 31.8 degrees Celsius. The average temperature across the sites was 29.03 degrees Celsius.
- The Mellaluka Homestead Pool, Lignum and Stories springs showed a negative oxidation reduction potential, with values ranging from -55 mV to -240 mV. The ORP for the Mellaluka Homestead Dam was reported as 37 mV.

A tabulated summary of the analytical results from the groundwater and spring sampling event is presented in Appendix A. Where the drinking water and ecosystem protection guideline values were exceeded, these values are highlighted in the tabulated laboratory results. NATA accredited laboratory results are provided for reference in Appendix A.

Physical and Inorganic Chemicals

Groundwater pH (lab analysed) ranged from 6.42 to 7.8 pH units, averaging as neutral (7.2 pH units). Spring water pH (lab analysed) ranged from 6.48 to 7.92 pH units, averaging at 7.40 pH units. TDS levels ranged from fresh (281 mg/L) to brackish (2,260 mg/L) in groundwater and averaged as fresh (1,028 mg/L). Spring water quality showed a wider range compared to groundwater analysed, with TDS levels ranging from fresh (450 mg/L) to saline (7,800 mg/L) and averaging as brackish (2,845 mg/L). A number of results exceeded the ANZECC ecosystem freshwater guidelines and to a lesser extent the Australian Drinking Water Guidelines. Exceedences were identified for aluminium, boron, chromium, copper, manganese, lead, cadmium, arsenic, zinc, nickel and fluoride. Organic Chemicals Each of the seven locations sampled and analysed for BTEX and TPH showed concentrations below the laboratory detection limits for these compounds.



1:65,000 (at A4)

0 0.5 1 1.5 2

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

LEGEND

- Homestead
- Spring Group (Surveyed)
- Spring Water Quality Locations
- Spring (Id Number)
- Track
- Watercourse
- (Project) Mine
- Wetland Management Area (WMA)
- Wetland Management Area (WMA) - Trigger
- Spring Groups

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number 41-26422
Revision B
Date 30-07-2013

Mellaluka Springs borehole and spring locations

Figure 5

G:\41\26422\GIS\Maps\MXD\0300_Hydrology\41-26422_350_rev_b.mxd

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Data Source: GHD: Spring Complex and Groups/2013; GA: Watercourses, Roads, Homesteads (2007); DME: Carmichael Mine Site; Google: Imagery -2004 (2012); DNRM: WMA, WMA Trigger (2010), Springs (2012). Created by:MS

2.4 Data analysis

Analysis of the water and sediment quality data was undertaken in accordance with the requirements of the QWQG (DERM, 2009a), the *Monitoring and Sampling Manual 2009* (DERM, 2009b), and the ANZECC guidelines (ANZECC and ARMCANZ, 2000). Summary statistics, including minima, 20th percentiles, medians, averages, 80th percentiles and maxima have been presented where appropriate. Spatial and temporal presentation of the data has also been included in the assessment in order to gain an understanding of any trends in the data.

Comparisons against nominated water quality objectives (WQOs) have been undertaken. As defined by the QWQG (DERM, 2009a), median values have been used for comparison of physical parameters and nutrients against nominated WQOs. The ANZECC guidelines (ANZECC and ARMCANZ, 2000) require comparison of toxicant data to WQOs be undertaken using 80th percentile values. This procedure has been followed for the assessment. Algorithms for the calculation of a HMTV for metals and metalloids have been utilised where appropriate, as described by the ANZECC guidelines (ANZECC and ARMCANZ, 2000).

Interpretation of results to the nominated WQOs was undertaken by comparing:

- Median values for physical parameters and nutrient data (refer to QWQG; DERM 2009a)
- 80th percentile values for toxicant data (refer to the ANZECC guidelines; ANZECC and ARMCANZ, 2000)

Where appropriate and as required by the ANZECC guidelines HMTV were calculated for the comparison of metal data, (ANZECC and ARMCANZ, 2000).

2.5 Water quality objectives

To provide the WQOs for the Carmichael River the Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) Guidelines for Fresh and Marine Water Quality were used to review water quality data collected from four sites on the Carmichael River over a 12 month period. Water samples were collected during the dry season from April – September 2011 and the wet season November 2012 – April 2013. Samples were taken during the 2012/2013 wet season to fill gaps identified by the DEHP.

Data was obtained from Adani in spreadsheet form and added to an existing dataset held by GHD used in the Carmichael Coal Mine and Rail Project EIS. GHD undertook a quality assurance check of the provided data. The data was then interrogated to obtain the percentiles necessary to determine the baseline data for the site specific WQOs, including 20th, 50th and 80th percentiles.

Baseline water quality conditions were determined from the four Carmichael River sampling sites as further described in Section 4.3. Updated WQOs were developed against the full historic dataset for the four sites using the methodology described in ANZECC and ARMCANZ (2000) and incorporating feedback from the DEHP regarding derivation of WQOs.

In using the data provided by Adani, it is assumed that appropriate quality assurance and quality control procedures have been applied in the sampling, analysis and reporting of data for all monitoring locations.

3. Legislative framework

3.1 Overview

The following sections provide an overview of the key regulatory and non-regulatory instruments, guidelines and policies relevant to the surface water resources of the Burdekin River Basin.

3.2 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, which are defined in the EPBC Act as matters of national environmental significance.

On 21 June 2013, the EPBC Act was amended to include a new matter of national environmental significance in relation to coal seam gas (CGS) and large coal mining development - the 'water trigger'. As a result, any CSG development or large coal mining development that has, will have or is likely to have a significant impact on water resources now requires referral and possibly approval by the Commonwealth Environment Minister under the EPBC Act.

3.3 Australian and New Zealand Guidelines for Fresh and Marine Water Quality

The Guidelines (ANZECC, 2000) provide recommended parameters for:

- Water and sediment quality that will sustain the ecological health of aquatic ecosystems
- Irrigation and general water use
- Livestock drinking water
- Aquaculture and human consumers of aquatic food
- Waters for recreational activities, such as swimming and boating
- Preservation of the aesthetic appeal of these waters.

3.4 Queensland Environmental Protection Act 1994

The aim of the *Environmental Protection Act 1994* (EP Act) is to protect Queensland's environment while allowing for development that improves the quality of life as well as maintaining the ecological processes on which it depends.

The EP Act also imposes a general environmental duty on all persons (including corporations) such that they must not conduct any activity that causes, or is likely to cause, environmental harm, unless they take all reasonable and practicable measures to prevent or minimise the harm.

The *Environmental Protection Regulation 2008* identifies environmental relevant activities (ERAs) prescribed under the EP Act, for which development approval is required. Relevance to the project

3.5 Queensland Environmental Protection (Water) Policy 2009

The *Environmental Protection (Water) Policy 2008* (EPP Water) (part 2, Section 6) provides a framework for:

- Identifying environmental values (EVs) for Queensland waters
- Deciding and stating water quality guidelines and objectives to enhance or protect the EVs
- Making consistent and equitable decisions about Queensland waters that promote the efficient use of resources and best practice environmental management
- Involving the community through consultation and education, and promoting community responsibility.
- The EVs considered applicable to the Project (Mine) to be particularly enhanced or protected under the EPP (Water) are the following:
- Biological integrity of an aquatic ecosystem
- Suitability for agricultural use and
- The cultural and spiritual values of the water.

3.6 Queensland Water Act 2000

The *Water Act 2000* provides a framework for management and allocation of water resources and licences, based on development of catchment-based Water Resource Plans (WRPs). The WRPs are then activated through related Resource Operations Plans (ROPs) which provide detail on how the water resources will be managed to implement the strategies and objectives as set out in the WRP.

The *Water Act 2000* defines a watercourse as a:

- river, creek or stream in which water flows permanently or intermittently in a natural channel, whether artificially improved or not
- or in an artificial channel that has changed the course of the watercourse.

Approvals are required for activities that interfere with a watercourse. However, recent amendments to the Water Act by the *Land Water and Other Legislation Amendment Bill 2013* (Qld) (LWOLA Bill), which was introduced into Parliament on 15 March 2013. The Act was assented to on 14 May 2013. It introduces a 'Waterway Diversion Exemption' in section 20(4) Water Act which exempts proponents from the requirement to get a water licence for the diversion of a watercourse on a mining lease where the impacts of the diversion were assessed as part of the grant of an environmental authority (EA) for the mining lease and the EA was granted with a condition about the diversion of the watercourse. This particular amendment to section 20 Water Act is due to commence on proclamation once guidelines and an assessment manual have been finalised.

The *Water Act 2000* also sets out the law with respect to:

- rights to surface and groundwater
- control of works with respect to surface and groundwater conservation and protection
- irrigation, water supply, drainage and flood control.

Under the *Water Act 2000,* an approval/licence will be required for any works which may affect surface and groundwater. The following permits may be required under relevant sections of the *Water Act 2000*:

- Section 206 – taking water from a watercourse, lake, spring or underground water source (Water Licence)
- Section 286 – destroy vegetation, place fill or excavate in a watercourse (Riverine Protection Permit).

3.7 Guideline: Preparation of Water Management Plans for Mining Activities

A Water Management Plan (WMP) may be mandated within the conditions of an approval under the EP Act or to comply with the EPP Water. This guideline (2010) is to assist the operators of mining activities to plan and implement water management practices in a manner that protects EVs and meets obligations under the EP Act. The guideline applies to all existing and proposed level 1 mining projects.

3.8 Manual for Assessing Hazard Categories and Hydraulic Performance of Dams constructed as part of environmentally relevant activities pursuant to the Environmental Protection Act 1994, Version 2

The Manual (2011) sets out the requirements of the Department of Environment and Heritage Protection (the administering authority), for hazard category assessment and certification of the design of dams and other land-based containment structures, constructed as part of ERAs under the EP Act.

3.9 Guideline: Regulated dams in environmentally relevant activities

This guideline (2010) provides information about the procedures of the administering authority, for dealings involving dams and related containment structures, constructed as part of ERAs pursuant to the EP Act. This Guideline should be read in conjunction with the Manual described above.

3.10 Sustainable Planning Act 2009

Under the SP Act, development authorised to occur on a mining lease is generally exempt from the requirements for assessment and approval. However, there are some limited exceptions, such as approvals for building, plumbing and drainage work. Adani seeks recommendations from the Coordinator-General that development approval be given for all of the identified aspects of assessable development for the Project, subject to appropriate conditions. As an alternative, if considered more appropriate by Coordinator-General, Adani seeks a recommendation that a preliminary approval be granted, subject to appropriate conditions.

3.11 Water Regulation 2002

The *Water Regulation 2002* is subordinate to the *Water Act 2000* and defines the purpose of use (such as stock / domestic use) that do not require authorisation to take water and, by omission, those purposes that do require authorisation.

3.12 Water Resource (Burdekin Basin) Plan 2007

The Burdekin Basin WRP serves to provide a framework for sustainably managing water and the taking of water within the Burdekin Basin, within which the Project (Mine) lies. The Project (Mine) lies within sub-catchment E of the WRP area (see Schedule 2 of the ROP discussed below) thus waterway diversions and stormwater collection systems required for the Project will come under Section 147 of the WRP which establishes need for monitoring of various parameters by the operators of infrastructure for interfering with water (including overland flows).

3.13 Burdekin Basin Resource Operations Plan 2009

The Burdekin Basin ROP implements the provisions made by the Burdekin Basin WRP, specifically the rules and operational requirements for managing the surface water in that basin. The ROP also informs the granting of a licence for the interference with water under Section 206 of the *Water Act 2000*, which will apply to the Project (Mine).

3.14 Water Resource (Great Artesian Basin) Plan 2006

The Project (Mine) lies within the Great Artesian Basin WRP management area. The purpose of the Great Artesian Basin WRP is to:

- Define the availability of water in the plan area
- Provide a framework for sustainably managing water and the taking of water
- Identify priorities and mechanisms for dealing with future water requirements
- Provide a framework for establishing water allocations
- Provide a framework for reversing, where practicable, degradation that has occurred in natural ecosystems.

3.15 Great Artesian Basin Resource Operations Plan February 2007 Amended November 2012

The Great Artesian Basin Resource Operations Plan (GABROP) specifies rules and operational requirements for managing ground water resources that are defined to be within one of the 25 groundwater catchments listed under the Water Resource Plan (WRP). The Project as a whole triggers various aspects of the WRP depending on the activity and location.

3.16 Guideline: Activities in a watercourse, lake or spring associated with a resource activity or mining operations

This guideline is to allow activities in a watercourse, lake or spring associated with a resource activity or mining operations without the need for a riverine protection permit. Activities include the destruction of native vegetation, excavation and placement of fill in a watercourse, lake or spring. The *Water Regulation 2002* permits these activities provided the activity is in accordance with this guideline.

This guideline outlines the requirements, providing outcomes and acceptable solutions to ensure activities minimise adverse impacts on water quality, water flow, vegetation and the physical integrity of the watercourse, lake or spring.

3.17 Water Supply (Safety and Reliability) Act 2008

Failure impact assessment determines whether a dam is a referrable dam, that is, a dam that would put population at risk in the event of failure, by reference to the provisions of the *Water Act 2000* and the *Water Supply (Safety and Reliability) Act 2008* (WSSR Act).

The 10 gigalitre (GL) storage dam for the Project (Mine) will require failure impact assessment in the detailed design phase, and on an ongoing basis as required under the WSSR Act.

3.18 Guidelines for Failure Impact Assessment of Water Dams

These guidelines have been developed by the Department of Energy and Water Supply (2012) to help owners comply with the WSSR Act and dam safety conditions for referable dams (these include both conditions relating to dam safety imposed on development permits and safety conditions imposed under the Act).

The Guidelines provide information about:

- Referable dams
- Failure impact ratings
- Failure impact assessment and how it is done
- Certification of a failure impact assessment
- Lodging a failure impact assessment for an existing dam
- Lodging a failure impact assessment for a new or proposed dam
- Lodging a failure impact assessment for works on an existing dam
- Timing requirements for undertaking failure impact assessments
- Processes for accepting, rejecting or reviewing a dam failure impact assessment
- Responsibilities, penalties and provisions for appeals.

3.19 Queensland Water Quality Guidelines 2009

These guidelines interpret the ANZECC 2000 Guidelines by:

- Providing guideline values (numbers) that are tailored to Queensland regions and water types
- Providing a process/framework for deriving and applying more locally specific guidelines for waters in Queensland

3.20 Queensland Fisheries Act 1994

The *Fisheries Act 1994* (Fisheries Act) is implemented by the state government, and provides for the management, use, development and protection of fisheries resources and fish habitats and the management of aquaculture activities. The Fisheries Act's objective is to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats through the application of the principles of ecologically sustainable development. If a polluting matter is likely to affect fisheries resources or a fish habitat, the Chief Executive of the Department of Agriculture, Fisheries and Forestry may issue a notice to restore fish habitat requiring the responsible person to take action to redress the situation.

Significant changes to water quality as a result of the Project have the potential to affect fisheries resources and fish habitats protected by the Fisheries Act. Approvals requirements under the Fisheries Act are given effect through the *Sustainable Planning Act 2009* and hence do not apply to activities on a mining lease.

3.21 Policy for the Maintenance and Enhancement of Water Quality in Central Queensland 2003

This policy was created by the former Queensland Department of Local Government and Planning (2003). The *Policy for the Maintenance and Enhancement of Water Quality in Central Queensland 2003* (PMEWQCQ) provides a non-regulatory Head of Agreement for collaborative planning and management of water quality by local government, industry and landholders. It provides guidance for implementing strategies for river health and water quality. The policy also recognises the importance of accurately assessing, valuing, monitoring and reporting on the condition of the region's water resources for planning and management.

The guiding principles of the PMEWQCQ should be taken into consideration during the development of water management plans for the Project (Mine).

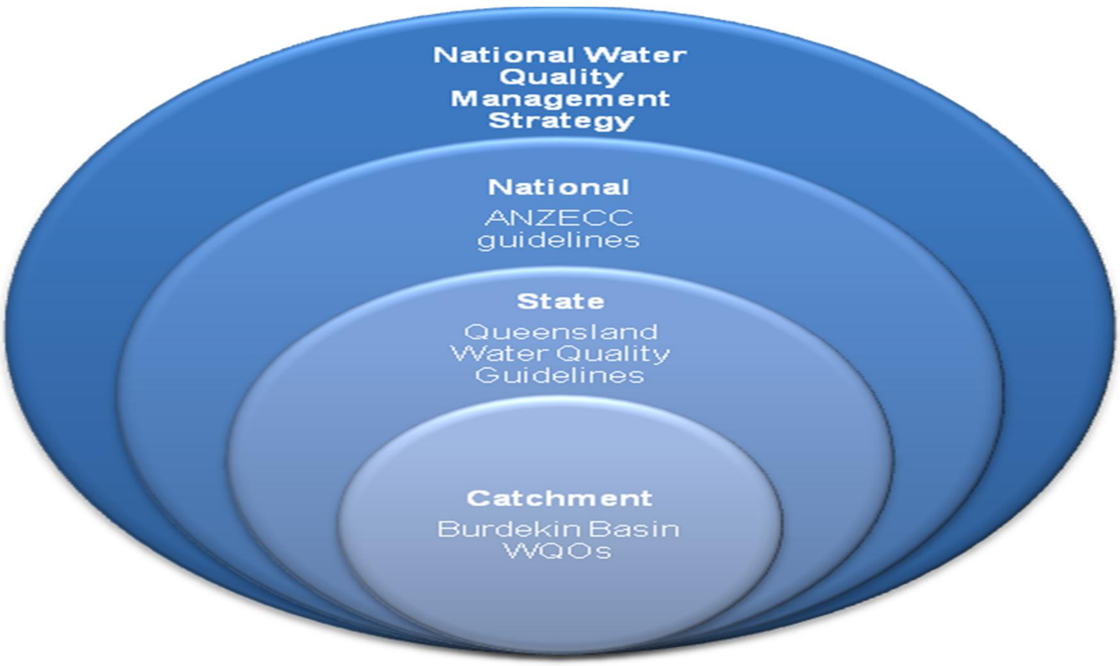
4. Existing environment

4.1 Environmental values and water quality objectives

4.1.1 National water quality management strategy

The National water quality management strategy (NWQMS) provides a framework for water quality management that is based on the principle of ecologically sustainable development. ANZECC and ARMCANZ (2000) are national guidelines that were developed as part of the NWQMS. These guidelines suggest that in order to protect and improve water resources a three tiered approach, comprising national, state (or territory) and regional or catchment, is required. Figure 6 provides an overview of this approach, including those guidelines and objectives that are relevant to the Study Area.

Figure 6 Tiered approach to water quality management relevant to the study area



When determining WQOs, locally derived objectives can be determined using processes set out in the QWQG (DERM, 2009a) if sufficient data is available. If local data is not available, regional or catchment based WQOs are then relied on and if no such objectives exist, or objectives are not set for a certain variable, then reference is made to the Queensland and then national water quality guidelines. Thus, locally derived WQOs take precedence over regional or catchment objectives which in turn take precedence over state and national WQOs.

The Study Area is located in the Burdekin Basin, defined as part of the central coast region in the QWQG (DERM, 2009a). The water types within the Study Area, as defined by the QWQG (DERM, 2009a), include upland streams (greater than 150 m elevation above sea level), and freshwater lakes/reservoirs.

As outlined in Section 3.5, WQOs for the Burdekin Basin are yet to be scheduled in the EPP (Water). Draft WQOs are proposed in the Burdekin Water Quality Improvement Plan (Dight, 2009) for four water types; upland streams, lowland streams, lakes, and wetlands. An assessment of the draft WQOs has identified that they are consistent with the WQOs contained in the QWQG (DERM, 2009a) and ANZECC and ARMCANZ (2000). The water and sediment quality objectives (SQOs) adopted for this assessment to protect the EVs are identified in Section 4.3. There are currently no guidelines for TPH.

4.1.2 Queensland Water Quality Guidelines environmental values

The QWQG (DERM, 2009a) provide a suite of EVs that may be applicable to an area of interest. These EVs capture both aquatic ecosystem values and human use values. An assessment of information available relating to the Study Area, including information collated during the field assessment, has been used to determine which EVs are applicable to the Study Area (refer to Table 9).

Table 9 Environmental values applicable to the study area (surface water)

Environmental value	QWQG definition (DERM, 2009a)	Relevant to the study area
Aquatic Ecosystems Level 1: High ecological / conservation value (HEV) ecosystem	Effectively unmodified or other highly valued systems, typically occurring in national parks, conservations reserves or in remote and/inaccessible locations. The ecological integrity of HEV systems is regarded as intact.	✗ The catchment of the Study Area is considered to be SMD (see below)
Aquatic Ecosystems Level 2: Slightly-moderately disturbed (SMD) ecosystem	Ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity. The biological communities remain in a healthy condition and ecosystem integrity is largely retained. Typically, freshwater systems would have slightly to be moderately cleared catchments and/or reasonably intact riparian vegetation. SMD systems could include rural streams receiving runoff from land disturbed to varying degrees by grazing or pastoralism.	✓ The catchment of the Study Area is considered to be a SMD as the water resource receives runoff from land disturbed by grazing, the watercourses are accessed by stock for watering and the dams are artificial habitats
Aquatic Ecosystems Level 3: Highly disturbed (HD) ecosystem	These are measurably degraded ecosystems of lower ecological value. Examples of HD systems include rural streams receiving runoff from intensive horticulture.	✗ The catchment of the Study Area is considered to be a SMD (see above)
Primary Industries Irrigation	Suitability of water supply for irrigation	✓ Some downstream crop irrigation occurs The site drains to the

Environmental value	QWQG definition (DERM, 2009a)	Relevant to the study area
		Burdekin Falls dam which supplies a number of irrigation areas
Primary Industries Farm Water Supply	Suitability of domestic farm water supply, other than drinking water.	× Farm dams used for stock watering only. This is captured under Stock Watering below
Primary Industries Stock Watering	Suitability of water supply for production of healthy livestock.	✓ Water resources within and downstream of Study Area used for stock watering
Primary Industries Aquaculture	Health of aquaculture species and humans consuming aquatic foods from commercial ventures.	× No aquaculture occurs within or immediately downstream of the Study Area. The ephemeral nature of the streams makes it unlikely that aquaculture would be introduced to the area
Primary Industries Human Consumers of Aquatic Foods	Health of humans consuming aquatic foods from natural waterways.	× No aquaculture or recreational fisheries within or immediately downstream of the Study Area.
Recreation and Aesthetics Primary Recreation	Health of humans during recreation which involves direct contact and a high probability of water being swallowed.	× No water-based recreation activities occur within or immediately downstream of the Study Area. The ephemeral nature of watercourses would generally preclude primary recreation.
Recreation and Aesthetics Secondary Recreation	Health of humans during recreation which involves indirect contact and a low probability of water being swallowed.	× No water-based recreation activities occur within or immediately downstream of the Study Area. The ephemeral nature of watercourses would generally preclude secondary recreation.
Recreation and Aesthetics Visual Recreation	Amenity of waterways for recreation which does not involve any contact with water.	× No water-based recreation activities occur within or immediately downstream of the Study Area due to lack of public access and distance from

Environmental value	QWQG definition (DERM, 2009a)	Relevant to the study area
		settlements
Drinking Water	Suitability of raw drinking water supply. This assumes minimal treatment of water is required.	✓ It is expected that some individual downstream extractions occur for the purpose of drinking water.
Industrial Uses	Suitability of water supply for industrial use.	× Farm dams used for stock watering only
Cultural and Spiritual Values	Indigenous and non-indigenous cultural heritage.	✓ Traditional owners of the Study Area are the Wangan and Jagalingou people. The Project EIS is of relevance to these groups

In summary, the following EVs are considered to be relevant to the Study Area:

- Aquatic ecosystems – slightly to moderately disturbed
- Primary industries – irrigation
- Primary industries – stock watering
- Drinking water
- Cultural and spiritual values

4.2 ANZECC and ARMCANZ and Queensland Water Quality Guidelines

4.2.1 Overview

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000) form part of Australia's NWQMS. The primary objective of the guideline is "to provide an authoritative guide for setting WQOs required to sustain current or likely future, EVs [uses] for natural and semi-natural water resources in Australia and New Zealand".

ANZECC and ARMCANZ (2000) set benchmark values against which the quality of waters can be assessed. However, it is difficult for a national document to cover the vast range of water types found in Australia, and the national guidelines themselves recommend developing more regionally specific guidelines. The QWQG (DERM, 2009a) have been developed to deliver this regional focus. Under the EPP Water the QWQG (DERM, 2009a) inform the setting of WQO required to protect or enhance EVs for Queensland waters.

The QWQG (DERM, 2009a) provide procedures for deriving local guidelines for aquatic ecosystem protection. This may be necessary for a number of regions or water types where little previous data has been collected or where there are specific conditions that are not covered by the QWQG (DERM, 2009a) or ANZECC and ARMCANZ (2000) Guidelines.

4.2.2 Ecosystem type, condition and level of protection

The Guidelines recognise three categories of ecosystem condition, with a level of protection assigned to each. These are:

- High conservation/ecological value systems – effectively unmodified or other highly-valued ecosystems, typically (but not always) occurring in national parks, conservation reserves or in remote and/or inaccessible locations.
- Slightly to moderately disturbed systems – ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity. The biological communities remain in a healthy condition and ecosystem integrity is largely retained. Typically, freshwater systems would have slightly to moderately cleared catchments and/or reasonably intact riparian vegetation These systems could include rural streams receiving runoff from land disturbed to varying degrees by grazing or pastoralism.
- Highly disturbed systems – these are measurably degraded ecosystems of lower ecological value. Examples of highly disturbed systems would be some shipping ports and sections of harbours serving coastal cities, urban streams receiving road and stormwater runoff, or rural streams receiving runoff from intensive horticulture.

Table 10 Recommended basis for determining Queensland guideline values for waters at different levels of protection (QWQG, 2009)

Level of protection	Basis for guideline value
High ecological value systems	No change to natural values
Slightly to moderately disturbed systems	Guideline based on 20th and/or 80th percentiles of reference data from good quality reference sites
Highly disturbed systems	Guideline locally derived based on: a) a less stringent percentile, e.g. 10th/90th or b) reference data from more impacted but still acceptable reference sites

The slightly to moderately disturbed system level of protection has been adopted for the Carmichael River WQOs due to the presence of agricultural industry in the area. However, two areas of the Carmichael River that will not be impacted by the mining activities have been designated as high ecological value (Dight, 2009). These two areas include:

- Nairana National Park in the north-eastern corner of the Carmichael River catchment
- Wilandspey Conservation Park.

The Guidelines provide default guideline values for six ecosystem types. These are:

- upland rivers and streams
- lowland rivers
- freshwater lakes and reservoirs
- wetlands

- estuaries
- coastal and marine.

Upland streams are defined as those at greater than 150 m altitude and as such, the Carmichael River can be defined as a water body within this ecosystem type.

4.2.3 Environmental values

The EVs that would apply to the whole of the Carmichael River hydrological catchment are as follows:

- Aquatic ecosystems
- Recreational water—primary contact, secondary contact and visual use
- Drinking water (raw water)
- Primary industries—irrigation and general water use, livestock drinking water and aquaculture and human consumers of aquatic foods.

Of these, the aquatic ecosystems generally represent the most sensitive aspect of catchment health, so WQOs appropriately default to these values where they are available. Where guideline WQOs are unavailable and site-specific WQOs cannot be determined, it would be appropriate to use a guideline based on the next most sensitive values.

4.3 Aquatic ecosystem water quality objectives

4.3.1 Derivation of sub-regional water quality objectives

Sub-regional WQOs can be derived on the basis of the QWQG (DERM, 2009a) procedure. The recommended process is to calculate a series of different percentiles for different parameters as follows:

- For physicochemical parameters: 20th and/or 80th percentile;
- For nutrients and non-toxic compounds: 80th percentile; and
- For metals: 80th percentile.

Then compare the:

- ANZECC and ARMCANZ (2000) default trigger values for freshwater ecosystems and toxicants in freshwaters;
- Reliable background level (80th percentile) of parameters at the chosen reference site; and
- Regional WQOs.

In general, the highest value is selected as the WQO, though for metals if the background conditions are equal to or higher than the published WQO or when no trigger value exists, then the 80th percentile of the data set should be adopted as the WQO (ANZECC and ARMCANZ (2000), Section 8.3.5.5, Volume 2).

4.3.2 Data requirements: Chemicals and seasonal variation

A good understanding of the ambient water quality and its seasonal variations is a critical part of any environmental assessment study. The background data collected should include each chemical that may be present in the discharge water and may enter the environment. This is of particular importance when natural background concentrations of these chemicals are high as may be the case in mineralised mining environments.

The ANZECC and ARMCANZ Guidelines (2000) and QWQG (DERM, 2009a) recommend that, for the purpose of deriving ambient values, a sufficient amount of data needs to be collected and that it should characterise seasonal variations:

“A minimum of two years of continuous monthly data at the reference site is required before a valid trigger value can be established. “ (ANZECC and ARMCANZ 2000 Volume 1, Section 7.4.4.1).

The guidelines recommend the use of filtered (or dissolved) concentrations as a conservative approach to estimating the amount of the indicator. This allows for better estimation of the presence of metals in their bioavailable form (ANZECC and ARMCANZ 2000 Volume 1, Section 7.4.2).

The background data currently available at the time of preparing this report includes data from the 2011 dry season and the 2012/2013 wet season.

For the purposes of this water quality assessment, parameters of concern were identified from the suite of parameters monitored. It should be noted that hardness data is collected for all sites to allow for hardness modification of WQOs in the event that downstream toxicant concentrations exceed the WQOs.

Data validation

All available data collected to date was considered in the determination of ambient conditions and the assessment of WQOs.

When the dataset was sufficient (in terms of number of data points) then percentiles were calculated for the derivation of sub-regional WQOs. For the purpose of providing some direction, where the dataset contains insufficient information, percentiles may be included with a note that they do not meet the minimum two year monthly sampling requirement.

Data below limit of reporting

When the analytical result was below the LOR for a particular chemical species, then a value of half the detection limit was included in the calculation. This is one of the recommended approaches by the Water Quality Monitoring and Reporting Guidelines (ANZECC and ARMCANZ (2000b), Section 6.2.1). It is also understood that this approach has limitations, in particular, when over 25 percent of the data is below the detection limit. Where greater than 25 percent of values in a background dataset were below the detection limit the ANZECC and ARMCANZ (2000) default trigger value was selected as the sub-regional WQO.

4.3.3 Hardness modified trigger values

The ANZECC and ARMCANZ (2000) guidelines require the trigger values for several metals to be corrected for hardness to account for the hardness of the local water. The metals which fall in to this category are cadmium, chromium (iii), copper, lead, nickel and zinc. The WQO was modified for hardness using the 50^{th} percentile hardness value for the downstream monitoring location.

4.3.4 Water quality results

This section presents and discusses results from four monitoring points along Carmichael River as shown in Table 11.

Table 11 Project (Mine) water quality sampling program – sampling sites

Monitoring site	Water resource represented	Location
Site 1	Major Waterway: Carmichael River	Immediately upstream of the mine area
Site 2	Major Waterway: Carmichael River	Within the mine area
Site 3	Major Waterway: Carmichael River	Within the mine area
Site 4	Major Waterway: Carmichael River	Within the mine area

For a summary of each site, followed by a summary of the water quality data available for that site and discussion of trends from the data refer to Section 2.1.2.

Sites sampled along the Carmichael River displayed little spatial variation, indicating that the results obtained from the monitoring program are fairly typical of that stretch of the river. Therefore, water quality data from Sites 1 to 4 have been consolidated to form a data set of sufficient size and quality for deriving sub-regional WQOs for the Carmichael River. Site 1 is heavily influenced by groundwater. The influence of groundwater is evident in the elevated EC for all sites sampled on the Carmichael River (see Section 4.5.7).

Table 12 Carmichael River statistical summary – April 2011-April 2013

	pH pH Units	EC µS/cm	TSS mg/L	Hardness (mg/L)	TDS mg/L	Faecal Coli CFU/ 100mL	Chla µg/L	Ca mg/L	Mg mg/L	F mg/L	SO4 mg/L	Turbidity NTU
No. of results	254	264	53	12	24	24	24	43	41	29	17	254
Min Conc	7.06	371	2.5	79	505	10	0.5	1.0	0.5	0.05	2	2.0
Max Conc	8.48	2,430	960	103	960	11,000	4.0	25	35	0.5	14	267
Av Conc	7.85	777	88	88	673	659	1.7	12.3	10.8	0.276	8.5	80
20th % percentile	7.39	178	5.0	81	590	50	0.5	9.0	4.0	0.1	4.8	11.0
50th % percentile	7.87	689	16	88	621	96	1.0	13	12	0.2	8.0	46
80th % percentile	8.31	1,490	106	95	711	200	3.0	15	14	0.4	13.4	130

	TP µg/L	Reactive P µg/L	Ammonia as N µg/L	Nitrate as N µg/L	Nitrite as N µg/L	TN µg/L	Organic N mg/L	Al µg/L	As µg/L	Be µg/L	B µg/L	Cd µg/L
No. of results	53	24	53	53	28	28	28	42	29	29	43	43
Min Conc	5.0	1.0	2.5	1.0	1.0	120	0.12	5.0	0.5	BDL[1]	25	BDL
Max Conc	440	17	2,960	620	50	700	0.60	810	4.0		260	
Av Conc	97	4.4	137	57.4	8.3	350	0.30	133	1.3		131	
20th % percentile	12.6	1.0	2.5	2.0	1.0	230	0.20	5	0.5		60	
50th % percentile	25	4.0	50	30	1.0	295	0.27	80	1.0		130	
80th % percentile	200	7.0	100	80	3.0	592	0.47	212	2.0		182	

[1] Below detection limit

	Cu µg/L	Cr (III+IV) µg/L	Co µg/L	Fe mg/L	Pb µg/L	Mn µg/L	Hg µg/L	Mo µg/L	Ni µg/L	Se µg/L	Ag µg/L	Zn µg/L
No. of results	41	14	41	41	41	41	41	41	41	41	41	41
Min Conc	0.5	0.5	BDL	25	BDL	0.5	BDL	BDL	0.5	BDL	BDL	2.5
Max Conc	9.0	2.0		2,780		1,690			3.0			43
Av Conc	1.8	1.0		379		230			1.2			5.5
20th % percentile	0.5	0.5		90		14.8			0.5			2.5
50th % percentile	1.0	0.5		230		103			1.0			2.5
80th % percentile	2.6	2.0		580		346			2.0			4.0

4.3.5 Sub-regional water quality objectives

The water quality in the Carmichael River, upstream and downstream of the proposed mine site are shown in Table 13. The ANZECC and ARMCANZ (2000) default trigger values for tropical upland rivers and QWQG are also detailed in Table 13. These values were used to derive WQOs for the commonly monitored parameters as described in Section 2.1.3. The adopted WQOs (refer Table 14) are selected from the values shown in Table 15 with an explanation of the selection process detailed in Table 14.

Table 13 Carmichael River conditions and water quality objectives for ecosystem protection

Parameter	Unit	Carmichael River 80th percentile	ANZECC and ARMCANZ 2000 Default Trigger Values	QWQG (DERM, 2009) + Dight (2009)	Selected WQO
Physico chemical					
pH	pH Units	7.39-8.31	6.6-7.32	6.5-8.5	6.5-8.5
EC	µS/cm	1,300	802	168	1,300
Turbidity	NTU	130	5	25	130
TSS	mg/L	106	112	nd	106
TDS	mg/L	711	-	-	711
Nutrients					
Ammonia – N	µg/L	100	62 (9005)	10	100
NOx-N	µg/L	80	342	15	80
Organic N	µg/L	470	-	225	470
Total Nitrogen	µg/L	590	1802	250	590
FRP	µg/L	7.0	7.02	15	15
Total Phosphorus	µg/L	200	132	30	200
Sulfate	mg/L	13.4	1000[3]	-	129[4]
Dissolved metals					
Aluminium	mg/L	0.212	0.0555	-	0.212
Arsenic	mg/L	0.002	0.0135	-	0.013
Boron	mg/L	0.182	0.375	-	0.37

[2] ANZECC and ARMCANZ 2000 section 8.2.2.1 default trigger value for QLD upland rivers

[3] ANZECC and ARMCANZ 2000 section 4.3.3.4 livestock drinking water guidelines

[4] Elphick et al. 2011

[5] ANZECC and ARMCANZ 2000 table 3.4.1 trigger value for 95 percent species protection. These values apply for dissolved metals.

Parameter	Unit	Carmichael River 80th percentile	ANZECC and ARMCANZ 2000 Default Trigger Values	QWQG (DERM, 2009) + Dight (2009)	Selected WQO
Cadmium	mg/L	<0.0001	0.00025	-	0.0002
Copper	mg/L	0.0026	0.00145	-	0.0026
Chromium (III+IV)	mg/L	0.002	0.0015	-	0.002
Iron	mg/L	0.58	0.36	-	0.58
Lead	mg/L	BDL	0.00345	-	0.0034
Manganese	mg/L	0.35	1.95	-	1.9
Mercury	mg/L	BDL	0.00065	-	0.0006
Nickel	mg/L	0.002	0.0115	-	0.011
Zinc	mg/L	0.004	0.0085	-	0.008

Table 14 Justification for the selection of the water quality objectives

Parameter	Justification
pH	The monitoring data provides 20th and 80th percentile values of the wide range 7.39 to 8.31 which is within the QWQG (DERM, 2009a) WQO for upland rivers. The QWQG (DERM, 2009a) range provides the broadest range of values and hence was adopted as the WQO for the Carmichael River sub-region.
EC	The 75th percentile of the background dataset of 1300 µS/cm is higher than the WQO for the Belyando-Suttor zone in QLD of 168 µS/cm due to the influence of the groundwater entering the river system. Therefore the 75th percentile of the background was selected as the WQO for the Carmichael River sub-region.
Turbidity	The background data provides an 80th percentile value of 130 NTU, which is higher than the ANZECC and ARMCANZ (2000) default trigger value for upland rivers (5 NTU) and the QWQG (DERM, 2009a) of 25 NTU due to the variable water flow through the sampling sites. Elevated turbidity is seen during high flow events in the wet season and also increases as the water stops flowing and pooling increases. The 80th percentile, as the highest value, was selected as the WQO.
TSS	The background data provides an 80th percentile value of 106 mg/L, which is higher than the ANZECC and ARMCANZ (2000) default trigger value for upland rivers (11 mg/L) due to the variable water flow through the sampling sites. Elevated TSS is seen during high flow events in the wet season and also increases as the water stops flowing and pooling increases. The 80th percentile, as the highest value, was selected as the WQO.
TDS	The background data provides an 80th percentile value of 711 mg/L, due to the variable water flow through the sampling sites. The 80th percentile, as the only value, was selected as the WQO as QWQG (DERM, 2009a) and ANZECC and ARMCANZ (2000) does not provide aquatic ecosystem protection guidelines for this parameter, instead using EC.

[6] ANZECC and ARMCANZ 2000 low reliability trigger value for iron.

Parameter	Justification
Ammonia	The 80th percentile of the background dataset of, 100 µg/L is higher than the ANZECC and ARMCANZ (2000) default trigger value for upland rivers in QLD of 6 µg/L, but lower than the ANZECC and ARMCANZ (2000) trigger value of 900 µg/L . The 80th percentile was also higher than the QWQG (DERM, 2009a) of 10 µg/L. Therefore the 80th percentile was selected as the WQO.
NOx	The 80th percentile of the background dataset of 80 µg/L is higher than the ANZECC and ARMCANZ (2000) default trigger value for upland rivers in QLD of 34 µg/L and also higher than the QWQG (DERM, 2009a) of 15 µg/L. Therefore the 80th percentile was selected as the WQO.
Organic Nitrogen	The 80th percentile of the background dataset of 470 µg/L is higher than the QWQG (DERM, 2009a) of 225 µg/L. Therefore the 80th percentile was selected as the WQO.
Total Nitrogen	The 80th percentile of the background dataset of 0.59 mg/L is higher than the QWQG (DERM, 2009a) of 0.25 mg/L and the ANZECC and ARMCANZ (2000) default trigger value for upland rivers in QLD of 0.18 mg/L. The 80th percentile was therefore selected as the WQO.
FRP	The 80th percentile of the background dataset of 7.0 µg/L is equal to the ANZECC and ARMCANZ (2000) default trigger value for upland rivers in QLD and lower than the QWQG (DERM, 2009a) of 15 µg/L. The QWQG (DERM, 2009a) value was selected as the WQO.
Total Phosphorus	The 80th percentile of the background dataset of 200 µg/L is higher than the ANZECC and ARMCANZ (2000) default trigger value for upland rivers in QLD of 13 µg/L and higher than the QWQG (DERM, 2009a) of 30 µg/L. The 80th percentile was therefore selected as the WQO.
Sulfate	The 80th percentile of the background dataset of 13.4 mg/L is less than the ANZECC and ARMCANZ (2000) guideline value for livestock drinking water quality of 1000 mg/L commonly used for WQOs. However, the livestock drinking water guideline will not provide protection for aquatic ecosystems. Elphick et al. (2011) has calculated trigger values SO4 based on water hardness based using a suite of freshwater species. A trigger value for moderately hard water was calculated as 644 mg/L, however, as this was calculated using northern hemisphere species the trigger value for soft water will provide a level of confidence in the protective ability WQO. A trigger value of 129 mg/L was therefore selected as the WQO.
Hardness	There were insufficient hardness data to derive hardness modified trigger values as discussed in Section 4.2.5 for Cd, Cr (III), Cu, Pb, Ni or Zn. The WQOs will be modified once sufficient hardness data is obtained.
Aluminium	The 80th percentile of the background dataset of 0.212 mg/L is higher than the ANZECC and ARMCANZ (2000) toxicants 95 percent species protection level of 0.055 mg/L. The 80th percentile was therefore selected as the WQO.
Arsenic	The 80th percentile of the background dataset of 0.002 mg/L is lower than the ANZECC and ARMCANZ (2000) toxicants 95 percent species protection level of 0.013 mg/L. Therefore, the ANZECC and ARMCANZ (2000) trigger value selected as the WQO.
Boron	The 80th percentile of the background dataset of 0.182 mg/L is lower than the ANZECC and ARMCANZ (2000) toxicants 95 percent species protection level of 0.37 mg/L. Therefore, the ANZECC and ARMCANZ (2000) trigger value selected as the WQO.

Parameter	Justification
Cadmium	The 80th percentile of the background dataset was below the laboratory detection limit of 0.0001 mg/L, therefore, it is lower than the ANZECC and ARMCANZ (2000) toxicants 95 percent species protection level of 0.0002 mg/L. Therefore, the ANZECC and ARMCANZ (2000) trigger value selected as the WQO.
Copper	The 80th percentile of the background dataset of 0.0026 mg/L is higher than the ANZECC and ARMCANZ (2000) toxicants 95 percent species protection level of 0.0014 mg/L. The 80th percentile was therefore selected as the WQO.
Chromium (III+IV)	The 80th percentile of the background dataset of 0.002 mg/L is higher than the ANZECC and ARMCANZ (2000) toxicants 95 percent species protection level of 0.001 mg/L. The 80th percentile was therefore selected as the WQO.
Iron	The 80th percentile of the background dataset of 0.58 mg/L is higher than the ANZECC and ARMCANZ (2000) toxicants 95 percent species protection level of 0.30 mg/L. The 80th percentile was therefore selected as the WQO.
Lead	The 80th percentile of the background dataset was below the laboratory detection limit of 0.001 mg/L, therefore, it is lower than the ANZECC and ARMCANZ (2000) toxicants 95 percent species protection level of 0.0034 mg/L. Therefore, the ANZECC and ARMCANZ (2000) trigger value selected as the WQO.
Manganese	The 80th percentile of the background dataset of 0.35 mg/L is less than the ANZECC and ARMCANZ (2000) toxicants 95 percent species protection level of 1.9 mg/L. The ANZECC and ARMCANZ (2000) trigger was therefore selected as the WQO.
Mercury	The 80th percentile of the background dataset was below the laboratory detection limit of 0.0001 mg/L, therefore, it is lower than the ANZECC and ARMCANZ (2000) toxicants 95 percent species protection level of 0.0006 mg/L. Therefore, the ANZECC and ARMCANZ (2000) trigger value selected as the WQO.
Nickel	The 80th percentile of the background dataset of 0.002 mg/L is less than the ANZECC and ARMCANZ (2000) toxicants 95 percent species protection level of 0.011 mg/L. The ANZECC and ARMCANZ (2000) trigger was therefore selected as the WQO.
Zinc	The 80th percentile of the background dataset of 0.004 mg/L is less than the ANZECC and ARMCANZ (2000) toxicants 95 percent species protection level of 0.008 mg/L. The ANZECC and ARMCANZ (2000) trigger was therefore selected as the WQO.

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Table 15 Water quality objectives adopted for the assessment

Parameter	Units	Australian Drinking Water Guidelines##	Aquatic Ecosystems#	Primary Industries*	
			Carmichael River	Irrigation	Stock Watering
Physical parameters					
DO	percent saturation	-	90 – 110*	-	-
pH		-	6.5 – 8.5#	-	6.0 – 8.5
Electrical Conductivity	µS/cm	-	1,300**	-	16,700
Turbidity	NTU	-	130**	2 - 15	-
Biological					
Faecal coliforms	cfu/100 mL	0	-	10 (direct contact) 1000 (indirect contact)	1000
Nutrients					
Ammonia as N	µg/L	500 (Aesthetic)	100**	-	-
Nitrate (as N)	µg/L	50,000	80**	-	400,000
Nitrite (as N)	mg/L	3,000	-	-	30
Nitrogen (Total)	µg/L	-	590**	5000 - 125000	-
Organic Nitrogen	µg/L	-	470**		
Phosphorus	mg/L	-	0.02**	0.05 - 12	-
Reactive Phosphorus as P	mg/L	-	0.015**	-	-
Major ions					
Calcium	mg/L	-	-	-	1,000
Magnesium	mg/L	-	-	-	2,000

Parameter	Units	Australian Drinking Water Guidelines##	Aquatic Ecosystems#	Primary Industries*	
			Carmichael River	Irrigation	Stock Watering
Fluoride	mg/L	1.5	-	1 - 2	2
Sulphate	mg/L	500	129^^	-	1,000
TDS	mg/L	-	-	-	2,500
Metals and metalloids*					
Aluminium	mg/L	0.1	0.232**	5 - 20	5
Arsenic	mg/L	0.01	0.013*	0.1 - 2	0.5
Beryllium	mg/L	0.06	-	0.1 - 0.5	-
Boron	mg/L	4	0.37*	0.5	5
Cadmium	mg/L	0.002	0.0002*	0.01 - 0.05	0.01
Chromium (III+VI)	mg/L	0.05 (CrVI)	0.001*	0.1 - 1	1
Cobalt	mg/L	-		0.05 - 0.1	1
Copper	mg/L	2	0.0014*	0.2 - 5	1
Iron	mg/L	0.3 (Aesthetic)	0.30*	0.2 - 10	-
Lead	mg/L	0.01	0.0034*	2 - 5	0.1
Manganese	mg/L	0.5	1.9*	0.2 - 10	-
Mercury	mg/L	0.001	0.00006*	0.002	0.002
Molybdenum	mg/L	0.05		0.01 - 0.05	0.15
Nickel	mg/L	0.02	0.011*	0.2 - 2	1
Selenium	mg/L	0.01	0.005*	0.02 - 0.05	0.02
Silver	mg/L	0.1	0.00005*	-	-
Uranium	µg/L	0.017	-	10 - 100	200

Parameter	Units	Australian Drinking Water Guidelines##	Aquatic Ecosystems#	Primary Industries*	
			Carmichael River	Irrigation	Stock Watering
Vanadium	mg/L	-	-	0.1 - 0.5	-
Zinc	mg/L	3 (Aesthetic)	0.008*	2 - 5	20
Polycyclic aromatic hydrocarbons					
Naphthalene	µg/L	-	16*	-	-

from the QWQG (DERM, 2009a); ## from the Australian Drinking Water Guidelines (2011); * from the ANZECC guidelines (ANZECC and ARMCANZ, 2000), range values for irrigation WQOs represent LTV and short term trigger values (STV); ^ 75th percentile for Belyando-Suttor salinity zone (DERM 2009a); **80th percentile for Carmichael River Data; ^^ Elphick et al 2011.

4.3.6 Sediment results

The metal concentrations in the sediment samples from the Carmichael River sample sites showed that all metals were below the ANZECC and ARMCANZ (2000) Interim Sediment Quality Guidelines (ISQG) low. There were no hydrocarbons detected in any of the Carmichael River sediments. Therefore, the ANZECC and ARMCANZ (2000) ISQG have been used for the sediment quality objectives.

Table 16 Sediment quality objectives adopted for the assessment

Parameter	ISQG low* (mg/kg)	ISQG high* (mg/kg)
Arsenic	20	70
Cadmium	1.5	10
Chromium (III+VI)	80	370
Copper	65	270
Lead	50	220
Mercury	0.15	1
Nickel	21	52
Silver	1	3.7
Zinc	200	410
Acenaphthene	0.016	0.5
Anthracene	0.085	1.1
Benz(a)anthracene	0.261	1.6
Benzo(a) pyrene	0.43	1.6
Chrysene	0.384	2.8
Dibenz(a,h)anthracene	0.063	0.26
Fluoranthene	0.6	5.1
Fluorene	0.019	0.54
Naphthalene	0.16	2.1
Phenanthrene	0.24	1.5
Pyrene	0.665	2.6

*ISQG (Interim Sediment Quality Guidelines); from the ANZECC guidelines (ANZECC and ARMCANZ, 2000)

4.3.7 Aquatic ecosystem summary

The assessment of the existing surface water quality environment identified that the surface water resources onsite display both spatial and temporal variability as discussed in Appendix Q in the draft Project EIS. The influence of groundwater on the water quality of the Carmichael River at the proposed mine site is evident. Therefore, the water quality at this site meets very few of the WQOs derived for the Burdekin - Bowen zone or the Belyando-Suttor zone (QWQG, DERM, 2009a).

The WQOs derived and shown in this document will allow for ecosystem protection and therefore, all other protected values (irrigation, stock watering etc.) will also be protected. The WQOs should be met at all stages of construction and operations. These WQOs are the most stringent and will provide protection for 95 percent of the populations from a 10 percent reduction in growth or reproduction. However, there does need to be very strong measures in place to prevent sediment from erosion caused by construction and operations entering the waterways.

Having point sources for discharging will enable management of the discharge water quality. Management and mitigation measures nominated in the SEIS Volume 4 Appendix K5 Revised Mine Hydrology Impact Assessment Report can be put in place to maintain the WQOs at the edge of the mixing zone. It should be noted that the discharge at the end of pipe does not have to meet the WQOs

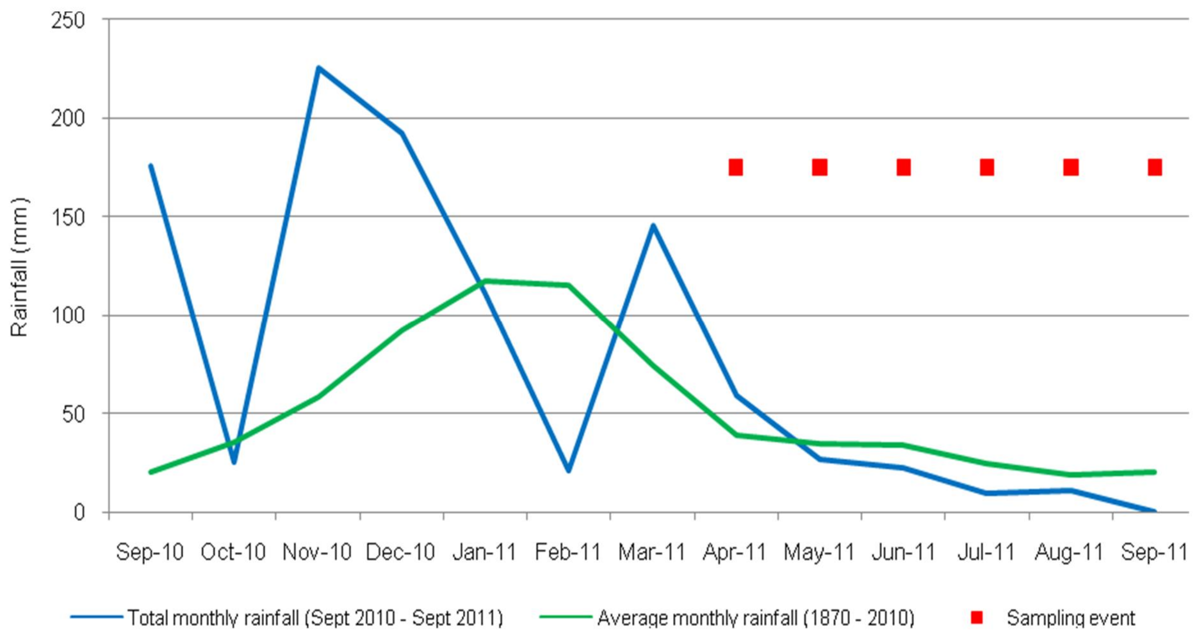
4.4 Weather observations

Rainfall inputs to waterways and associated overland flows have the potential to substantially influence the water quality observations. Accordingly, in order to assist in interpretation of the monitoring program results (presented following), a summary of the climatic conditions experienced prior to and during dry season and wet season monitoring is provided. Data sourced from the Bureau of Meteorology (BOM) weather station closest to the Study Area, located at Clermont, has been assessed. The Clermont BOM station (ID 035019) is located approximately 150 km south east of the Study Area (refer Figure 1) and gives the most geographically relevant data available.

Above average rainfall was experienced in the region prior to the commencement of sampling in April 2011 (refer to Figure 7). In the period leading up to water quality sampling, between September 2010 and March 2011, a total of 896 mm of rain was recorded in Clermont. This is well above the long-term (1870-2010) average of 513 mm for the same period (BOM, 2011). A significant amount of this rainfall (418 mm) fell during November and December 2010 (refer to Figure 7). During that period dry watercourses and drainage lines at the north of the Study Area exhibited flash flows (refer to original EIS Volume 4 Appendix O – Mine Aquatic Ecology Report). The riparian zone of the Carmichael River showed signs of recent flooding including scattered debris at the commencement of the sampling program (refer Plate 1).

During the sampling program, between April 2011 and September 2011, a total rainfall of 129 mm was recorded in Clermont. This is below the long-term (1870-2010) average of 172 mm for the same period (BOM, 2011). This is in contrast to the rainfall prior to the wet season sampling in 2012/2013 which was below the monthly average for all months except January 2013 (refer Figure 8). During the sampling program, between November 2012 and April 2013, a total rainfall of 365 mm was recorded in Clermont. This is below the long-term (1870-2010) average of 479 mm for the same period (BOM, 2013). The low rainfall in February and March limited the number of sites which could be sampled.

Figure 7 Rainfall recorded prior to and during dry season monitoring



Source: BOM, 2011

Figure 8 Rainfall recorded prior to and during wet season monitoring

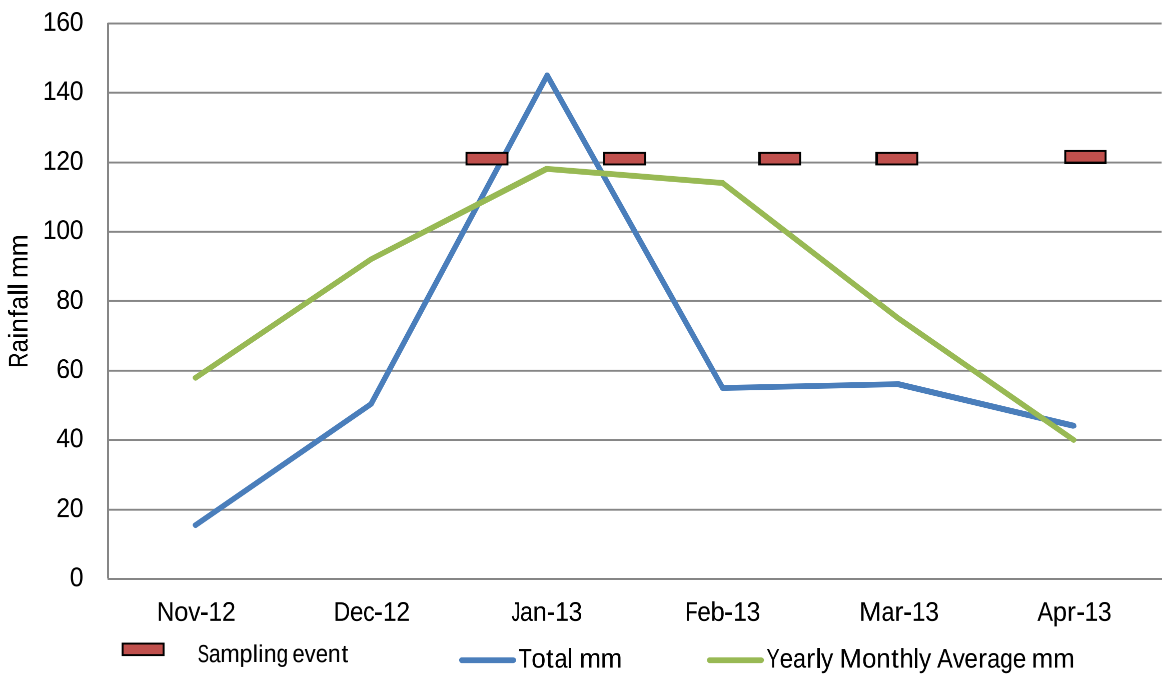


Plate 1 Evidence of flooding at the Carmichael River (July 2011)

4.5 Water quality

4.5.1 Major ions dry season 2011

An assessment of the major ion concentrations (sodium (Na^+), potassium (K^+), magnesium (Mg^{2+}), calcium (Ca^{2+}), chloride (Cl^-), sulphate (SO_4^{2-}), bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) of the surface water resources of the Study Area has been undertaken for the dry season 2011 and wet season 2012/2013 samplings. Figure 9 and Figure 10 presents piper diagrams categorising the water types based on major ion chemistry. This indicates that the water present in the still water bodies has a different major ion 'finger print' than the water present in the Carmichael River.

The still water bodies were characterised by a major ion water type comprising sodium/potassium bicarbonate. This characterisation was consistent throughout the monitoring program. By contrast, there was variation in the major ion characteristics in the Carmichael River over the sampling period. At the end of the wet season (May 2011) the Carmichael River was characterised by a major ion water type comprising sodium chloride bicarbonate. As the influence of the wet season decreased, the water type of the Carmichael River changed; concentrations of bicarbonate decreased and concentrations of sodium and chloride increased, resulting in a water type classified as sodium chloride. Towards the end of the dry season (September, October and November 2011) the concentrations of magnesium in the Carmichael River substantially increased, as reflected by the changes in EC (refer results presented above).

Groundwater sampling bores in proximity to the Carmichael River were established towards the end of the surface water quality monitoring program (refer EIS Volume 4 Appendix K1 Updated Mine Hydrogeology Report for details of the groundwater program). Sampling of the major ion

chemistry of the groundwater in proximity to the Carmichael River was undertaken in October and November 2011 (refer to Figure 9). The major ion chemistry of the groundwater at this time was characterised by a water type of sodium chloride. Magnesium was also present in the groundwater samples.

Additional surface water samples were obtained from Carmichael River sites during the groundwater sampling events in October and November 2011. These samples were tested for major ion concentrations. The additional samples provide temporal continuity between the surface water and groundwater major ion data sets, thus allowing for a comparison between these water resources to be undertaken.

A comparison of the major ion chemistry of the groundwater and surface water (refer to Figure 9) indicates that it is likely that the surface water of the Carmichael River is influenced by the nearby groundwater aquifers during the dry season and to a lesser extent as the wet season proceeds. From the temporal change observed in the surface water major ion chemistry it can also be surmised that the influence of groundwater on the Carmichael River is greater in the dry season than in the wet season when rain water is entering the system (Figure 10). Further sampling of the major ion chemistry of the groundwater and surface waters of the Carmichael River is planned so as to confirm this surface water / groundwater interaction.

Table 17 Maximum values of major ion concentrations (mg/L) (April – November 2011)

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Calcium	25	19	14	15	5	14	13	4	6
Magnesium	35	27	15	17	2	6	5	1	3
Fluoride	0.5	0.5	0.4	0.4	BDL	0.2	BDL	BDL	BDL
Sulphate	14	13	14	14	2	5	1	0.5	0.5
TDS	932	960	894	954	234	378	240	129	136

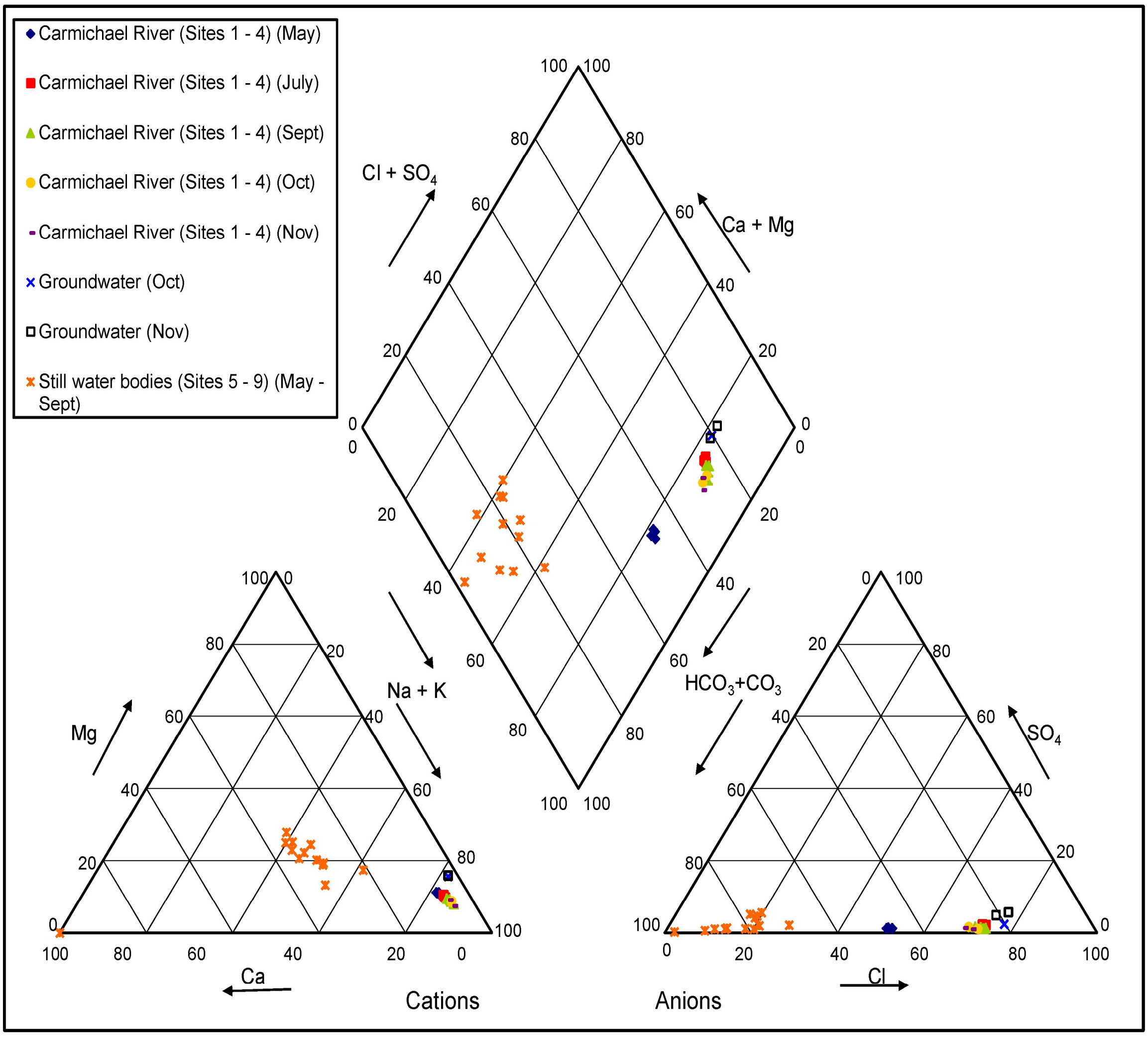
BDL= Below detection limits

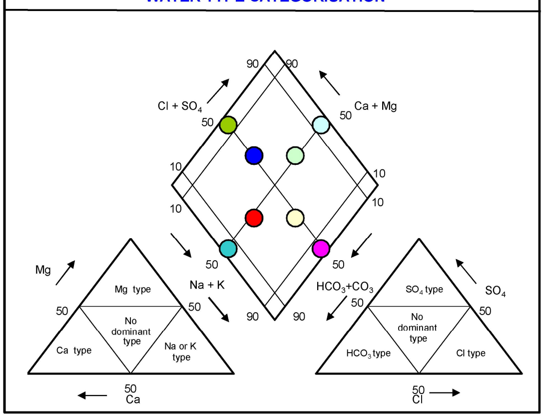
Table 18 Maximum values of major ion concentrations (mg/L) (November 2012 – April 2013)

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 13	Site 14	Site 15	Site 16
Calcium	15	-	25	25	10	31	14	112	21
Magnesium	17	-	27	35	2	23	7	10	17
Fluoride	0.4	-	0.5	0.5	0.2	0.8	0.5	0.4	0.4
Sulphate	-	-	2	3.0	9	6	-	-	16
TDS	735	-	1070	1300	1290	915	1040	485	446

\- = No data

Figure 9 Piper diagram of major ion chemistry dry season 2011

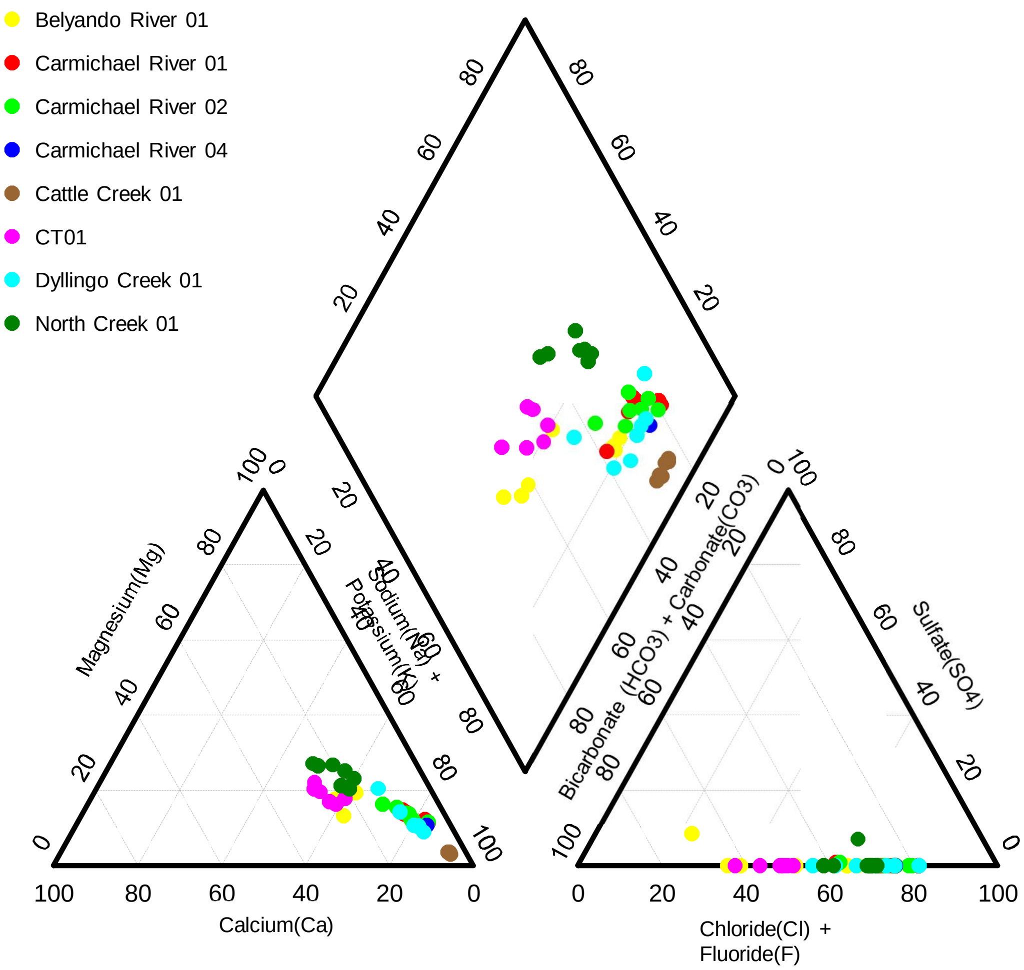




WATER TYPE SUB-FIELDS

- Ca + Mg, Na + K type
- Ca + Mg type
- HCO_3, Cl + SO_4 type
- HCO_3 + CO_3 type
- Na + K, Ca + Mg type
- Na + K type
- Cl + SO_4, HCO_3 type
- Cl + SO_4 type

Figure 10 Piper diagram of major ion chemistry wet season 2012/2013



4.5.2 Physical parameters

Physical parameters tested as part of the monthly in-situ sampling program (from April to September 2011 and November 2012 to April 2013) included turbidity, DO, pH, temperature and electrical conductivity. The following section provides a discussion of the existing surface water quality environment in relation to these physical parameters.

4.5.3 Turbidity

Turbidity is a measure of suspended particulate matter in water. Turbidity is known to fluctuate naturally with changes in flow regimes and rates of particle re-suspension, with high turbidity often corresponding to catchment runoff events. The bulk movement of suspended solids is often associated with high flow events (Dunlop et al., 2005). Levels of turbidity within a system are closely linked to environmental characteristics of the system including sediment grain size and the presence and prevalence of phytoplankton and organic matter. High levels of suspended sediment are noted by Dunlop et al. (2005) to be a major contributor to the turbidity of Queensland streams. Other contributors to turbidity measures include organic matter, biological matter and water colour (Dunlop et al., 2005). Sources of suspended sediment can include point sources (such as stormwater drains), diffuse land run off due to erosion of terrestrial soils (ANZECC and ARMCANZ, 2000) and alluvial processes within river channels (Dunlop et al., 2005) that result in sediment re-suspension. There do not appear to be any point sources in the study area, and hence land runoff and alluvial sources are the contributors to suspended solids levels and turbidity.

Spatial and temporal variations in turbidity were observed throughout the monitoring program. Sites 10 – 12 were dry throughout the assessment, and therefore do not have associated turbidity data. The highest turbidity values were recorded in April 2011 at the start of the monitoring program, which coincided with the end of the wet season. As monitoring progressed into the dry season and water flow decreased, the turbidity values decreased related to lack of water movement. As water in the stagnant pools dried out, towards the end of the dry season, turbidity generally increased. Stock watering also had an impact on measured turbidity at several of the sites.

The sites located on the Carmichael River (Sites 1 – 4) were fairly comparable to each other; turbidity at these sites ranged from less than 5 NTU to greater than 220 NTU. The median turbidity of the Carmichael River sites was typically greater than the sites located in the farm dams (Sites 6 – 9) and on Cabbage Tree Creek (Site 5), which was not flowing during the dry season sampling. The range of turbidity experienced at the farm dam sites was less than the Carmichael River sites, with Site 7, located at Swamp Tank dam, displaying the smallest range of the program (56 NTU). The minimum turbidity value at Site 6 (Four Mile Dam) was higher than all other sites. Similarly, Site 6 displayed the highest median and average turbidity values, indicating that occurrences of lower turbidity were not as common at this site compared to the other still water bodies, possibly due to the presence of stock.

It is expected that sediment re-suspension in the flowing river is the cause of the spatial variation between the river and still water bodies. It is likely that the observed temporal variations in turbidity are linked to the changes in the onsite flow regime and associated process of evapo-concentration. All of the sites experienced a decrease in depth through time during the dry season. The change in depth at the Carmichael River sites is likely to have increased the potential for alluvial sediment re-suspension. Sampling during the wet season showed that the depth of the Carmichael River is related to rainfall; however, the base flow is most probably groundwater dependent.

Table 19 Turbidity (NTU) summary statistics (April 2011 – April 2013)

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Number of samples (n)	64	66	67	57	47	50	60	60	60
Minimum	3.00	2.30	2.00	4.70	4.70	12.70	3.60	9.80	6.60
20th percentile	8.38	3.98	7.70	23.54	59.30	17.10	18.34	18.76	10.20
Median	81.35	23.20	39.30	40.05	98.50	110.20	33.55	35.30	27.00
Average	110.02	70.00	64.20	76.18	107.28	113.01	34.56	56.20	49.60
80th percentile	224.52	125.42	85.30	86.80	154.52	201.80	58.38	83.02	40.68
Maximum	267.00	257.00	223.00	267.00	267.00	232.00	59.60	195.60	192.80

Sites 10 – 12 were dry during sampling events.

	Site 13	Site 14	Site 15	Site 16					
Number of samples (n)	4	4	5	4					
Minimum	11.5	6.1	9.1	12.1					
20th percentile	11.5	6.1	9.1	12.1					
Median	37.8	8.1	25.2	25.3					
Average	68.0	7.9	819.0	24.3					
80th percentile	184.9	9.5	2062	34.6					
Maximum	184.9	9.5	2087*	34.6	* First flush event				

4.5.4 Dissolved oxygen

DO is influenced by the balance between oxygen consuming processes, such as respiration, and oxygen releasing processes, such as photosynthesis and atmospheric input (ANZECC and ARMCANZ, 2000). The amount of DO within a water body can be affected by a number of environmental and biological factors including, but not limited to temperature, salinity, atmospheric and hydrostatic pressure, rates of photosynthesis (which displays strong diurnal pattern), rates of atmospheric input, and turbulence of the water body.

Values of DO displayed both temporal and spatial changes (refer to Table 20) which is not unexpected given the number of different factors that influence DO concentrations. Missing values at Site 5 are related to the inaccessibility of the site during some sampling events.

All DO concentrations recorded at all sites throughout the monitoring program were low due to the lack of flowing water. The QWQG (DERM, 2009a) states that the DO guidelines for freshwater should only be applied to flowing waters. Stagnant pools in ephemeral waters can naturally experience DO levels below 50 percent saturation (DERM, 2009a), which is consistent with the findings of the monitoring program.

The distinct spatial patterns observed in the turbidity results were not present in the DO results. DO maximum results at Sites 1 – 3 on the Carmichael River followed a similar temporal pattern and displayed low maximum values (refer to Table 20). DO maximum concentrations at Site 4, also located on the Carmichael River, were more comparable to those recorded at Site 5 (Cabbage Tree Creek) than the other Carmichael River sites. These two sites displayed a DO concentration range of greater than 90 percent saturation (refer to Table 20). The dam sites (Sites 6 – 9) generally followed a similar temporal pattern (refer to Table 20). These sites also displayed comparable ranges in DO concentration; approximately 45 percent saturation (Table 20).

Table 20 Dissolved oxygen (percent saturation) summary statistics (April 2011 – April 2013)

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Number of samples (n)	64	66	67	67	47	60	60	60	60
Minimum	42.40	53.00	47.20	37.90	31.03	40.40	46.28	46.40	35.80
20th percentile	45.61	56.28	53.14	40.33	34.20	50.40	48.56	50.80	49.48
Median	55.84	64.18	55.03	49.11	40.40	59.47	69.40	64.74	58.35
Average	54.16	62.97	55.95	60.11	51.11	60.40	68.79	66.48	59.77
80th percentile	59.60	67.24	59.17	55.86	63.76	67.58	88.12	83.14	75.90
Maximum	65.20	76.46	67.90	130.50	130.50	86.60	91.76	89.90	82.27
Note: Sites 10 – 12 were dry during sampling . No dissolved oxygen data was available for sites 13 - 16									

4.5.5 pH

pH is a measure of the acidity or alkalinity of water. The pH of surface waters can be highly variable, being driven by local and regional factors such as underlying geology, climate, land use, organic loading and flow regime. Most natural freshwaters range in pH from 6.5 (slightly acidic) to 8.0 (slightly alkaline; ANZECC and ARMCANZ, 2000). The QWQG (DERM, 2009a) considers extremes of pH to be less than 5 and greater than 9.

All sites located on the Carmichael River (Sites 1 – 4) were consistently outside the trigger values listed in ANZECC and ARMCANZ (2000) range (6.5 – 7.5; refer to Table 21), however, the pH values were within the QWQG (2009) (6.5 – 8.5; refer to Table 21). The Carmichael River sites all displayed a similar temporal pattern in pH, with little spatial variation between sites during each of the events. An investigation of the soil properties of the immediate surrounds identified that the soil types are alkaline (refer to Volume 4 Appendix L Soils Report). It is expected that the soil alkalinity strongly influenced the alkaline pH levels of water quality of the Carmichael River. Groundwater is also influencing the water quality in the river.

The pH of the still water bodies (Site 5, Cabbage Tree Creek and Sites 6 – 9, farm dams) were also within the QWQG (2009). Missing data points at Site 5 are related to site access issues encountered during monitoring. pH at the still water sites showed a greater variation within each site, with ranges varying from 0.89 pH units at Site 5 to 2.64 pH units at Site 9 (refer to Table 21). Extreme values of pH (> 9) were recorded at Site 7, Site 8 and Site 9. These values were recorded at the end of the dry season monitoring program at Site 7 and Site 8, and at the start of the monitoring program (April 2011) at Site 9. Temporal patterns at the still water sites were not as distinct as those observed at the Carmichael River sites. Similarly, spatial variability between the still water sites was more pronounced during each monitoring event.

Table 21 pH summary statistics (April 2011 – April 2013)

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Number of samples (n)	64	66	67	67	47	60	60	60	60
Minimum	7.70	7.47	7.31	7.06	7.23	7.75	7.65	7.88	6.68
20th percentile	7.71	7.95	8.01	7.78	7.40	7.77	7.77	7.99	7.59
Median	7.89	8.13	8.10	8.06	7.52	8.01	7.94	8.53	7.80
Average	7.92	8.14	8.09	7.97	7.64	8.08	8.14	8.58	7.95
80th percentile	8.03	8.24	8.21	8.07	8.07	8.25	8.21	9.10	8.49
Maximum	8.34	8.48	8.43	8.12	8.12	8.69	9.36	9.41	9.32
	Site 13	Site 14	Site 15	Site 16					
Number of samples (n)	6	5	6	6					
Minimum	7.81	7.64	7.11	7.64					
20th percentile	7.89	7.69	7.12	7.67					
Median	8.11	7.77	7.19	8.45					
Average	8.11	7.93	7.23	8.26					
Note: Sites 10 – 12 were dry during sampling									

4.5.6 Temperature (April 2011 – April 2013)

Variations in surface water temperature can occur naturally as part of diurnal and seasonal cycles, as changes in depth occur, or as a result of anthropogenic activities (ANZECC and ARMCANZ, 2000). Site specific influences, such as shading, wind and rainfall regime can also affect water temperature. WQOs for temperature have not been developed due to the very wide range of temperatures that may occur in fresh waters.

Recorded water temperature varied in accordance with seasonality (and air temperatures) throughout the monitoring period, with minimum temperatures recorded in June at all sites (Table 22); missing data at Site 5 due to site access issues). Spatial variation in temperature was also observed within the sites on the Carmichael River (Sites 1 – 4) generally recording lower temperatures to those in the still water bodies (Cabbage Tree Creek and dam sites).

Variations in temperature at the Carmichael River sites ranged from 10 °C at Site 2 to 16 °C at Site 3 (Table 22). In contrast, sites located in the still water bodies displayed a higher temporal variation with ranges from 16 °C at Site 6 to 25 °C at Site 5 (refer to Table 22). The contrast in temporal variation trends is associated with the temperature maxima; there was less variation between river and still water body sites at the lower temperatures than at the higher temperatures.

The differences in temperature between the Carmichael River sites and the still water bodies is likely associated with the high degree of shading by riparian vegetation at the river sites. The still water bodies had limited to no shading and would thus be more influenced by direct radiance from the sun, leading to heating of the water body (refer Section 2.1 for site descriptions). This indicates that shading of water bodies provides a buffering capacity against variations in temperature.

Table 22 Temperature (°C) summary statistics

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Number of samples (n)	64	66	67	67	47	60	60	60	60
Minimum	10.30	15.00	8.60	11.30	11.30	12.00	15.80	11.50	9.90
20th percentile	17.00	15.68	15.40	15.90	15.90	19.90	23.20	19.40	21.10
Median	18.30	17.15	18.00	20.15	17.30	24.50	26.45	22.65	22.00
Average	18.19	18.55	17.79	19.30	22.54	22.35	25.96	21.54	22.17
80th percentile	20.90	20.92	22.00	22.60	26.20	25.50	27.10	24.82	27.90
Maximum	30.0	25.50	30.3	33.0	36.20	28.30	36.60	28.20	30.20
	Site 13	Site 14	Site 15	Site 16					
Number of samples (n)	6	6	7	26.9					
Minimum	26.8	23.1	24.1	28.8					
20th percentile	26.8	25.4	24.2	32.2					
Median	27.6	29.4	26.2	32.2					
Average	28.5	27.8	26.4	23.3					
80th percentile	30.9	31.1	28.8	35.7					
Maximum	30.9	31.4	29.8	37.4	Note: Sites 10 – 12 were dry during sampling				

4.5.7 Electrical conductivity

EC is an indicator used to measure the total concentration of inorganic ions (salts) in water. Freshwaters are generally defined by having an EC of less than 1,000 μS/cm (ANZECC and ARMCANZ, 2000). The EC of a water body can be affected by a number of factors including concentrations of salts in catchment soils and groundwater, land use, climate and flow regime.

Average EC values across the sites were close to or less than 1,000 μS/cm (Table 23). As such, the waters of the Study Area can be considered to be freshwater. EC levels at the Carmichael River sites (Sites 1 – 4) were substantially higher than the still water bodies (Cabbage Tree Creek and dam sites, Sites 5 – 9). Median EC levels at the still water bodies were generally below the QWQG (2009) (Sites 5 – 9; missing data at Site 5 related to site access issues). The Carmichael River sites all displayed a similar temporal pattern, with EC generally increasing through the dry season and variable during the wet season. By June 2011 the EC levels at the river sites had increased above 1,000 μS/cm, indicating an increased concentration of major ions present in the water. This water is still considered to be freshwater due to its location and lack of tidal influence, but higher EC values mean that the ability of the water to provide aquatic habitat is compromised. The observed increase in EC is as the dry season progressed is likely related to the cumulative effects of the evapo-concentration of the salts, and groundwater inputs. Potential inputs of saline groundwater are further explored in Volume 4 Appendix R Mine Hydrogeology Report.

The temporal trends observed in the EC of river sites are likely linked to the local climate and flow regime. The lower EC levels were present at the end of the wet season during which time the heavy rainfall would have caused dilution of the salts present in the river.

Table 23 Electrical conductivity (µS/cm) summary statistics (April 2011-April 2013)

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Number of samples (n)	64	66	67	67	47	60	60	60	60
Minimum	312	371	397	563	52	131	145	37	62
20th percentile	988	988	972	919	59	141	153	45	66
Median	1153	1193	1199	1054	67	144	177	47	74
Average	1135	1175	1154	1069	383	150	174	46	75
80th percentile	1309	1336	1315	1293	1292	159	184	51	84
Maximum	1400	2000	2000	1400	1327	180	206	51	93
	Site 13	Site 14	Site 15	Site 16					
Number of samples (n)	6	6	7	6					
Minimum	260	1474	206	448					
20th percentile	386	1525	242	473					
Median	979	1611	678	567					
Average	933	1610	537	567					
80th percentile	1422	1690	771	662					
Maximum	1502	1725	795	687					
Note: Sites 10 – 12 were dry during sampling									

4.5.8 Nutrients

Nutrients that were assessed as part of the monitoring program were total nitrogen, ammonia, oxides of nitrogen, total phosphorus and reactive phosphorus. A table of all the nutrient analytical results is provided in Appendix A; summary statistics are provided below to assist in data interpretation. Nutrient pollution has the potential to impact upon a system via the stimulation of growth of nuisance plants and cyanobacteria (ANZECC and ARMCANZ, 2000). Growth of these plants can lead to changes in the biological community composition as well as flow on affects to aspects of water quality such as depletion of DO concentration. Observations of macrophyte presence and prevalence were undertaken during each monitoring event. No macrophytes of high prevalence (blooms) were noted during monitoring.

Total nitrogen

Total nitrogen is comprised of organic nitrogen, and inorganic nitrogen, including ammonia (NH_3 or NH_4^+), nitrate (NO_3^-) and nitrite (NO_2). Median total nitrogen concentrations displayed distinct spatial patterns whereby the concentrations found in the still water bodies were consistently higher than those found in the Carmichael River. There was little spatial separation of the median total nitrogen concentrations at the Carmichael River sites. These sites all followed a similar pattern of high concentrations at the end of the wet season (April 2011 and April 2013), followed by a decrease in June and then a gradual increase back to values. Summary statistics of the total nitrogen values recorded throughout the monitoring program are provided in Table 24.

The total nitrogen concentrations for most sites were mainly comprised of organic nitrogen. The QWQG (DERM, 2009a) state that during periods of low flow increased organic nitrogen levels can result from a build-up of organic matter derived from natural sources. These higher organic nitrogen levels should not be considered to exceed the guidelines if levels of inorganic nitrogen remain low (DERM, 2009). The Study Area was subject to low (Carmichael River sites) or no flow (Cabbage Tree Creek and dam sites) throughout the dry season monitoring program and for two sites during the wet season monitoring. A build-up of organic matter, such as plant detritus and cow manure, was observed at all sites during the monitoring program. As such, higher organic nitrogen levels are not unexpected.

Total phosphorous

Total phosphorus concentrations exhibited similar spatial and temporal patterns to total nitrogen concentrations. The still water bodies displayed substantially higher total phosphorus concentrations than the sites located in the Carmichael River. The Carmichael River sites displayed a small temporal variation (maximum variation of 0.029 mg/L at Site 4) when compared to the Cabbage Tree Creek and dam sites (maximum variation of 0.257 mg/L at Site 7; Table 25). The Carmichael River sites also displayed little spatial variation.

Table 24 Total nitrogen (µg/L) summary statistics (April 2011 - April 2013)

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Minimum	254	146	127	157	837	590	1530	1360	1140
20th percentile	250	230	220	240	866	640	1530	1930	2150
Median	310	300	235	280	995	670	1925	2030	2175
Average	362	325	297	328	1063	697	2068	2028	2070
80th percentile	350	350	370	320	1232	780	2700	2210	2270
95th percentile	613	560	543	605	1381	818	2775	2510	2450
Maximum	700	630	600	700	1430	830	2800	2610	2510
	Site 13	Site 14	Site 15	Site 16					
Minimum	240	1260	-	870					
20th percentile	-	-	-	-					
Median	-	-	-	-					
Average	350	-	-	1020					
80th percentile	-	-	-	-					
95th percentile	-	--	-	-					
Maximum	460	-	-	1170					

Table 25 Total phosphorus (mg/L) summary statistics (April 2011 – April 2013)

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Minimum	0.005	0.009	0.0025	0.009	0.077	0.064	0.091	0.087	0.068
20th percentile	0.0086	0.011	0.0086	0.015	0.132	0.070	0.159	0.096	0.087
Median	0.018	0.019	0.0195	0.032	0.170	0.076	0.202	0.101	0.113
Average	0.018	0.020	0.059	0.084	0.172	0.079	0.219	0.108	0.115
80th percentile	0.027	0.030	0.17	0.118	0.212	0.088	0.310	0.120	0.140
95th percentile	0.029	0.033	0.23	0.43	0.257	0.098	0.339	0.137	0.160
Maximum	0.03	0.034	0.24	0.44	0.272	0.101	0.348	0.142	0.167
	Site 13	Site 14	Site 15	Site 16					
Minimum	0.005	0.005	0.005	0.005					
20th percentile	0.026	0.012	0.005	0.005					
Median	0.10	0.06	0.02	0.08					
Average	0.15	0.059	0.15	0.09					
80th percentile	0.31	0.10	0.35	0.17					
Maximum	0.32	0.10	0.38	0.18					

Reactive phosphorous

Measures of reactive phosphorus provide an indication of the potentially bioavailable forms of phosphorus in the system. The majority of reactive phosphorus samples from the Carmichael River were below the QWQG (DERM 2009a). Conversely, the majority of the reactive phosphorus samples from the still water bodies were above the QWQG (DERM 2009a).

Reactive phosphorus concentrations ranged from 0.001 mg/L (Site 3) to 0.017 mg/L (Site 2) at the Carmichael River sites (Sites 1 – 4; refer to Table 26). The still water body site (Sites 5 – 9), which generally contained higher levels of reactive phosphorus, ranged from 0.004 mg/L (Site 9) to 0.027 mg/L (Site 7).

Table 26 Reactive phosphorus (mg/L) summary statistics (April 2011 – April 2013)

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Minimum	0.002	0.002	0.001	0.002	0.007	0.007	0.008	0.006	0.004
20th percentile	0.005	0.004	0.001	0.002	0.007	0.007	0.010	0.006	0.012
Median	0.006	0.007	0.004	0.004	0.008	0.010	0.012	0.010	0.015
Average	0.006	0.008	0.003	0.004	0.008	0.010	0.014	0.010	0.014
80th percentile	0.007	0.011	0.005	0.005	0.009	0.012	0.013	0.011	0.016
95th percentile	0.010	0.016	0.006	0.007	0.010	0.012	0.024	0.016	0.019
Maximum	0.011	0.017	0.006	0.007	0.010	0.012	0.027	0.017	0.020
Note: Sites 10 – 12 were dry during sampling. Reactive phosphorus was not tested at sites 13-16									

4.5.9 Hydrocarbons

All PAHs and TPHs tested were below the laboratory limit of reporting across all sites and all sampling events. Hence hydrocarbons are not considered to exceed any guidelines.

4.5.10 Metals and metalloids

Total and dissolved metals measured as part of the monitoring program were aluminium, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, mercury, nickel, selenium, silver, tin, uranium, vanadium and zinc. A table of all the metal and metalloid analytical results is provided in Appendix A. A number of the tested metals were not detected above laboratory limits of reporting throughout the monitoring program at any sites or times, these were:

- Beryllium (total and dissolved)
- Cadmium (total and dissolved)
- Mercury (total and dissolved)
- Molybdenum (total and dissolved)
- Selenium (total and dissolved)
- Silver (total and dissolved)
- Uranium (total and dissolved)
- Vanadium (dissolved)

Summary statistics of the dissolved metals that returned results for the Carmichael River sites (Sites 1 – 4) and the still water bodies (Cabbage Tree Creek and farm dams; Sites 5 – 9) are provided in Table 27 and Table 28, respectively. Sites 10 – 12 were dry throughout the monitoring program; as such no data for these sites is presented in this section.

The hardness of a water sample has the potential to reduce the toxicity of metals and metalloids at particular concentrations (ANZECC and ARMCANZ, 2000). An assessment of water hardness across the Study Area has identified that the use of a HMTV is appropriate for the Carmichael River samples (moderate hardness; 60 – 119 mg/L).

Dissolved aluminium, copper, iron and zinc 95th percentile concentrations were the only analytes that were above the WQOs for the Carmichael River adopted for this project for protection of aquatic ecosystems at the Carmichael River sites (Sites 1 – 4). All other 95th percentile metal concentrations recorded from the Carmichael River were below the nominated WQOs (Table 4-20).

A number of exceedances of the nominated WQOs were recorded at the still water bodies (Sites 5 – 9). Total and dissolved aluminium, chromium, copper, lead and zinc 95th percentile concentrations exceeded the WQOs for protection of aquatic ecosystems. Total aluminium 95th percentile concentrations also exceeded the LTV for metals in irrigation water and the WQOs nominated for stock watering (refer to Table 29). The 95th percentile concentrations of total and dissolved manganese in the still water bodies also exceeded the LTV for metals in irrigation water. All other 95th percentile metal concentrations recorded from the still water bodies were below the nominated WQOs (Table 28).

Table 27 Metal summary statistics (mg/L) for Carmichael River sites (Sites 1 – 4) April 2011 – April 2013

Metal		Number of samples (n)	Minimum	20th percentile	Median	Average	80th percentile	95th percentile	Maximum
Aluminium	Dissolved	42	0.005	0.005	0.080	0.133	0.212	0.538	0.810
Arsenic	Dissolved	43	BDL	0.0005	0.001	0.0013	0.002	0.004	0.004
Boron	Dissolved	43	0.025	0.060	0.130	0.131	0.182	0.248	0.260
Chromium (III+VI)	Dissolved	41	BDL	0.0005	0.0005	0.001	0.002	0.002	0.002
Cobalt	Dissolved	41	BDL	-	-	-	-	-	-
Copper	Dissolved	41	0.0005	0.0005	0.001	0.0018	0.0026	0.0059	0.009
Iron	Dissolved	41	0.025	0.090	0.230	0.379	0.580	1.500	2.780
Lead	Dissolved	41	BDL	-	-	-	-	-	-
Manganese	Dissolved	41	0.0005	0.015	0.103	0.230	0.346	1.410	1.690
Nickel	Dissolved	41	0.0005	0.0005	0.001	0.0012	0.002	0.003	0.003
Zinc	Dissolved	41	0.0025	0.0025	0.0025	0.0055	0.004	0.039	0.043

Note: BDL = below detection limits. Highlighted cells are above WQOs for Carmichael River

Table 28 Metal summary statistics (mg/L) for still water body sites (Cabbage Tree Creek (Sites 5) and Farm Dams (Sites 6 – 9)) dry season 2011

Metal		Number of samples	Minimum	20th percentile	Median	Average	80th percentile	95th percentile	Maximum
Aluminium	Dissolved	11	0.020	0.030	0.050	0.274	0.180	1.322	2.030
Arsenic	Dissolved	13	0.001	0.001	0.002	0.002	0.002	0.002	0.002
Barium	Dissolved	13	0.023	0.039	0.176	0.165	0.242	0.317	0.354
Boron	Dissolved	11	0.050	0.060	0.080	0.091	0.104	0.174	0.180
Chromium (III+VI)	Dissolved	13	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Cobalt	Dissolved	13	BDL	BDL	BDL	BDL	BDL	BDL	0.001
Copper	Dissolved	13	0.0010	0.0020	0.0020	0.0026	0.003	0.0045	0.005
Iron	Dissolved	11	0.060	0.074	0.160	0.353	0.470	1.218	1.680
Lead	Dissolved	13	BDL	BDL	BDL	BDL	BDL	BDL	0.0010
Manganese	Dissolved	13	0.002	0.003	0.007	0.034	0.038	0.155	0.182
Nickel	Dissolved	13	0.001	0.001	0.002	0.002	0.002	0.002	0.002
Zinc	Dissolved	13	0.012	0.015	0.020	0.023	0.031	0.038	0.040

Note: BDL = below detection limits

Table 29 Metal summary statistics (mg/L) for Creek sites (Cattle Creek, Dyllingo Creek and North Creek (Sites 14-16) and Belyando River (Site 13)) wet season 2012/2013

Metal		Number of samples	Minimum	20th percentile	Median	Average	80th percentile	95th percentile	Maximum
Aluminium	Dissolved	27	0.005	0.005	0.005	0.026	0.048	0.142	0.150
Arsenic	Dissolved	27	0.0005	0.0005	0.002	0.002	0.0024	0.004	0.004
Barium	Dissolved	13	0.088	0.111	0.160	0.197	0.284	0.309	0.0309
Boron	Dissolved	27	0.025	0.060	0.150	0.144	0.204	0.278	0.290
Chromium (III+VI)	Dissolved	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.001
Cobalt	Dissolved	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.002
Copper	Dissolved	27	0.0005	0.0005	0.001	0.0014	0.002	0.003	0.003
Iron	Dissolved	27	0.025	0.025	0.025	0.110	0.182	0.580	0.580
Lead	Dissolved	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Manganese	Dissolved	27	0.0005	0.002	0.058	0.143	0.238	0.685	0.793
Nickel	Dissolved	27	0.0005	0.0005	0.002	0.0017	0.003	0.003	0.003
Zinc	Dissolved	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.024

Note: BDL = below detection limits

4.6 Biological parameters

Biological parameters tested as part of the dry season monitoring program were chlorophyll a and faecal coliforms.

4.6.1 Chlorophyll a

As noted in the QWQG (DERM, 2009a) measures of chlorophyll a provide an indication of the algal biomass in a water sample. Temporal trends in chlorophyll a at the Carmichael River sites (Sites 1 – 4) were consistent, with the majority of sites comparable during each sampling event (refer to Table 30). Temporal variation at these sites was between 2 mg/m^3 and 3 mg/m^3. Maximum concentrations at the Carmichael River sites of 4 mg/m^3 were recorded in July 2011.

With the exception of Site 6, all still water bodies (Sites 5 – 9) contained much higher concentrations of chlorophyll a, and thus higher algal biomass, than the Carmichael River sites (Table 30; missing data from Site 5 due to site access issues). Temporal variation at these sites was between 2 mg/m^3 and 52 mg/m^3 (refer to Table 30). There was a similar trend in the concentration of nitrogen in the still water bodies (refer to Section 4.5.8). As described in Section 4.5, Site 6 displayed higher minimum turbidity values than the other still water bodies. It is likely that the turbidity values at this site limited the growth of algae in this water body.

Table 30 Chlorophyll a (mg/m^3) summary statistics dry season 2011

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Minimum	1.0	1.0	1.0	1.0	6.0	2.0	8.0	10.0	12.0
20th percentile	1.6	1.0	1.6	1.0	7.2	2.0	12.0	11.0	18.0
Median	3.0	1.0	2.0	2.0	12.5	3.0	15.0	15.0	23.5
Average	2.8	1.8	2.0	2.0	12.5	3.0	14.5	16.7	30.3
80th percentile	4.0	2.4	2.4	2.4	17.8	4.0	17.0	17.0	41.0
95th percentile	4.0	3.6	2.9	3.6	18.7	4.0	19.3	28.3	58.3
Maximum	4.0	4.0	3.0	4.0	19.0	4.0	20.0	32.0	64.0
Note: Sites 10 – 12 were dry during sampling									

4.6.2 Faecal coliforms

Testing for the presence and prevalence of faecal coliforms provides an indication of faecal contamination, and thus the potential presence of microbial pathogens, in a water sample. Faecal coliform concentrations at all sites were consistently above the WQOs for irrigation (direct contact; 10 cfu/100 ml; Table 31). Site 2, Site 4, Site 6 and Site 8 all exceeded the WQOs for stock watering and irrigation (indirect contact; 1000 cfu/100 ml) for at least one monitoring event (refer to Table 31).

Faecal contamination of a water body can be caused by a number of human and animal vectors. As cattle grazing is the current land use of the Study Area and adjacent surrounds, it is likely that the faecal coliform concentrations identified during monitoring are associated with the presence of cattle onsite (refer to Table 31).

Table 31 Faecal coliform (cfu/100 ml) summary statistics dry season 2011

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9
Minimum	10	40	60	20	30	20	20	24	64
20th percentile	50	140	74	30	42	36	26	30	69
Median	82	245	160	73	56	79	90	89	90
Average	71	2028	142	399	161	602	238	522	97
80th percentile	100	500	200	200	237	1400	370	1100	124
95th percentile	100	8375	200	1550	434	1850	715	1625	136
Maximum	100	11000	200	2000	500	2000	830	1800	140
WQOs	10 direct contact 1000 indirect contact	10 direct contact 1000 indirect contact	10 direct contact 1000 indirect contact	10 direct contact 1000 indirect contact	10 direct contact 1000 indirect contact	10 direct contact 1000 indirect contact	10 direct contact 1000 indirect contact	10 direct contact 1000 indirect contact	10 direct contact 1000 indirect contact

4.7 In-stream sediment quality

In-stream sediment quality testing undertaken as part of the monitoring program comprised testing for physical parameters, total metals, nutrients, biological parameters and hydrocarbons. A table of all in-stream sediment quality analytical results is provided in Appendix A. Sampling of in-stream sediments at Cabbage Tree Creek was not achieved due to site access restrictions. References to still water body sites in relation to in-stream sediment quality therefore relate only to the farm dam sites (Sites 6 – 9).

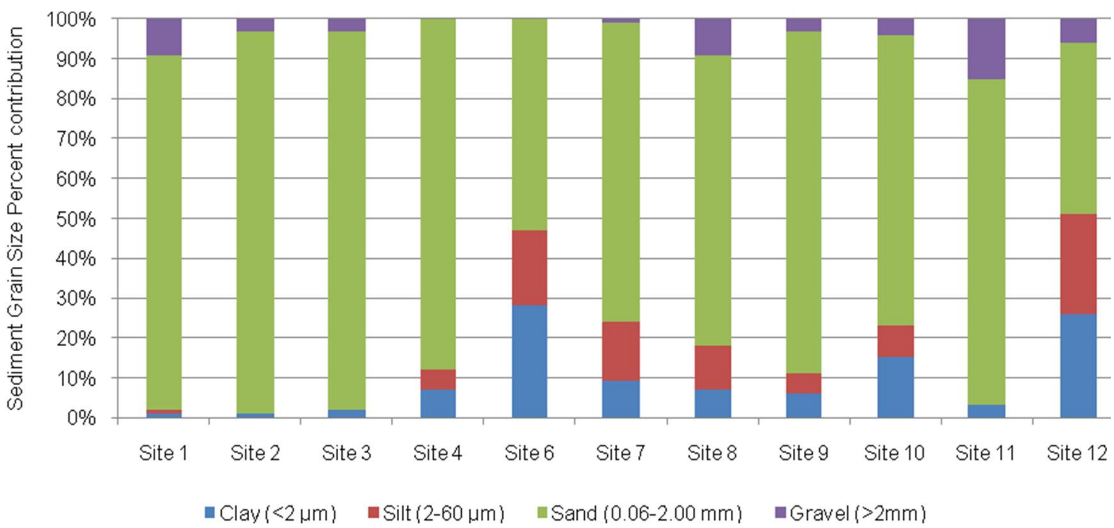
4.7.1 Physical parameters

Physical parameters assessed as part of the monitoring program were sediment grain size, total organic carbon and moisture content. The latter two parameters were tested to assist in interpretation of analytical results; results are provided in Appendix A. Sediment grain size results are presented below.

The sediment composition across the Study Area was dominated by sands (0.06 – 2 mm; refer to Figure 11). The Carmichael River sites (Sites 1 – 4) were comprised of sand, gravel, clay and silt, at an average ratio of 92:4:3:1. Sampling of in-stream sediments at Cabbage Tree Creek was not achieved due to site access restrictions. The still water body sites (Sites 6 – 9) contained less sand than the Carmichael River sites, comprising sand, clay, silt and gravel (average ratio of 72:12.5:12.5:3). The sites with no water contained an average ratio of 66:15:11:8 of sand, clay, silt and gravel.

As outlined above, and shown in Figure 11, the Carmichael River sediments contained a greater proportion of coarse material, and conversely a smaller proportion of fine material on the river beds compared to the sites with no flow, or no water. This is likely associated with the flow characteristics of the Carmichael River, whereby fine materials are more easily mobilised and transported from the bed than coarser materials. This is supported by the turbidity findings presented in Section 4.5, which identified high loads of fine sediments suspended in the water column.

Figure 11 Sediment grain size results for each site



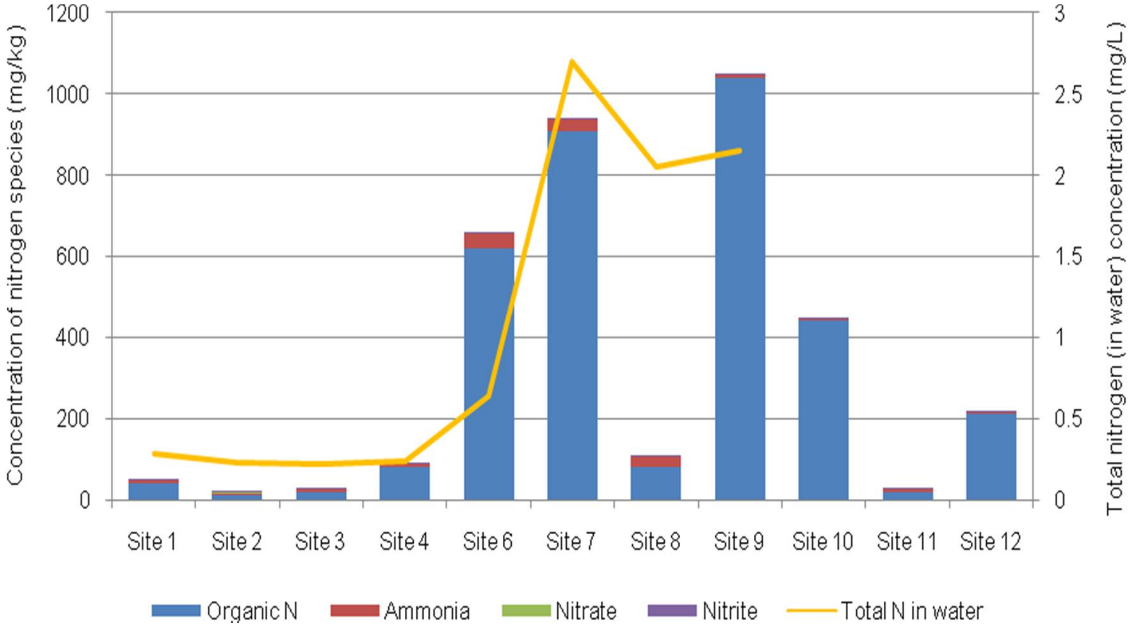
Note: Cabbage Tree Creek (Site 5) not sampled

4.7.2 Nutrients

The concentration of total nitrogen in the sediment samples displayed a similar spatial pattern to that observed in the water quality analysis when compared to water quality samples taken at the same time (July 2011; refer to Figure 12). The Carmichael River sites (Sites 1 – 4) contained substantially less total nitrogen than the majority of the still water bodies (Sites 6 – 9), and three of the sites with no water (Site 10 - 12; refer to Figure 12).

The composition of nitrogen species within the sediment was dominated by organic nitrogen (refer to Figure 12), which is consistent with the findings of the water quality assessment (refer Section 4.5.8).

Figure 12 Composition of nitrogen species (mg/L) for each site

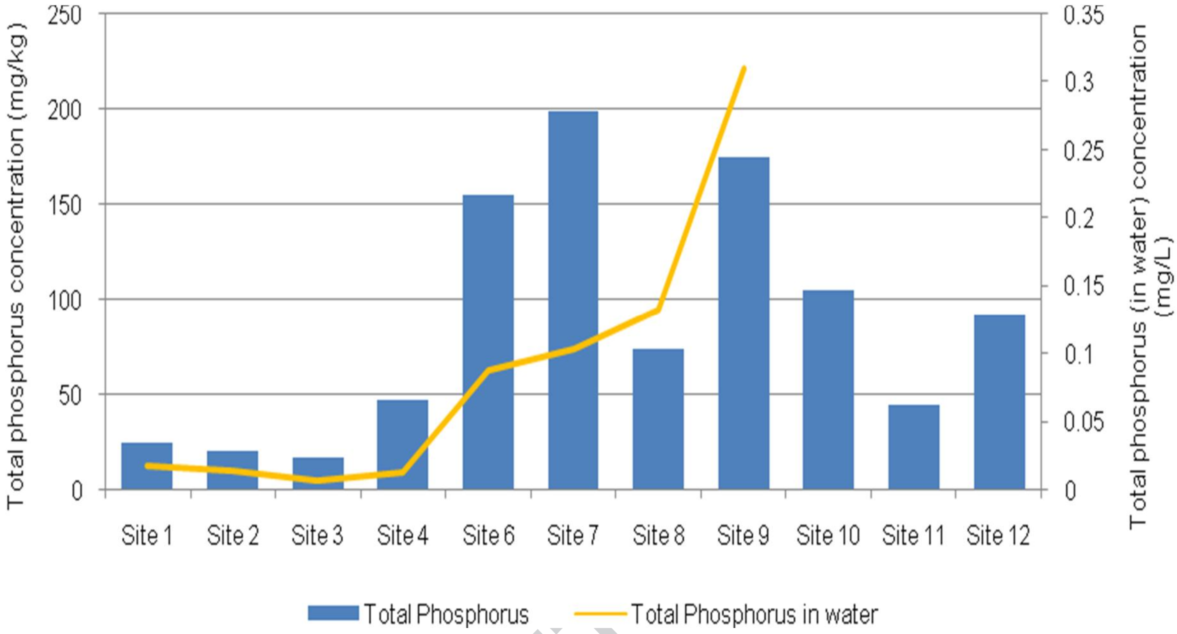


Note: Sites 10, 11 and 12 did not have water at the time of sampling therefore no dissolved nitrogen results are available.

Concentrations of total phosphorus in the sediment samples displayed a similar pattern to total nitrogen (refer to Figure 13). The Carmichael River sites (Sites 1 – 4) contained substantially lower total phosphorus concentrations than the still water bodies and dry creek beds (refer to Figure 13). This observed spatial pattern is consistent with the results of the water quality assessment (refer Section 4.5.8), however trends in sediment and water concentrations are not as closely aligned as those observed for total nitrogen (refer to Figure 13). Reactive phosphorus was not found above laboratory limits of detection at the Carmichael River sites. Where detected at the still water bodies and dry creek beds, concentrations were low (maximum of 0.2 mg/kg).

There are no available SQOs for nutrients. As such, no comparison of data to SQOs has been undertaken.

Figure 13 Total phosphorus concentrations for each site



Note: Sites 10, 11 and 12 did not have water at the time of sampling therefore no dissolved phosphorus results are available.

4.7.3 Biological parameters

Testing for the presence and prevalence of faecal coliforms in the sediment was undertaken as part of the monitoring program. Faecal coliforms were only detected above laboratory limits of reporting at one of the Carmichael River sites (Site 4). Faecal coliforms were detected at all of the still water bodies and one of the dry creek bed sites. The highest concentrations of faecal coliforms were associated with the farm dams (still water bodies). These results are not unexpected given the presence of cattle in these areas, and the infrequent flushing of the farm dams.

The spatial patterns of faecal coliforms observed in the sediments is different to that identified in the water samples. It is likely that the results obtained from the water samples provide an indication of recent faecal coliform additions to the resources, whereas concentrations in the sediment are indicative of long term accumulation. There are no SQOs for faecal coliforms; as such no comparison of the data to SQOs has been undertaken.

4.7.4 Hydrocarbons

All PAHs and TPHs tested were below the laboratory limit of reporting; data is provided in Appendix A. For some PAHs (acenaphthene, anthracene, benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, naphthalene, phenanthrene, pyrene), the laboratory limit of reporting was not able to achieve the required level of detection for comparison against the nominated ISQG Low SQOs. All PAHs were below the nominated ISQG High SQOs.

4.7.5 Metals and metalloids

A number of metals were not detected above the laboratory limits of reporting, including boron, cadmium, mercury, selenium and silver and these are not reported further. Where metals were detected, concentrations were generally lower in the Carmichael River sediments than at the other sites Table 32). Where applicable, the concentrations of metals and metalloids in the sediment samples have been compared to the nominated SQOs. No exceedances of the lower ISQG (ISQG Low) were recorded (Table 32).

Table 32 Metal and metalloid concentrations (mg/kg) in sediment during July 2011 sampling

	SQO ISQG Low	SQO ISQG High	Site 1	Site 2	Site 3	Site 4	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12
Aluminium	n/a	n/a	600	380	320	1200	7950	2100	2860	2100	3280	2020	6090
Arsenic	20	70	0.3	0.5	0.3	0.5	1.2	1.9	0.9	1.1	4	3.1	1.5
Barium	n/a	n/a	12.6	6.8	9.8	24.1	188	89.7	20.7	33.8	31.5	665	17.4
Beryllium	n/a	n/a	<0.1	<0.1	<0.1	0.2	0.5	0.5	0.2	0.2	0.4	0.5	0.7
Chromium (III+VI)	80	370	2.2	1.5	1.6	4.5	17.4	9.9	24	20.3	36.6	47.1	21.1
Cobalt	n/a	n/a	0.5	0.5	0.6	1.5	5	5.4	2.3	4.4	4.8	28	4.6
Copper	65	270	0.6	0.3	0.4	1.7	8.1	6.3	3.6	3.2	5	6.2	12.1
Iron	n/a	n/a	1360	1090	1100	2220	9410	6720	4880	6280	10,200	12,100	10,900
Manganese	n/a	n/a	13.3	11.4	59.1	27.3	225	232	58.6	181	136	3450	87.4
Molybdenum	n/a	n/a	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.3
Nickel	21	52	0.6	0.4	0.5	1.4	6.6	3.9	3.3	2.1	5.3	13.1	6.2
Phosphorus	n/a	n/a	25	21	17	47	155	199	74	175	105	45	92
Strontium	n/a	n/a	1.4	0.6	0.9	2.8	21.9	10.5	2.1	4.5	5.8	12.1	7.1
Uranium	n/a	n/a	<0.1	<0.1	<0.1	0.1	0.7	0.2	0.1	0.2	0.4	0.2	1.6
Vanadium	n/a	n/a	4	2	3	8	34	24	20	22	46	51	32
Zinc	200	410	1.5	0.8	1.1	3.5	12.5	9.7	2.6	4.7	4.4	2.7	10

4.7.6 Deionised water leach

As outlined in Section 2.1.4, stream bed sediment samples collected at the sites that did not contain any water throughout the monitoring program were subject to a DI water leach preparation. This was undertaken in order to gain an understanding of the potential for the release of contaminants into surface waters during flow events. As outlined in the QWQG (DERM, 2009a), short-term spikes in pollutants during flood events in ephemeral streams can be expected as surface runoff mobilises pollutants within the stream bed and from the surrounding catchment. The values above the nominated guidelines (described following) are considered to be reflective of this process.

A table of all DI leach supernatant analytical results is provided in Appendix A.

Nutrients

Nutrients measured from the DI water leach supernatant were total nitrogen, ammonia, oxides of nitrogen, total phosphorus and reactive phosphorus. Total nitrogen concentrations, which ranged from 20 to 80 µg/L, were below the nominated WQOs at all sites, as were nitrate concentrations. In contrast to the sites that contained water during the monitoring program, ammonia was present in higher concentrations than organic nitrogen. The concentrations of ammonia exceeded the ANZECC and ARMCANZ (2000) guidelines at all sites.

Total phosphorus concentrations ranged from 0.021 and 0.128 mg/L, with two of three sites exceeding the ANZECC and ARMCANZ (2000) guidelines for upland streams. Reactive phosphorus exceeded the ANZECC and ARMCANZ (2000) guidelines for upland streams at all three DI leach testing sites.

Metals and metalloids

Concentrations of total and dissolved aluminium and chromium were above the ANZECC and ARMCANZ (2000) guidelines for upland streams at all three locations. Concentrations of total and dissolved zinc at Site 10 and Site 12 were above the ANZECC and ARMCANZ (2000) guidelines for upland streams. Concentrations of total copper were also above the ANZECC and ARMCANZ (2000) guidelines; however dissolved copper concentrations remained below nominated WQOs. All other metals were below nominated WQOs, or were not detected above the laboratory limits of reporting.

Hydrocarbons

All PAHs and TPHs tested from the DI water leach supernatant were below the laboratory limit of reporting at all three sites and did not exceed any guidelines.

4.8 Doongmabulla Springs water quality

4.8.1 Overview

The Doongmabulla Springs complex is located approximately 8 km west of the proposed Carmichael Coal Project area. These springs are a Great Artesian Basin (GAB) spring complex and comprises of two spring groups, Moses and Joshua, located on Doongmabulla Station near the confluence of three creek systems; Cattle Creek, Dyllingo Creek and Carmichael Creek. Carmichael Creek joins Dyllingo Creek just upstream of Doongmabulla Station, the Dyllingo Creek and Cattle Creek converge east of the Doongmabulla Springs complex to form the

Carmichael River. A description of the ecology of the Doongmabulla Springs complex, based on a desktop review of existing information and on a field inspection (between 22 and 24 June 2012).

Water quality sampling and analysis from the Doongmabulla Springs complex and nearby creeks has therefore been undertaken to provide further information on potential water sources to the springs and to identify any similarities and/or variations in the water quality between:

- Individual springs of the springs complex
- The spring complex and nearby creeks

4.8.2 Sampling observations

Observations made at each sampled location on 22 and 24 June 2012, along with the name of the spring or group of springs and assigned spring 'morphology' are summarised in Table 33.

Table 33 Sampling observations, June 2012

Location ID (and Sample ID)	Spring / group of springs	Assigned spring 'morphology'	Observations at sample collection
Doon Spring (DS1)	Believed to be Little Moses Spring	Non mounding artesian spring	On east side of small rise. Flowing water (clear, colourless) from beneath possible sandstone outcrop on rise. Algal growth along edges of flow channel. Flow rate estimated <0.5 L/s.
Doon Spring 2a (DS2A)	Un-named	Non artesian (recharge) spring	Standing stagnant looking water in pools within shallow sloping, shallow gully - no vegetation. Tall grasses down-slope, boggy ground. Sample collected from hand dug hole (brown muddy water).
Doon Spring 3	Moses Spring group	Mound spring	No flow observed from mound. Mound squelchy under foot but no standing water. Two wet areas (seeps, approximately 30 cm x 30 cm) on perimeter of mound but no flow, just glistening with water. No sample collected.
Doon Spring 4 (DS4)	Moses Spring group	Mound spring	Mound within extensive wetland (boggy) grassed area. Shallow ponding of standing water adjacent to spring mound, water slightly cloudy, brown colour. No flow observed.
Doon Spring 5 (DS5)	Moses Spring group	Mound spring	Located around 10 m south of sandstone bluff on flat plain. Standing water within grasses of mound spring, with some dampness of the surrounding ground. Water clear and colourless. No flow observed.
Doon Spring 5A	Moses Spring group	Mound spring	Minor seepage from mound, but not enough to sample.
Doon Spring 5B (DS5B)	Moses Spring group	Mound spring	Located around 30 m south of sandstone bluff (around 10 m high) on flat plain. Pool of water in centre of mound spring (no movement or bubbling of this water observed). Water also ponded within grasses of mound spring (sampled). Ground boggy around vicinity of mound. Minor flow observed (<0.1 L/s) from mound area towards ponded water adjacent to mound (slightly cloudy, colourless).
Doon Spring 6 (DS6)	Moses Spring group	Mound spring	Water ponded within grasses on mound. Mound is wobbly like a water bed. Seepage evident from perimeter of mound to immediate area surrounding spring, but dry beyond this.

Location ID (and Sample ID)	Spring / group of springs	Assigned spring 'morphology'	Observations at sample collection
Doon Spring 7 (DS7)	Moses Spring group	Mound spring	Water ponded within grasses on mound, slightly cloudy. Area surrounding mound spring is dry but with some seepage evident from perimeter of mound.
Doon Spring 8 (DS8)	Moses Spring group	Mound spring	Standing water ponded adjacent to outer edge of spring, slightly cloudy and brown. No flow observed.
Doon Spring 8A (DS8A)	Moses Spring group	Mound spring	Some ponding of water in places adjacent to edge of mound spring. Water very muddy. No sample collected.
Doon Spring 9A (DS9A)	Moses Spring group	Mound spring	Mound within the same extensive wetland (boggy) grassed area as Doon Spring 4. Shallow standing water adjacent to spring mound. Water slightly cloudy. No flow observed.
Doon Spring 10 (DS10)	Joshua Spring (modified to turkeys nest to store water)	Modified high flow spring (artesian?)	Clear water flowing from overflow pipe of turkeys nest (at rate of approximately 5 L/s). Surface of the ponded water within turkeys nest moving as if water is being pushed up from below in one small area towards western side of turkeys nest.
Close vicinity to Doon Spring 3 (DS3A)	Drainage from wetland area to lake	Not applicable	Located around 40 m west of Spring 3. Clear, colourless water, flowing from nearby grassed wetland area towards lake adjacent to nearby group of Melaleuca trees. Flow rate approximately <0.1 L/s.
Dyllingo Creek	Downstream of springs complex, upstream of Doon Spring 2A	Not applicable	Creek flowing. Water cloudy, pale orange-brown colour. Sandy creek bed with sandstone gravels and cobbles. Creek banks sandy, incised by around 3 m. Melaleuca trees present.
Cattle Creek	Downstream of springs complex, upstream of Doon Spring 2A	Not applicable	No flow in creek, large pools of standing water. Water cloudy and pale brown with purple film on surface, containing particulates. Creek bed sandy, Melaleuca trees present.

4.8.3 Data analysis

Major ion chemistry

A piper plot of the major ion chemistry for all of the sampled springs and creeks is shown in Figure 14 and for the springs sampled within the Moses Spring group in Figure 15. Summary tables of the water quality sampling analysis results are included in Appendix A.

The piper plots indicate the following:

- All of the samples collected from the Little Moses (DS1) and the Moses Spring group (DS4, DS5, DS5B, DS6, DS7, DS8 and DS9) mound springs, with the exception of DS11, have similar major ion chemistry but with variable proportions of chloride (refer Figure 14). The sample collected from DS3A (of water draining from a wetland area around 40 m from mound spring Doon Spring 3) was also similar in its major ion chemistry. The concentrations of calcium and magnesium in all of these samples (except for Little Moses) are less than 1 mg/L (refer to Appendix A). This suggests that the groundwater feeding these springs is likely to be from the same source and has been subject to similar conditions below the surface. The higher proportions of bicarbonate, coupled with the very low proportions of calcium, magnesium and potassium suggests that ion exchange may have occurred. This typically occurs when water passes through clays, whereby the positive ions (i.e. calcium, magnesium, potassium and sodium) are preferentially removed from solution by adsorbing onto clay particles if conditions (such as pH) are favourable.
- The samples from Joshua Spring (DS10) have proportionally more calcium and magnesium than the samples collected from Little Moses and the Moses Spring group. This spring is physically very different to the Moses Spring group (mound springs) with the highest discharge flow rate of all the springs sampled (estimated at approximately 5 L/s) and, if it had not been modified to store water for supply use, may have looked similar to Little Moses spring. The differences in major ion chemistry of Joshua Spring to the Moses Spring group suggests either a different source of water (which given the geological setting is considered unlikely), different pathway and hence contact with different lithological units before discharging to surface. However, the modification to the spring could also play a part in the different chemistry.
- The major ion chemistry for the Cattle Creek and Dyllingo Creek samples is very similar to each other and, of the spring samples, is most similar to Joshua Spring with similar proportions of calcium and sodium although with a higher proportion of chloride than Joshua Spring.
- The sample collected from DS2A (non-artesian (recharge) spring) has a different major ion chemistry to the other spring samples, containing both calcium and magnesium and with the highest proportion of chloride of all of samples. The sampled location is almost 2 km east of Little Moses spring and is in the near vicinity of the stratigraphic boundary of the Moolayember Formation, Clematis Sandstone and Tertiary-age strata at a very slight break in slope. This suggests that the source of the spring water is likely to be the Clematis Sandstone (as for the other springs) but that the spring mechanism for discharge may be different (i.e. groundwater is forced out of the aquifer at a sudden change to a low permeability lithology along the groundwater flow path). The likely different mechanism for discharge at this spring and the different major ion chemistry is

consistent with the findings of the ecology inspection which found different species at this spring in comparison to the other springs inspected.

- The major ion chemistry of sample DS11C is significantly different to the other samples collected from the Moses Spring group, with almost 100 percent bicarbonate. However, this result may not be representative of the water at this location given that the cation-anion balance for this sample is unusually high (+10 percent).
- The Moses Spring group are considered to be discharge springs, i.e. the water source of the springs passes through a low permeability confining layer before discharging to surface (Fensham pers. Comm.). In this case the low permeability confining layer is likely to be the Quaternary alluvium and/or underlying (mapped) Moolayember Formation.
- Samples from DS10 (Joshua Spring), DS2A (non-artesian (recharge) spring), Cattle Creek and Dyllingo Creek have higher proportions of calcium, magnesium and potassium in comparison to the Moses Spring group samples coupled with lower proportions of bicarbonate. The same applies to DS1 (Little Moses spring), although to a lesser extent. This suggests that whilst ion exchange may still be occurring, it is not as pronounced. This in turn suggests the groundwater is taking a more rapid pathway such as through a better connected fracture system and/or a shorter pathway to the ground surface at these locations. In the case of DS2A, groundwater is forced out of the aquifer at a low permeability lithology along the groundwater flow path and therefore a shorter pathway existing to recharge the spring.
- With reference to Figure 16, comparison between the major ion chemistry of the springs complex (and creeks) and that of samples from the Carmichael River suggests that with the exception of the May 2011 sample round (collected following the wet season), the samples collected from the Carmichael River within the Mine lease area (July, September, October and November 2011), plot in a similar location on the piper plot to the samples collected from Cattle Creek and Dyllingo Creek. This suggests that all of these samples have similar major ion chemistry characteristics, which is not surprising given that Cattle Creek and Dyllingo Creek feed into the Carmichael River upstream of the Mine lease area. It is likely that the Doongmabulla springs provide base flow to the adjacent Carmichael River.

Figure 14 Piper plot, all sampled springs and creeks (May and June 2012)

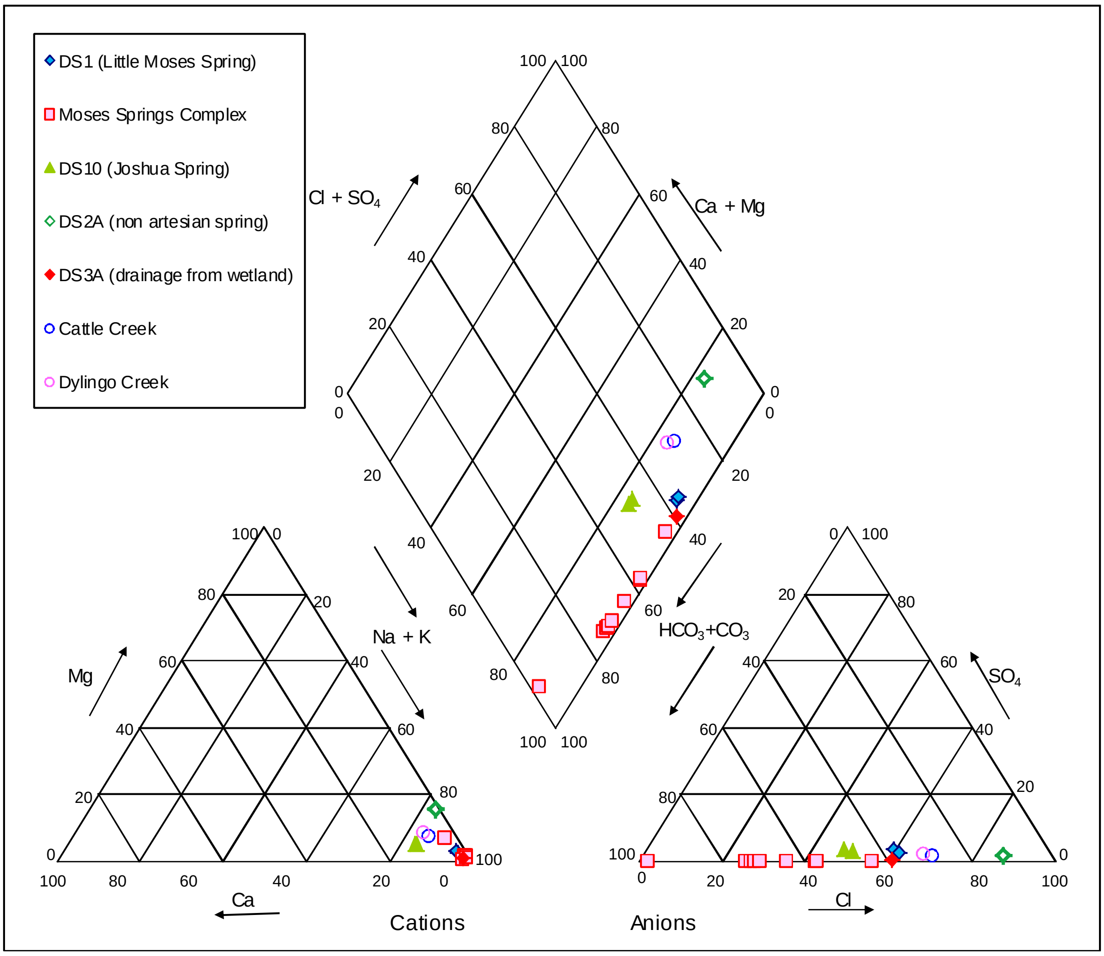


Figure 15 Piper plot, Moses Spring group

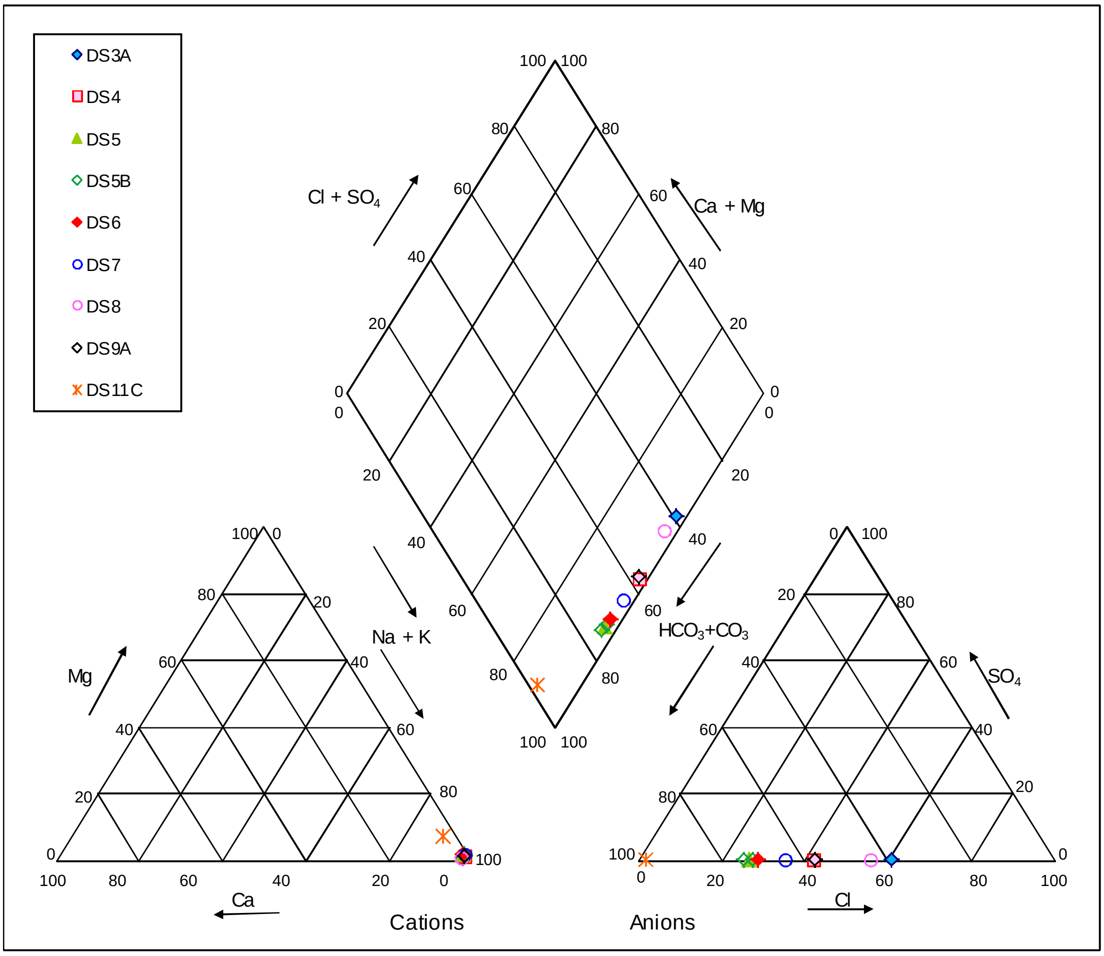
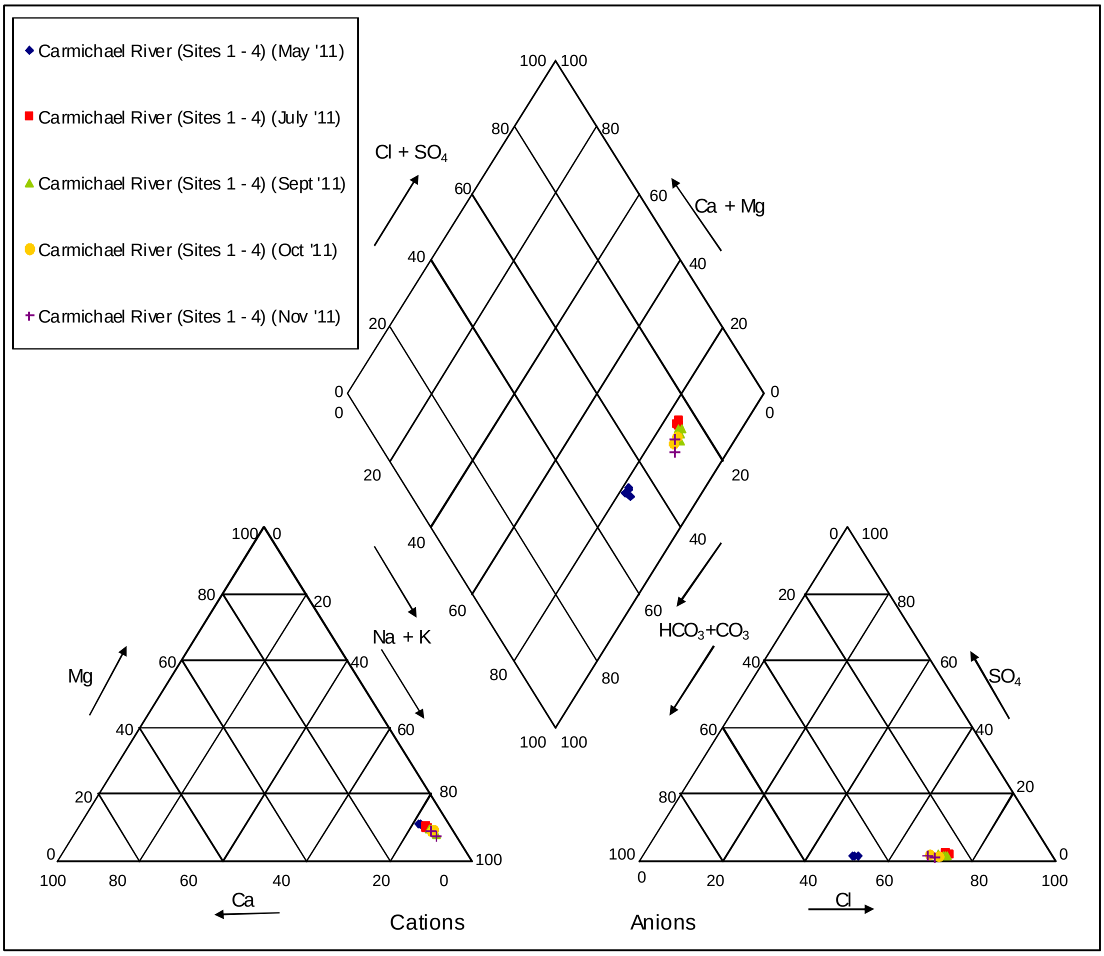


Figure 16 Piper plot, Carmichael River



Inorganics

The samples from the springs and creeks can be described as relatively fresh, with electrical conductivity (EC) for the spring samples ranging from 376 to 889 µS/cm and EC values of 742 µS/cm in Dyllingo Creek and 1,370 µS/cm in Cattle Creek (refer to Appendix A). The concentrations of the inorganic parameters analysed (fluoride, silica, electrical conductivity, TDS and pH) show no significant variation between Little Moses spring, the Moses Springs group and Joshua spring.

The one exception is the sample from DS2A with significantly higher concentrations of silica and fluoride and a slightly more acidic (pH 5.4) than the other springs. This is consistent with the location of this spring, which is geographically set apart from the other springs to the west and within a different geological setting.

Dissolved metals

Of the dissolved metals, low concentrations of dissolved iron (0.06 to 0.79 mg/L), manganese (0.002 to 0.29 mg/L) and zinc (0.005 to 0.014 mg/L) were identified in the spring and creek samples (refer to Appendix A). The concentrations of these metals are relatively consistent between the various springs sampled within the Little Mosses group (i.e. mound springs, samples DS4, DS5, DS5B, DS6, DS7, DS8 and DS9A). However, are somewhat different to the concentrations of dissolved iron and manganese found in the samples from Joshua spring (DS10) and Little Moses spring (DS1).

4.8.4 Summary

The mapped geology in the vicinity of the Doongmabulla Springs complex suggests that all of the springs are likely fed by groundwater from the Clematis Sandstone aquifer, with most springs discharging through the overlying Moolayember Formation and/or Quaternary alluvium. This is consistent with available information on the physical features of Doongmabulla Springs (reference QLD081) which are described as 'derived from faults allowing water to flow from thin confining beds of the Great Artesian Basin aquifer' (in the *Australian Wetlands Database – Directory Wetland Information* (http://www.environment.gov.au/cgi-bin/wetlands/report.pl?smode=DOIWanddoiw_refcodelist=QLD081)).

Despite the apparent single aquifer source some potentially significant differences can be observed in the hydrochemistry of samples taken from the springs. Potential causes of the observed differences in major ion chemistry include:

- The characteristics of the material overlying the source aquifer through which the water passes (i.e. the material overlying the Clematis Formation in the area which includes the Moolayember Formation and Quaternary alluvium).
- Post discharge processes including dissolution and evaporation which are in turn likely to be related a range of additional factors including discharge rate and, the degree of ponding at the discharge location.

Based on the limited geological and major ion data currently available, and bearing in mind the potential causes of chemical differences identified above, the main conclusions from the sampling work can be summarised as follows:

- The major ion chemistry of the sample taken from spring DS2A is distinctly different from the other samples in that it shows elevated proportions of calcium and magnesium and the highest proportion of chloride of all of samples. Given the location of this spring close to the mapped boundary of the Moolayember Formation and the underlying Clematis Sandstone it is considered most likely that the observed chemistry differences are due to the source aquifer being relatively close to the surface at this location. It may be that the Moolayember Formation is absent and that water is being discharged directly from the Clematis Sandstone. The different major ion chemistry observed at Spring DS2a is consistent with the findings of the ecological site visit which found different species at this spring in comparison to the other springs visited.

- The sample taken from the Joshua Spring (DS10) is also characterised by proportionally more calcium and magnesium than the samples collected from Moses and Little Moses mound springs. Unlike Spring DS2a this site is located in an area where the Moolayember Formation is likely to be relatively thick and hence the chemical similarities between the two samples are surprising. However, the Joshua Spring (DS10) is also characterised by the highest discharge rate of all the springs in the complex. It may be that a fault or similar feature is present at this location forming a relatively rapid pathway for flow through the Moolayember Formation despite its thickness.
- The majority of the remaining spring samples which were taken from the Moses and Little Moses mound springs (i.e. samples. DS1, DS4, DS5, DS5B, DS6, DS7, DS8 and DS9) are all characterised by very low proportions of calcium and magnesium but variable proportions of chloride. Given the similar morphology and ecology observed at these springs and their close proximity it is considered likely that the discharge pathway at each of the springs is similar. The observed differences in the proportion of chloride are therefore thought most likely to be related the degree of post discharge evaporation occurring at each spring head.

4.9 Existing environment summary

The existing surface water resources within the Study Area include the Carmichael River, ephemeral creek drainage lines (dry during the dry season monitoring period) and numerous farm dams. The Carmichael River, designated as a fifth order stream (DERM, 2009c), is the major surface water resource within the Study Area. The flow regime of the Carmichael River (further described in Volume 4 Appendix R Hydrogeology Report) is subject to seasonal variability as wet season overland flow drains from the catchment. Late in the dry season the Carmichael River is reduced to a low flow environment, interspersed with deeper pools. The Carmichael River was characterised by a well-established riparian zone that provided extensive shading of the water. Conversely, the farm dam sites and Cabbage Tree Creek all had limited or absent riparian zones, resulting in increased exposure to direct radiance from the sun.

An assessment of the water chemistry of the Carmichael River and nearby groundwater resources identified that it is likely that the surface water of the Carmichael River is influenced by the nearby groundwater aquifers. Temporal changes in the surface water chemistry also indicate that the influence of groundwater on the Carmichael River is greater in the dry season than in the wet season when rain water is entering the system.

Parameters analysed as part of the monitoring program displayed both spatial and temporal variations. Spatial patterns were consistently related to the differences between the types of water resources (Carmichael River versus non-flowing environments). Sites sampled along the Carmichael River displayed little spatial variation, indicating that the results obtained from the monitoring program are fairly typical of that stretch of the river. Temporal patterns at the Carmichael River sites were related to seasonal variability associated with the influx of overland flows prior to the start of the dry season monitoring program, and subsequent drying of the water resources as the dry season progressed. All dry season monitoring was undertaken in low-flow conditions, and flow progressively decreased as monitoring progressed through the dry season. Flow varied during the wet season monitoring due to intermittent rain events.

The in-stream sediments of the Carmichael River were characterised by sands. Nutrients were present in low concentrations and faecal coliforms were present in the sediments at only one site. As with the findings from the water quality assessment, hydrocarbons were not present in the in-stream sediments of the Carmichael River.

Some of the nominated sampling sites located in the north of the Study Area were dry throughout the dry season monitoring program. In order to gain an understanding of the potential contaminants that may be released during flow events DI leach testing of sediments was undertaken. Results were generally consistent with the findings of the broader monitoring program, indicating that the sampling sites can be considered to be representative of the water resources present within the Study Area.

The quality of the water in the still water bodies was different to the Carmichael River, which is primarily due to the non-flow conditions of those bodies, lack of riparian cover and use of the dam water resources by cattle. The electrical conductivity of the still water bodies was substantially lower than the Carmichael River, indicating that input from the alluvial groundwater aquifer that interacts with the river is unlikely. Given that dams are designed to limit the potential for leaching of waters, the disconnect between these resources and groundwater aquifers is not unexpected.

Collated information relating to the water resources of the Study Area identified the following EVs of relevance:

- Aquatic ecosystems – slightly to moderately disturbed
- Primary industries – irrigation
- Primary industries – stock watering
- Drinking water
- Cultural and spiritual values.

As required by the QWQG (DERM, 2009a), WQOs for the protection of the EVs were identified. Data obtained during the assessment has been compared to the nominated WQOs where appropriate. The WQOs will be updated on a yearly basis following ANZECC and ARMCANZ (2000) guidelines as additional data becomes available.

A water quality monitoring program has been developed (refer Appendix F) for water quality monitoring including sample locations, analytes and frequency for pre-construction, during construction, during mine operations and post mine operations. This monitoring program will be updated on a yearly basis according to mine operations and DEHP requirements.

5. Potential impacts and mitigation measures – construction phase

5.1 Introduction

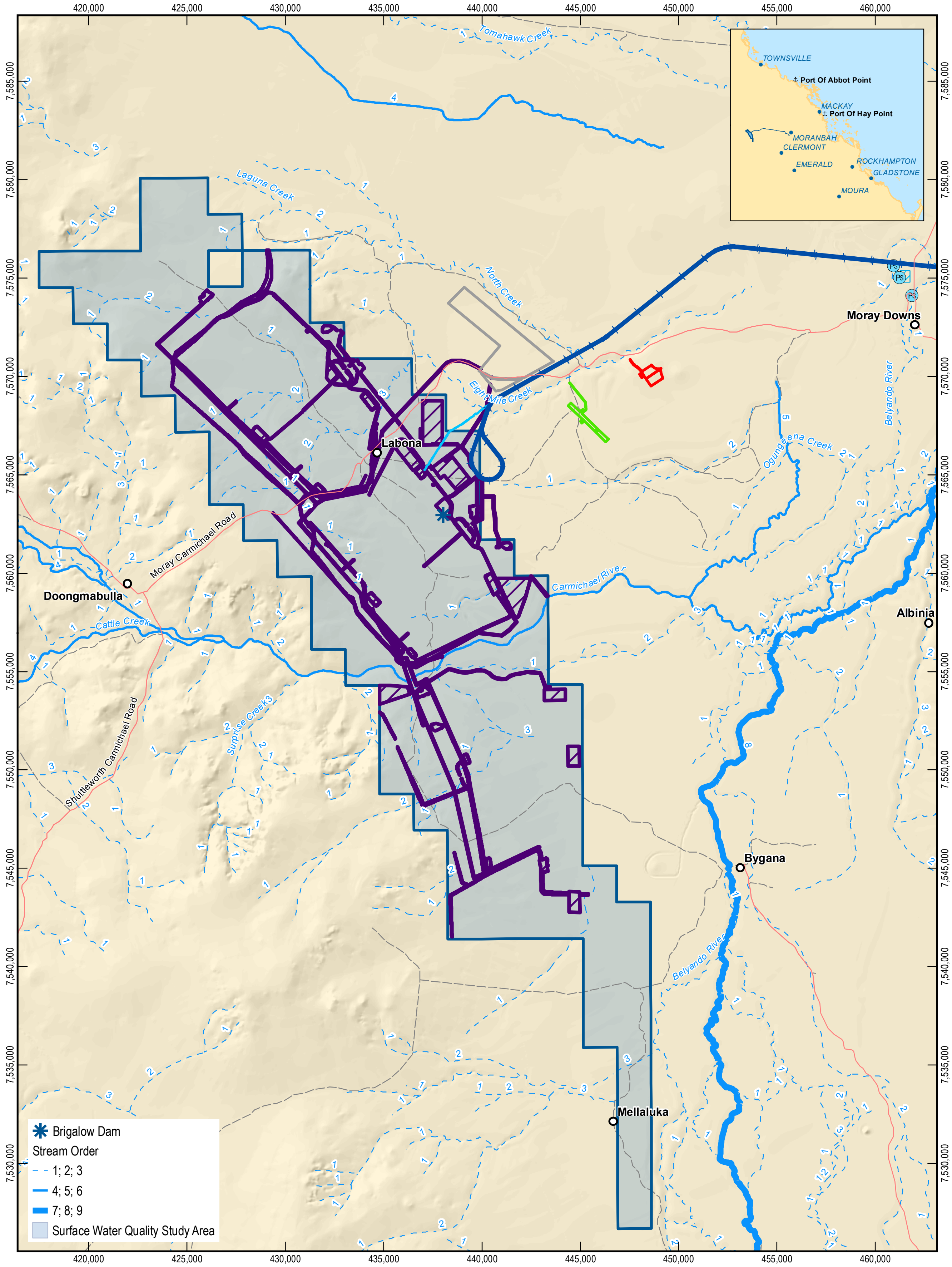
The construction phase of the Project (Mine) will involve the following principal activities:

- Development of Mine Infrastructure Area (MIA)
- Construction of Mine access roads
- Construction of water management structures including levees, bunds and water storages
- Installation of erosion and sediment control structures such as diversion drains and sediment controls
- Initial diversion of minor drainage lines
- Development of airport (off site)
- Development of workers accommodation village (off site)
- Development of off-stream storage and pump station near Belyando River (0.05 ha)
- Infrastructure crossings of watercourses including:
  - Pipeline crossings, which will be buried
  - Access roads and haul roads. These will involve culvert crossings or, for minor access roads, crossings with low flow pipes
  - Conveyor crossings which will span watercourses

Figure 17 provides details of the expected disturbance area during the construction phase of the Project (Mine).

Initial water management activities and protocols would include:

- Reuse of water captured in sediment dams
- Utilising existing dams for water supply wherever possible
- Use of treated wastewater for dust suppression or irrigation



LEGEND

Homestead	Construction Phase Footprint	Mine (Offsite)	Airport
Local Road	Rail (West)	Pump Station	Industrial Area
Track	Mine (Onsite)	Storage Facility (Offstream)	Accommodation Village

Based on or contains data provided by the State of QLD (DERM) [2010]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

1:275,000 (at A4)

0 1 2 3 4 5

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

N

GHD adani

Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project SEIS

Job Number 41-26422
Revision F
Date 22-10-2013

Construction Phase Footprint

Figure 17

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Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: DERM: DCDB, Stream Network (2010); DME: EPC 1690 (2010)/EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road (2007); GHD: Construction Phase Footprint, Study Area (2011); Adani: Alignment, Offsite (2013). Created by: AJ, MS

This impact assessment has been structured to address impacts associated with primary construction activities. The potential impacts to surface water quality have been considered and appropriate management and mitigation measures proposed to ameliorate identified impacts.

5.2 Clearing of land

5.2.1 Overview

Land that will be cleared as part of the construction phase of the Project (Mine) includes the footprint of the MIA, mine village; airport and access corridors (refer to Figure 5-1). Water resources within the footprint include Brigalow Dam and a section of Obungeena Creek (refer to Figure 17).

Brigalow Dam is a small farm dam approximately 50 m in diameter, with a moderately sloping bank. During the dry season the water storage of this dam is substantially reduced, such that only a small, shallow pool of water remains (refer to Plate 2). Evidence of cattle and pig disturbance was observed during aquatic ecology site assessments (refer to original EIS Volume 4 Appendix O - Mine Aquatic Ecology Report for further details). Brigalow Dam is located within the mine area and was therefore not included in the water quality monitoring program. However, as Brigalow Dam has a similar structure and surrounding land use as dams within the mine area that were monitored during baseline studies, water quality of this dam when full is likely to be comparable to the dams that were assessed as part of the water quality monitoring program (Sites 6 – 9); characterised by high turbidity, low DO concentrations and elevated nutrient and faecal coliform levels. Additional survey work will be undertaken within the mine area to supplement the conclusions provided herein.

Obungeena Creek is an ephemeral drainage line that is likely to only contain water immediately after heavy rainfall (refer to Plate 3). This creek has a width of 2 m to 4 m and has a limited riparian zone. Evidence of cattle disturbance was observed during aquatic ecology site assessments (refer to original EIS Volume 4 Appendix O - Mine Aquatic Ecology Report for further details). The EVs of Obungeena Creek are considered comparable to the other dry creek beds assessed as part of the water quality monitoring program (Sites 10 – 12). It is therefore expected that potential pollutants identified at Sites 10 – 12 may be mobilised during flow events. Potential pollutants include fine sediments, elevated nutrients and some metals.

Clearing of land within the construction phase footprint (refer to Figure 5-1) is a direct disturbance that has the potential to impact upon the water resources within and in proximity to the footprint. Potential impacts that may be realised as a result of land clearing include:

- Mobilisation of sediments and pollutants via the removal of vegetation which provides natural erosion control features, exposure of and disturbance to soils, and introduction of potential pollutants to watercourses
- Direct disturbances to water resources, relating to construction activities undertaken within water resources and riparian zones
- Loss of catchment area and alteration of flows associated with the changes in existing overland flow paths during construction activities
- These impacts and potential management and mitigation measures are individually addressed below. Where interactions between impacts are likely this has been noted.

Plate 2 Brigalow Dam (September 2011)

Plate 3 North Creek (downstream of proposed construction footprint) (September 2011)

5.2.2 Mobilisation of sediments and pollutants

Potential impact

The construction phase of the Project (Mine) will require clearing of vegetation and cut, fill and compaction earthworks. These activities will take place across the entire construction phase footprint (refer to Figure 17).

The vegetation clearing and earthworks will expose soils to erosive forces. Rainfall and surface runoff may then convey soils to watercourses, resulting in degradation of water quality. An investigation of the soils of the region identified that the soil has a high proportion of fine sands and poor structural properties, making it susceptible to rain-related erosion on all but the flattest slopes. (refer to original EIS Volume 4 Appendix L Soils Report for further information). Wind erosion may also convey fine soils to water bodies. Once disturbed these soils are readily mobilised, and once in suspension within a water resource, may take a long time to settle out of suspension. Soils and subsoils from the exposed areas will be readily mobilised into local drainage lines and water bodies via erosion processes.

Works directly in watercourses will also destabilise bed and banks of watercourses and, if these are not managed during construction and stabilised after construction, this can result in long term sediment releases. .

Surface water resources in the area are expected to be subject to spikes in suspended solids loads during flow events, particularly early in the flow event, due to catchment characteristics. However, runoff from areas disturbed by construction is likely to carry higher than usual suspended solids loads and hence, further degrade water quality in streams downstream of the construction activities.

Areas to be disturbed during construction drain to Eight Mile Creek/North Creek and Obungeena Creek. Downstream, of the mine area, these two creeks traverse a very flat area and become un-channelised in some sections, meaning that flows then spread across a wider shallow floodplain. Ultimately, water from this area will drain to the Belyando River, 20 km east of the proposed construction activities.

The most significant impacts associated with increased sediment levels in the Belyando River would be in relation to aquatic ecosystem health, which is discussed in more detail in the SEIS Volume 4 Appendix I1 Revised Ecological Assessment Report. There are limited downstream water users taking water for stock and domestic use. Assuming that any water taken for potable uses would be filtered or otherwise treated, this use is not particularly affected except that, in the short term, potable water treatment costs may increase due to the need to remove higher levels of suspended solids.

There is potential for sediment to be conveyed to the Belyando River and erosion and sediment controls should be applied to construction activities to minimise mobilisation of soils from the site.

Diesel and oils will be utilised in construction vehicles and equipment and there will be a need to store diesel and oils in construction laydown areas. Spills of diesel and oils within watercourses, whether wet or dry, could result in mobilisation of contaminants to downstream environments. Spills to soils could also result in contaminants being mobilised by overland flow during a rain event. The Impacts of pollutants on aquatic ecosystems is discussed in the SEIS Volume 4 Appendix I1 Revised Ecological Assessment Report.

Downstream water users could be affected if hydrocarbons were mobilised into the Belyando River. Australian drinking water guidelines do not include guidelines for diesel or oils. Diesel fuel has a taste and odour threshold of 0.0005 mg/L and hence, waters taken for domestic use that are tainted with diesel are unlikely to be ingested (NHMRC 2011).

Minor spills of diesel and oil would be expected to break down naturally, however a larger spill or ongoing minor releases could render water in the Belyando River unusable for stock and domestic water supply with significant consequences.

Wash down facilities will be required for vehicle washing and water used for wash down will become contaminated with sediment and hydrocarbons and will therefore be unsuitable for release to the environment without treatment.

Sewage will be generated at the workers accommodation village and, a smaller package treatment plant will also be required to manage sewage from toilet facilities at the MIA area. Release of untreated or partially treated sewage may have a range of impacts:

- Nutrient levels may cause eutrophication of downstream aquatic ecosystems. This is discussed further in the Mine Aquatic Ecology Report (refer to original EIS Volume 4, Appendix O).
- Bacteria and other pathogens may cause illness in humans using water for domestic supply or primary contact recreation.
- Odour may affect aesthetic enjoyment of affected watercourses.

As these impacts are likely to be significant if not managed, sewage must be treated and managed such that exposure to harmful pollutants does not occur. The approach to sewage treatment and management is provided below.

Litter and other gross pollutants may also be conveyed into watercourses during construction. The main impact of this is on aesthetic enjoyment of watercourses, and direct impacts on larger aquatic animals that may become entangled in plastics and other litter.

Cement will also be utilised in construction and concrete batching carried out. These materials are generally low hazard however if a significant quantity of cement was spilled into a confined watercourse, it could cause an increase in pH with localised impacts on aquatic ecosystems from this change in water quality, and from direct smothering. Downstream water users would not be affected as any changes in pH would quickly be buffered in the aquatic environment.

Management and mitigation

The impacts associated with mobilisation of sediments and pollutants to water resources will be managed/mitigated via engineering and construction management solutions. Construction management solutions will be embedded in an Environmental Management Plan (EMP) to be implemented throughout the construction phase of the Project (Mine).

Management and mitigation measures to be implemented to minimise the impact associated with mobilisation of sediments include:

- Scheduling construction activities such that, during the wet season, erosion and sediment control devices are installed before any significant exposure of soils occurs.
- Scheduling construction works such that permanent stormwater management systems are installed as early as possible in the construction process.

- Scheduling construction works to minimise the period of time that soils are exposed between vegetation clearing and placement of final ground cover or reinstatement of disturbed surfaces.
- Developing an erosion and sediment control plan that complies with International Erosion Control Association of Australasia Best Practice Erosion and Sediment Control Guidelines (IECA 2008).
- Installing diversion drains around areas to be cleared or otherwise disturbed. Diversion drains will connect to existing flow paths or drainage lines and scour protection will be provided at outlets.
- Use of erosion control measures to minimise mobilisation of soils due to wind or water erosion. This may include temporary placement of mulch, matting or gravel.
- Use of sediment control devices to capture and retain flow from disturbed areas. Sediment control devices may include sediment fences, sediment ponds or sediment weirs in drainage lines.
- Avoiding works in watercourses during flow events, and stabilising any open works in anticipation of major flow events.
- Placing topsoil and mulch stockpiles at least 100 m from any watercourse or drainage line, and in such a way that the material cannot enter the watercourse.
- Stabilise disturbed areas as soon as practicable after disturbance in accordance with the relevant operational requirements of these areas.
- Using dust suppression to prevent significant windblown erosion from depositing in watercourses.

In relation to potential impacts of releases of hydrocarbons and other environmentally hazardous materials, mitigation measures rely on:

- Preventative measures, including:
  – Storing all materials, including environmentally hazardous materials and equipment at least 100 m from any watercourse or drainage line, and in such a way that the material cannot enter the watercourse.
  – Provision of diesel storages compliant with AS 1940-2004 - the storage and handling of flammable and combustible liquids.
  – Storage and handling procedures for diesel in accordance with AS 1940-2004 - the storage and handling of flammable and combustible liquids.
  – Transport of diesel and oils in accordance with the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code).
  – Storage of oils and oily wastes in enclosed and contained areas such that the volume of the largest container can be easily contained by secondary containment.
  – Procedures in relation to handling of diesel and oils, including refuelling procedures.
  – Training of staff in correct handling and storage procedures.
- Responsive measures, including:

- Provision of spill containment and clean up kits at all locations where a risk of spills greater than 20 L is identified. This will include spill kits in vehicles involved in mobile refuelling.
- Spill response procedures
- Training of staff in containing and cleaning up spills.
- Incident investigations and identification of corrective actions.

The hazard and risk assessment (detailed in Volume 2 Section 12 - Hazard and Risk Assessment) provides more information on prevention and management of spills. Other mitigation measures to be implemented to minimise the potential for impacts associated with mobilisation of pollutants include:

- Location of concrete and asphalt batch plants at least 100 m from any watercourse or drainage line.
- Dedicated waste storage facilities and prompt removal of wastes.
- Dedicated vehicle washdown areas that drain to a collection sump and treatment facility to remove hydrocarbons and sediment. Treated water is either to be recirculated for vehicle washing or used for dust suppression.
- All wash down of equipment to be undertaken within bunded areas to reduce the risk of uncontrolled releases to the environment.

All domestic waste water, including sewage, will be treated via package treatment plants located at the workers accommodation village and MIA.

Wastewater generated at the workers accommodation village will be used in irrigation of landscaped areas, rehabilitation trials and pasture areas and for dust suppression of construction activities at the off-site infrastructure area. Depending on the potential for human exposure during reuse, it will be treated to at least class A in relation to pathogens. Nitrogen and phosphorus levels will be determined following modelling of irrigation requirement using the model for effluent disposal by land irrigation (MEDLI). This model will also determine the optimal area required for irrigation to avoid impacts on soils, surface waters and groundwater and support development of an irrigation management plan.

For wastewater generated within the mining lease, this will be reused in dust suppression during construction. Treatment will be to Class A+ in relation to pathogens and indicative nitrogen and phosphorus concentrations will be 30 mg/L and 5 mg/L respectively.

Monitoring, inspections and corrective actions

Treated effluent quality will be monitored on a weekly basis. Monitoring of irrigation areas will also be carried out as identified in the land irrigation management plan.

Monitoring will also involve regular inspections of:

- Erosion and sediment control devices, including inspections before and after rainfall events resulting in any overland flow.
- Fuel, oil and waste disposal areas to check for proper storage and signs of spills
- Watercourses and drainage lines to check that materials have not been placed in such a way that the material might be conveyed to the watercourse.

- General work areas for litter or signs of potential contamination.

Corrective actions will be implemented as required where inspection indicates that there is a risk to surface water quality.

While a general program of surface water quality monitoring has been developed (refer to Appendix F), specific monitoring in relation to construction water quality will only be undertaken in the event of an incident involving actual or potential contamination of a watercourse.

Summary

Construction activities have the potential to impact on water quality via mobilisation of sediments and pollutants. Without controls, significant impacts on downstream water users may arise from major diesel spills, prolonged release of smaller quantities of hydrocarbons and release of untreated sewage. Significant aquatic ecosystem impacts may also occur, particularly in relation to sediment releases and this is discussed further in the SEIS Volume 4 Appendix I1 Revised Ecological Assessment Report.

Suitable mitigation measures are available to avoid or mitigate potential impacts and risks to surface water quality and with these measures in place, significant impact or risk is not expected.

5.2.3 Alteration of drainage patterns and flooding

Potential impact

Development works can alter drainage patterns in several ways:

- By changing the rainfall runoff characteristics of land. Typically, runoff becomes more intense as lower permeability; rougher surfaces are replaced with higher permeability, smoother surfaces.
- By changing the directions of flows when areas are levelled for placement of infrastructure or facilities.

To develop the MIA, workers accommodation village, airport and infrastructure corridors clearing of land needs to occur. These construction activities will remove approximately 1,830 ha from the Obungeena Creek catchment (refer to Figure 17). These will be changed from open permeable grazing land to developed areas, with compacted or sealed surfaces. Rainfall runoff will therefore occur more quickly with less infiltration, potentially leading to increased concentration of flow around minor drainage lines and higher intensity of flow in downstream watercourses. This concentration of flow can cause degradation of water quality due to erosion and scouring and destabilisation of bed and banks at and downstream of the affected area.

Given that the areas of each catchment to be disturbed are relatively small, adverse effects are expected to be localised only and substantial changes in flow volumes and rates downstream of construction areas are not expected.

Erosion and sediment control measures during construction will minimise water quality degradation and in the longer term, stormwater management measures will also minimise water quality degradation. Mitigation measures in this regard are presented below.

Only minor changes in topography are required in the vicinity of the off-site infrastructure as this area is relatively flat. The MIA will require more earthworks to prepare a flat surface for the various infrastructure and plant required at the MIA, however, runoff will still flow towards Obungeena Creek.

An assessment of the surface hydrology and water balance has been undertaken as part of the Project EIS (refer to SEIS Volume 4 Appendix K2 and SEIS Volume 4 Appendix K4). Mapping of the existing flood conditions for various average recurrence intervals up to 1000 years shows that, within the MLA, the flooding of the Carmichael River is largely contained within a 1.5 km corridor. For this reason, flooding from the Carmichael is unlikely to affect the construction footprint. However large rainfall events could cause surface runoff to flood the construction footprint with the potential for sediments and contaminants to mobilise to nearby water resources such as Obungeena Creek and Eight Mile Creek. Flooding may also impact upon the integrity of impact management infrastructure, such as sediment control devices, already established on site.

Construction of crossings of creeks for road access or pipeline construction may also cause short or long term disruption to flows and exacerbation of flooding upstream due to afflux. This can be addressed through design and construction measures. In any case, there are no flood sensitive receptors upstream of proposed crossings.

Management and mitigation

In relation to impacts of structures in streams, all crossings will be designed to:

- Maintain the bed level of streams;
- Minimise disturbance within the bed and banks of streams; and
- Minimise afflux.

Relevant guidelines include:

- Fish Habitat Management Operational Policy FHMOP 008;
- Best practice principles for riverine management (DNRM, September 2012);

The following additional management and mitigation measures should be considered to manage the risk associated with flooding during construction:

- Establishment of bunded areas for chemical storage will be completed prior to any chemicals being delivered to site
- Identification of threshold rainfall intensity or level in Eight Mile Creek at which construction activities will be ceased and personnel evacuated due to flood risk. Emergency response procedures, including flood forecasting and warning systems will be detailed in the construction EMP

Summary

Given the relatively small proportion of the catchments to be disturbed and minimal changes to topography, it is unlikely that changes in flow will lead to adverse impacts on watercourses and drainage lines. No residual impacts to surface water quality are expected as a result of alteration of drainage patterns.

5.2.4 Direct disturbance to water resources

Potential impact

Direct disturbance to watercourses and dams will occur as follows:

- Brigalow Dam will be removed.
- Crossings will be installed in watercourses for access roads, these will be culvert style crossings.
- Pipeline crossings will be installed, with all pipeline crossings buried beneath watercourses.
- A pump inlet will be installed in the Belyando River.

Each of these will result in direct disturbance to the bed and banks of watercourses. Water quality may be degraded if flows mobilise exposed soils and sediments downstream. Impacts associated with this are discussed further in Section 5.2.2 and mitigation measures proposed below.

In the longer term, if disturbance to the bed and banks of watercourses is not stabilised, flows within the watercourses will continue to erode the bed and bank material and lead to instability in the watercourse, as well as ongoing sediment inputs to downstream waters.

Management and mitigation

In relation to works within the bed and banks of watercourses, the following mitigation measures are required in addition to those set out in Section 5.2.3:

- Works in watercourses should be planned ahead, so that the works can be completed as quickly as possible.
- Works should preferably be carried out in periods of no flow, or in the case of the Belyando River, low flow.
- Design should take into account the need to stabilise the bed and banks and avoid scouring. Soft structures should be used rather than concrete.

Where water from existing storages needs to be removed, this water should be preferentially used for dust suppression or, if not required for dust suppression, transferred to another storage or used to irrigate pasture areas. The water should only be released to watercourses if the release will not result in the receiving waters exceeding the WQOs in Section 4.1. Forward planning will be required to ensure that water in the existing storages can be managed appropriately.

Summary

The removal of the Brigalow Dam water resource is unavoidable. Potential to impact upon the quality of surrounding water bodies will be managed through appropriate treatment of any waters to be decanted and/or reused onsite such that no flow on degradation to adjacent water bodies will be realised. Lost habitats and the value of these environments to flora and fauna are addressed under the Aquatic Ecology Report (refer to original EIS Volume 4 Appendix O). No residual impacts to water quality of the site are expected from removal of this dam resource.

5.3 Use of water during construction activities

5.3.1 Potential impact

Development of the offsite MIA, airport, access corridor and workers accommodation village will require water. Uses include domestic use in support of construction workforce, and use during construction for activities such as dust suppression and material handling.

Construction water supply will initially come from:

- An off-stream storage and pump station near Belyando River
- Any water captured in sediment basins

As construction proceeds, the operational water supply strategy will be developed and water for construction will be available from these sources. Impacts associated with flow reductions from the water supply strategy are discussed in Section 6.3.

No water will be taken from the Carmichael River for use in the construction phase of the Project (Mine). Given no water extraction is intended no impacts relating to such are required to be considered here.

5.3.2 Management and mitigation

Release quality characteristics for reuse of treated waste water have been outlined in Table 34. If treated waste water is to be used for dust suppression or irrigation activities these release quality characteristics must be achieved.

If treated waste water is not reused onsite the water must be managed appropriately such as disposal via an irrigation system downwind of the mine site.

5.3.3 Summary

No impact to the water quality of surface water resources onsite will be realised from this activity if the release quality characteristics outlined in Table 34 are achieved.

6. Potential impacts and mitigation measures – operation phase

6.1 Introduction

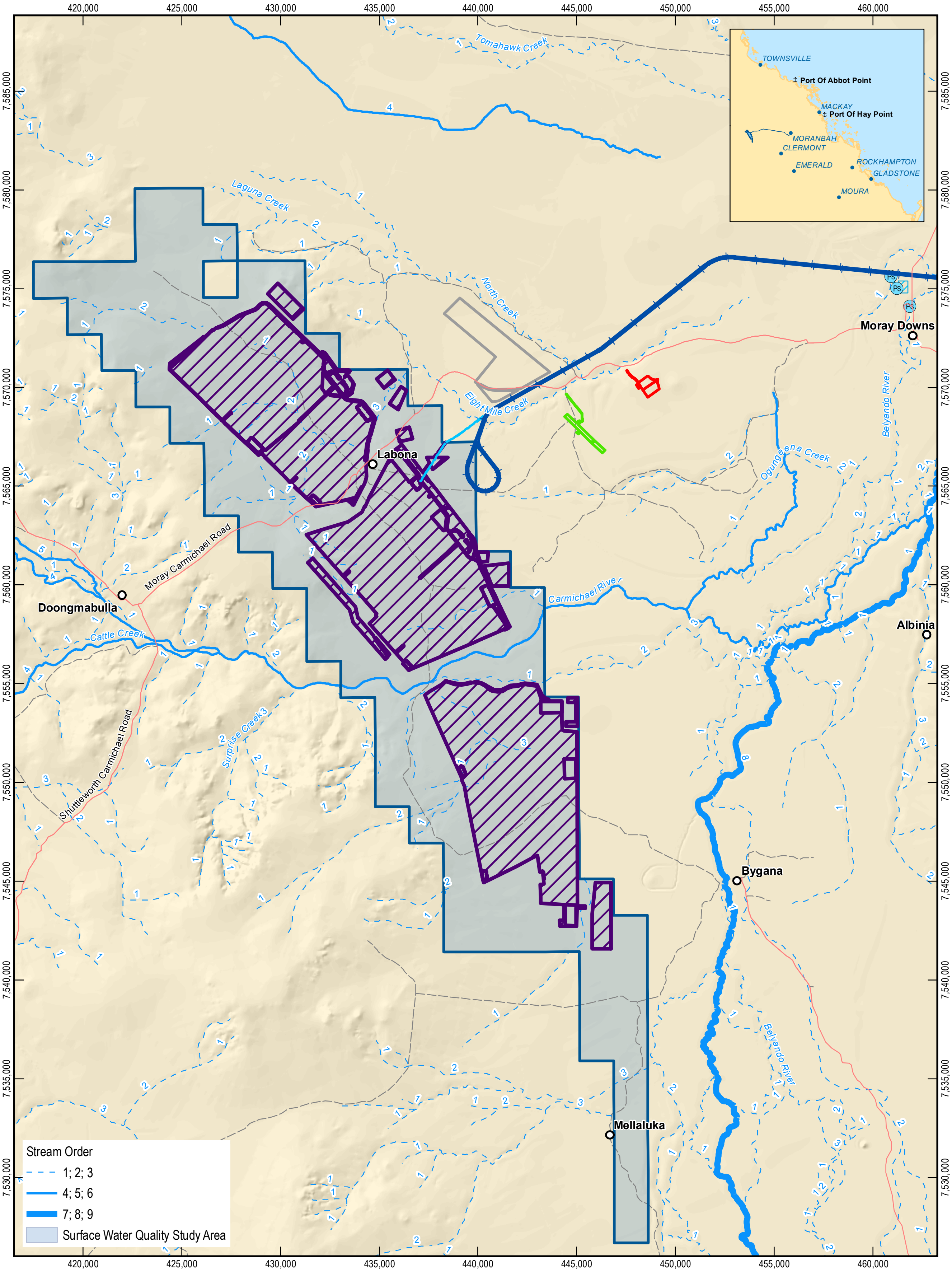
The operation phase of the Project (Mine) will involve the following principal activities, relevant to this assessment of water quality impacts:

- Underground mining staged through development with subsidence of mined areas expected to occur.
- Open cut mining staged through development and rehabilitation of pits over a 60 year mine life.
- Management of overburden through development and rehabilitation of waste areas over a 60 year mine life.
- Development and maintenance of clean water diversion drains to be established through the open cut pit areas linking the existing natural waterways and separating clean inflows from dirty water areas.
- Development and maintenance of an approximately 500 m flood levee from each bank of the Carmichael River. This will become the levee corridor once its construction occurs circa Year 2015.
- Management of (mine affected water) MAW water from operations through capture in dams for treatment and reuse.
- Management of spoil runoff through capture in sediment ponds.
- Discharge of water from sediment ponds to designated licenced discharge points if and when required.
- Sanitation wastewater for the operation will be treated in a packaged plant to a Class A+ standard. All effluent will be recycled on site, or removed from site and managed appropriately.
- Access to the southern portion of the lease will be achieved via one access point, a spanned bridge across the Carmichael River.

Figure 18 shows the expected disturbance area during the operational phase of the Project (Mine).

This impact assessment has been structured to address impacts associated with the following primary operational activities:

- Clearing of land
- Operational water management
- Alteration to groundwater regime
- The identified potential impacts associated with these activities are described following, with appropriate management and mitigation measures proposed.



LEGEND

- Homestead
- Local Road
- Track
- Operational Phase Footprint
- Rail (West)
- Mine (Offsite)
- Mine (Offsite)
- Pump Station
- Storage Facility (Offstream)
- Airport
- Industrial Area
- Accommodation Village

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Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number 41-26422
Revision F
Date 22-10-2013

Operational Phase Footprint

Figure 18

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Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: DERM: DCDB, Stream Network (2010); DME: EPC 1690 (2010)/EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road (2007); GHD/Adani: Operational Phase Footprint (2013), Study Area(2011); Adani: Alignment,Offsite (2013). Created by: AJ,MS

6.2 Clearing and topographical alteration of land

6.2.1 Overview

In order to operate the Carmichael Coal Mine, land across the site will be cleared or directly disturbed (refer to Figure 18) comprising the following footprints:

- Open cut pits
- Out of pit waste dumps
- Water management dams
- Access corridors, including Carmichael River crossing
- Flood protection levees
- Mine infrastructure such as overland conveying systems
- Explosives storage area
- Topside mine support facilities

Water resources within the operation phase footprint include numerous farm dams, the Carmichael River (access corridor crossing), Eight Mile Creek, Cabbage Tree Creek and numerous drainage lines (refer to Figure 19). Detailed descriptions of these resources are provided in earlier sections of this report, and in the Aquatic Ecology Report (refer to original EIS Volume 4 Appendix O).

All of these resources will be subject to varying levels of disturbance during the operational phase of the Project (Mine). The disturbance will also occur in stages as the development and operation of the mine progresses. In summary, the following levels of disturbance are expected:

- Farm dams, excluding those overlying the underground mine footprint, will be drained and removed or in-filled.
- Farm dams overlying the underground mine footprint will be subject to subsidence and will possibly be drained subject to risk assessment review.
- The Carmichael River will be crossed by an access corridor and bridge.
- Operational activities over sections of existing waterway.

Clearing of land within the operation phase footprint (refer to Figure 6-1) is a direct disturbance that has the potential to impact upon the water resources within and in proximity to the footprint. Potential impacts that may be realised as a result of land clearing include:

- Mobilisation of sediments and pollutants via the removal of vegetation which provides natural erosion control features, exposure of and disturbance to soils, and introduction of potential pollutants to watercourses.
- Loss of catchment area and alteration of flows associated with the changes in existing overland flow paths during operation activities.
- Direct disturbances to water resources, relating to operation activities undertaken within water resources and riparian zones.

- These impacts and potential management and mitigation measures are individually addressed in Sections 6.2.2 to 6.2.4. Where interactions between impacts are likely this has been noted.

6.2.2 Mobilisation of sediments and pollutants

Potential impact

Operation of the mine will require a variety of activities that have the potential to mobilise sediments and pollutants, including:

- Removal of vegetation
- Removal and stockpiling of topsoil
- Cut, fill and compaction earthworks
- Mining activities

The potential impacts outlined in the construction phase (refer to Section 5.2.2) all have the potential to be realised in this phase of the Project (Mine), albeit at a larger scale, including:

- Contaminated runoff from chemical and fuel storage areas
- Contaminated runoff equipment wash down facilities
- General construction waste and litter
- Domestic waste water, including sewage

The management and mitigation measures identified in the construction phase under Section 5.2 are applicable to the operation phase and will be applied here. Other potential impacts to water quality are associated with the unlikely occurrence of uncontrolled releases of to the environment in the event of a flood event exceeding 1,000 year ARI and the provided freeboard. Management and mitigation measures for these additional potential impacts are identified below.

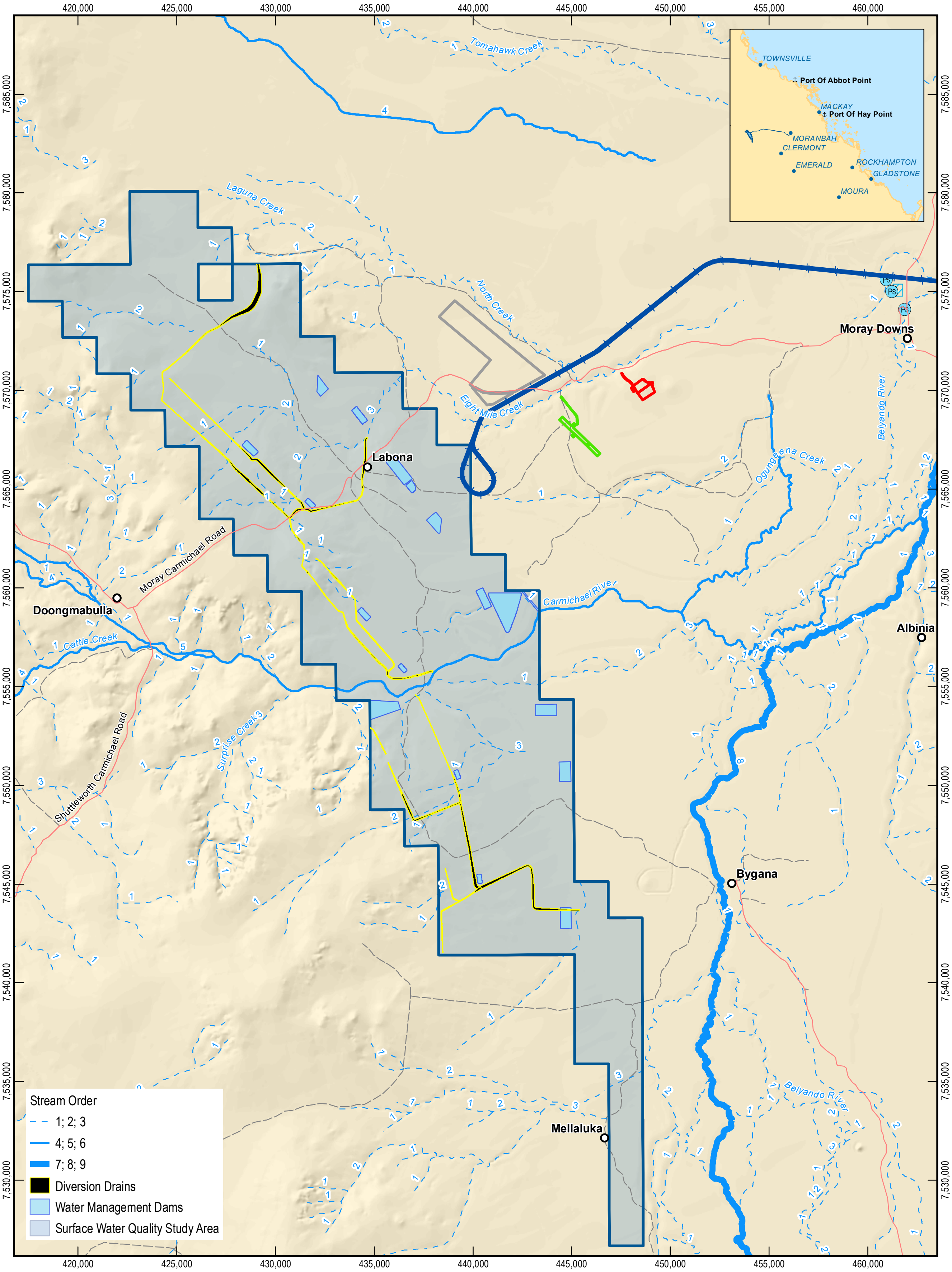
Management and mitigation

The impacts associated with the potential mobilisation of sediments and will be managed/mitigated via engineering and operational management solutions. Operational management solutions will be embedded in an EMP to be implemented throughout the operation phase of the Project (Mine) to avoid interactions between 'clean' water and MAW.

Engineering solutions include the establishment of creek diversions, flood levees and water management dams to manage and maintain, as much as possible, the surface hydrology of the site. Details of these solutions are provided in SEIS Appendix K4 Flood Study and SEIS Appendix K2 Water Balance Report. A summary of the solutions include the following:

- Staged construction of watercourse diversions through open cut pits to divert clean water from entering the site, maintain existing flows in waterways as practicable, and minimise disturbance to existing waterways. These diversions link existing sections of waterway to minimise changes to existing hydrology downstream of the mine site. Diversions are mapped in Figure 18.

- Construction of sediment basins to collect runoff from waste rock heaps for treatment of suspended sediments in water. Sizing of these dams to meet WQOs is described in SEIS K2 Water Balance Report.
- Staged construction of local surface water management drains from the subsidence areas overlying the underground mining areas. These will divert localised clean runoff into the waterway diversions to maintain existing catchment areas and avoid pooling in subsidence areas.
- Construction of MAW storage dams to receive dewatering product from the mine areas and other MAW. The site water management strategy aims to reuse MAW as much as possible to limit water supply requirements and discharges to the environment. This leads to only excess water requiring temporary storage in the MAW storages and allows optimisation of the storage size according to the results of the mine water balance. Potential sizing of these storages, based on currently available information, is described in SEIS Appendix K2 Water Balance Report.
- Flood levees, designed for protection against 1,000 year ARI flood events, will be established along each bank of the Carmichael River. Construction of these levees will occur as required by the staged mining activities as the pits become operational adjacent to the Carmichael River. At no time will mining activity occur within the existing 1,000 year ARI flood extents prior to the construction of the levees. These levees must be in place prior to the commencement of mining activities that would be affected by such a flood event.
- Construction of levees to protect waterway diversion through waste rock dumps just north-west of the infrastructure area. This is to allow the existing waterway to maintain connection through the mine site without contamination from the waste rock heap runoff.



LEGEND

- Homestead
- Local Road
- Track
- Rail (West)
- Mine (Offsite)
- Mine (Offsite)
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Kilometres
Map Projection: Universal Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 55

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GHD adani

Adani Mining Pty Ltd
Carmichael Coal Mine and Rail Project SEIS

Job Number	41-26422
Revision	E
Date	14-10-2013

Diversion of Watercourses

Figure 19

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Level 9, 145 Ann St Brisbane QLD 4000 T +61 7 3316 3000 F +61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data Source: DERM: DCDB, Stream Network (2010); DME: EPC 1690 (2010)/EPC 1080 (2011); © Copyright Commonwealth of Australia - Geoscience Australia: Mainland, Homestead, Locality, Road (2007); GHD: Study Area, Water Management Areas, Proposed Diversion (2013); Adani: Alignment, Mine Layout (2013).Created by: AJ, MS

The water balance found that despite the large reuse component there is a potential for large volumes of MAW to build-up in the mine water management dams, particularly if a series of wet years occurred. On an annual basis the average build-up of MAW is well within what might be able to be stored on the mine site; over the long operational life of the mine MAW volumes could build-up significantly without the ability to make controlled discharges to the environment. The estimated average annually required discharges show that controlled discharges are expected to be well within discharge limitations (based on flow volumes of the receiving environment) (refer to SEIS Water Balance Report for further details).

- MAW that has the potential to cause environmental harm will not be released to the environment except under environmental authority permit conditions. Waters to be released to the environment must comply with the contaminant release limits which will be identified in a receiving environment monitoring program.
- An assessment of the existing water quality of the Study Area identified that the naturally variable conditions onsite are not consistent with the WQOs contained in the QWQG (DERM, 2009a) and the ANZECC Guidelines (ANZECC and ARMCANZ, 2000). Site specific WQOs have been identified to protect the EVs of the region. This has been done following the survey design protocols contained in the QWQG (DERM, 2009a) to ensure that data is scientifically robust to effectively describe seasonal variation of the system.
- Where appropriate, site specific contaminant release limits will be identified for the parameters identified in Table 34. The data collected as part of the monitoring program can be used to facilitate this process however; additional temporal information will need to be collected to achieve QWQG (DERM, 2009a) survey design protocols.

Table 34 Potential contaminants for which site specific release limits should be established

Electrical conductivity	Copper	Selenium
pH	Iron	Silver
Turbidity	Lead	Uranium
Suspended Solids	Mercury	Vanadium
Sulphate	Nickel	Ammonia
Aluminium	Boron	Nitrate
Arsenic	Cobalt	Hydrocarbons (C6 – C9 and C10 – C36)
Cadmium	Manganese	Fluoride (total)
Chromium	Molybdenum	

* Contaminants proposed are to be reconsidered following determination of site specific WQOs. All metals and metalloids must be measured as dissolved (filtered).

- At a minimum water quality will be monitored at the contaminant release points, sources (MAW dams, sediment ponds), receiving water (upstream and downstream of the discharge points) and subsidence areas.

It is proposed that electrical conductivity and pH will be monitored continuously and for all other parameters monitoring is to commence within two hours of commencement of release and then at 24 hours thereafter.

The release of MAW to waters will take place during periods of natural flow events and must not exceed the electrical conductivity limits or the maximum release rate for each receiving water flow criteria for discharge as determined through additional monitoring prior to construction. The release of MAW will be undertaken so as to not cause erosion of the bed or banks of the receiving waters and cease if the water quality within the receiving waters (upstream or downstream) do not met the receiving water release limits.

Summary

Operational activities have the potential to impact on water quality via discharge of contaminants to the environment. The potential for this to occur will be managed by a range of site water management strategies and environmental authority permit conditions. This is expected to negate any impacts to water quality of the site. There is however residual risk in the potential for events larger than design capacity to occur in extreme circumstances and cause uncontrolled releases of MAW or SAW into the environment.

6.2.3 Alteration of drainage patterns

Potential impact

Similarly, to the construction phase, operational works can alter drainage patterns in several ways:

- By changing the rainfall runoff characteristics of land. Typically, runoff becomes more intense as lower permeability, rougher surfaces are replaced with higher permeability, smoother surfaces.
- By changing the directions of flows when areas are levelled for placement of infrastructure or facilities.
- By establishing creek diversions, flood levees and water management dams to manage and maintain, as much as possible, the surface hydrology of the site.

The operation of the Project (Mine), which includes construction of the mine, as a worst case, has the potential to remove 16,664 ha from the local river catchments, comprising 7,117 ha within the Carmichael River catchment and 9,547 ha from the Eight Mile Creek catchment or 25 percent of the local catchments. Development of the onsite water management and waterway diversions will occur at different stages over the 60 year mine life, staged according to the mining operations are described in SEIS Volume 4 Appendix K4 Flood Study. The system is designed to maintain environmental flows as far as practicable by connecting waterways across the mine site and maintaining flows close to existing.

Most diversions connect existing waterways upstream and downstream however an unnamed waterway traversing the mine site just to the south of the flood protection levee corridor is diverted to discharge to the Carmichael River.

The area overlying the underground mining area will be subject to subsidence. Whilst flow from higher in the catchment will be diverted through this area by the waterway diversions, it is expected that some flow will occur in this footprint as a result of localised rainfall. There is potential for this water to accumulate in subsidence depressions, creating new water resources. Localised subsidence drains will be constructed as required to drain these areas to the waterway diversions. Impacts associated with changes to surface hydrology are discussed in SEIS Volume 4 Appendix K5 Revised Mine Hydrology Impact Assessment Report.

Construction of an access corridor across the Carmichael River has the potential to alter the flow regime of the river. This may include impeding flows by narrow river crossing openings and changes to downstream geomorphology via deposition and scouring of sediment. Changes to water quality as a result of alteration of flow regime may be realised via increased input of sediment and pollutants.

Management and mitigation

- Loss of catchment area and some diversion of waterways are unavoidable; offset of the ecological loss associated with this impact should be considered as further discussed in the SEIS Volume 4 Appendix I1 Revised Ecological Assessment Report.
- The potential alteration of flow regime associated with a crossing at the Carmichael River will be managed/mitigated via engineering and construction management solutions including:
- Development of a crossing corridor across Carmichael River, with construction within the bed and banks restricted to the minimum amount necessary.
- Crossing infrastructure will comply with the Fish Habitat Management Operational Policy FHMOP 008.
- Measures addressing impacts associated with mobilisation of sediments and pollutants, identified in Section 6.2.2, will be applied to manage/mitigate impacts associated with the alteration of flows.

Summary

Loss of catchment area is unavoidable and diversion of waterways is essential to protect clean water. Waterway diversion design has maintained flows across the site as much as practicable to minimise this impact. Implementation of the identified management and mitigation measures during construction of the access corridor will maintain the flow regime of the Carmichael River such that flow-on effects to water quality are unlikely to occur.

6.2.4 Direct disturbance to water resources

Potential impact

Direct disturbances to water resources will include draining and removal/infilling of farm dams, diverting creeks and drainage lines and operation of an access corridor across the Carmichael River as discussed in the construction phase (refer to Section 5.2.4). Potential impacts associated with these activities include relocating potentially lower quality water from the farm dams to other existing water resources, mobilisation of sediment, and impediments to water flow. The latter two potential impacts and associated management and mitigation measures are addressed individually under Section 6.2.2.

Management and mitigation

Removal of the farm dams is unavoidable and will be undertaken in a staged manner over the life of the mine. Care will be taken to maintain the quality of the water resources until removal of the resources is required. This will assist in minimising localised impacts to ecological values (refer to SEIS Volume 4 Appendix I1 Revised Ecological Assessment Report). As such, management of the dam water removal will be undertaken to minimise impacts to the remaining water resources. Management measures identified for the management of dam water removal in the construction phase of the Project (Mine) (refer Section 6.2.2) are relevant to the operation phase of the Project (Mine), and will be applied.

Summary

Implementation of the identified management and mitigation measures will maintain the water quality of the resources until they are scheduled for diversion or removal.

6.3 Operational water management

6.3.1 Overview

Operation of the Carmichael Coal Mine will require the construction and operation of water management infrastructure, including water management dams, creek diversions and flood levees. Water will also be required to support the operation of the mine, utilised for activities such as coal processing and dust suppression. These water use activities have the potential to impact on the water quality of the site via the release of polluted water to the environment. Water usage and management during operation will be managed via a mine water management plan which will be implemented throughout the operation phase of the Project (Mine).

There is the potential for flood events greater than the design immunity events to occur. Overtopping or failure of the water management infrastructure could lead to uncontrolled releases of polluted water to the environment. This is unlikely to occur for infrastructure sized to the 1000 year ARI event, such as the flood protection levees, but more likely to occur for optimised infrastructure such as the sediment dams.

Water usage and management during operation will be managed via a water management plan which will be embedded within the EMP.

6.3.2 Controlled release of mine affected water

Mine affected water may be released from either of the two central mine affected water dams, one to the north of Carmichael River and one to the south. The water balance (refer to SEIS Water Balance Report for methodology) indicates that the water quality within the central mine affected dams will be as illustrated in Figure 20 and Figure 21. The salinity of the MAW storages was predicted to vary between approximately 1,000 mg/L and 2,000 mg/L.

This is significantly higher than the water quality discharge objectives of 1,300 µS/cm (Table 13) (~780mg/L); therefore releases will only occur when adequate flow in the Carmichael River will allow for a sufficient level of mixing and dilution of the salt concentration to background levels. Ultimately the site will have an operational procedure that will prescribe the minimum required Carmichael River flow for a range of dam salt concentrations.

It is anticipated that in situations of no flow in the Carmichael River, mine affected water with EC concentrations greater than 1,300 µS/cm will not be discharged.

Figure 20 Salt concentration central MAW dam north

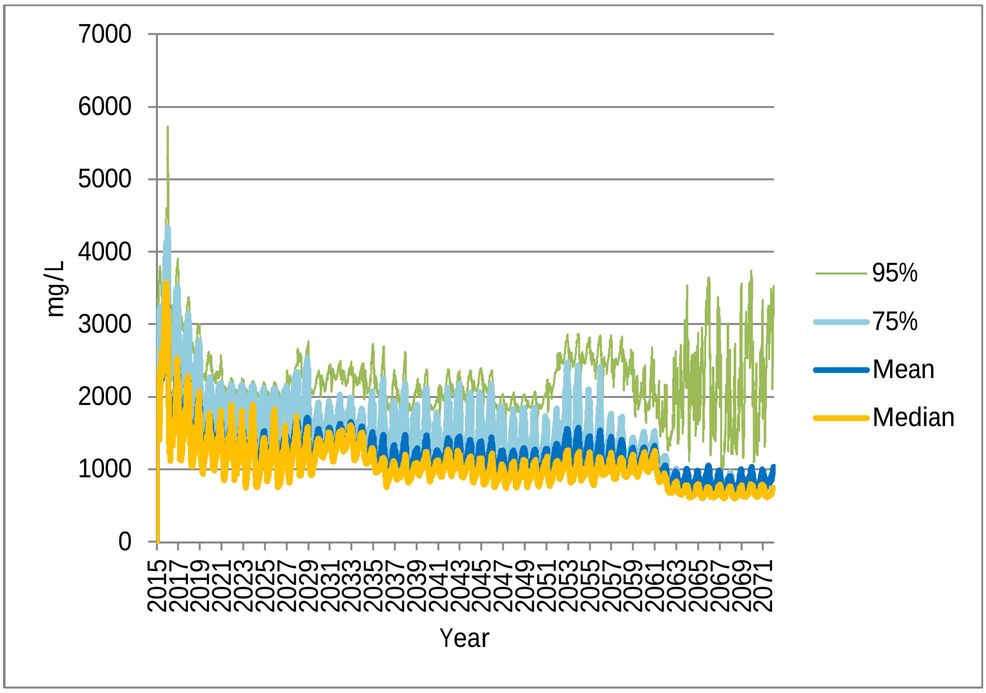
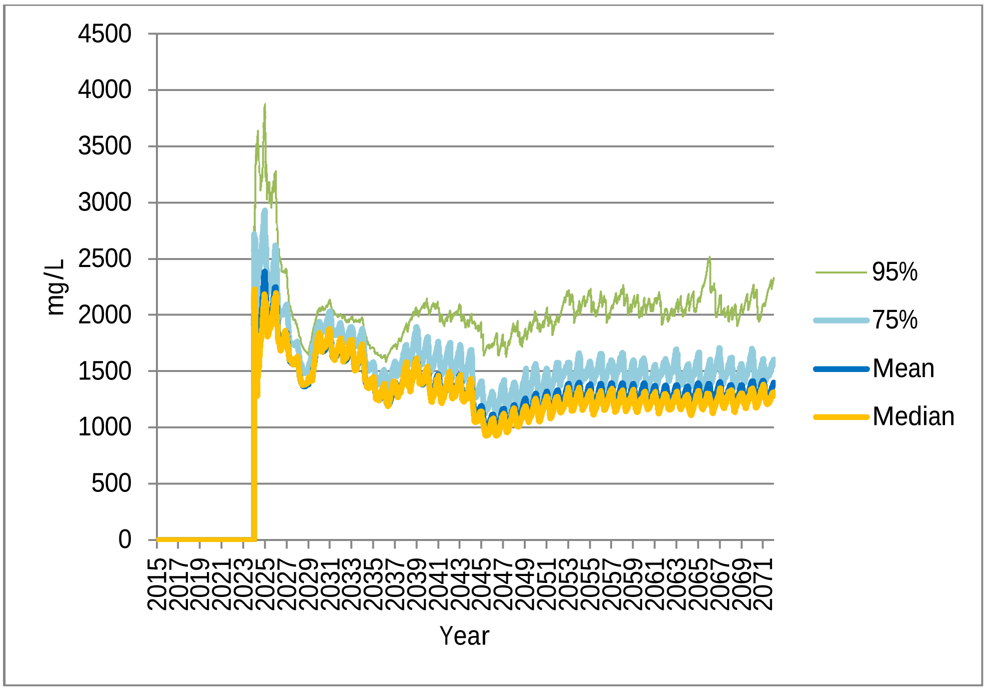


Figure 21 Salt concentration central MAW south



6.3.3 Uncontrolled release of mine affected and sediment affected water

Potential impact

An uncontrolled release of MAW or SAW has the potential to impact water quality in the surrounding environment. Uncontrolled releases could occur where there is overtopping or failure of the water management infrastructure during flood events above the design immunity. While unlikely to occur, examples of potential infrastructure failure include:

- Potential overtopping or failure of the MAW or SAW storages during flood events greater than the design storage capacity
- Diverted waterways spilling into surrounding mine, creating additional MAW or SAW that must be stored and treated
- Potential overtopping or failure of the sediment dams during flood events greater than the design storage capacity. The mine water balance indicates the overburden sediment dams will overtop multiple times each year (refer SEIS Volume 4 Appendix K5). However, total overflows are expected to be relatively small with a predicted 250 ML per year for as the worst case scenario.
- Failure or overtopping of the flood levee in events greater than 1000 year ARI plus freeboard, allowing the uncontrolled transfer of water between the Carmichael River into the mine with potential impacts to water quality.

Management and mitigation

Management and mitigation of potential impacts associated with the failure of water infrastructure will primarily be implemented through appropriate design immunity choices and engineering design solutions. Hydrologic modelling and the water balance assessment have identified appropriate infrastructure designs based on modelling of extreme weather events (refer SEIS Volume 4 Appendix K2 and K4).

Operational dam management solutions will be embedded as part of the mine water management plan and releases will be made when required to avoid uncontrolled overtopping during larger events. Regular inspection and servicing of all water management infrastructure will be part of the management strategy. Ongoing monitoring of the discharge water quality will be required to confirm the efficacy of the water management infrastructure. Monitoring requirements will form part of the receiving environment monitoring program and include sites upstream and downstream of the discharge point.

Clean-out frequencies for the sediment dams will form part of the site EMP. Frequent clean-outs will reduce the risk of sediments being resuspended in the event of an overflow, thereby reducing the risk of high sediment loads being released to the environment.

A warning threshold indicator will be established for flooding of operational areas. This threshold could be an agreed flow or water level in the Carmichael River or rainfall intensity at the nearest gauge. Should this threshold be reached, works onsite will cease and workers will be evacuated prior to flooding occurring. Works will not recommence until all relevant impact management infrastructure has been inspected and re-established to good working order.

Summary

Appropriate design of the water management infrastructure, in conjunction with regular inspection, servicing and monitoring of the receiving environment will mitigate the potential for impacts associated with uncontrolled MAW releases due to infrastructure overtopping or failure.

The mitigation options are expected to leave minimal residual probability of uncontrolled releases.

6.3.4 Use of water during operation

Potential impact

Potential impacts associated with the use of water during operations are associated with the quality of water that may be released to the environment. This release may occur as part of the water usage (e.g. during dust suppression activities), or during disposal after usage (e.g. sewage disposal).

Reuse of MAW during operation may be undertaken for dust suppression activities, irrigation of revegetated areas or coal processing. Dust suppression during operational activities is an essential management measure to minimise the potential for sediment/coal dust mobilisation into the downstream environment with impacts to water quality. Using MAW for this purpose has the dual benefit of reducing the need for an external source of water and allowing minimisation of the size of the MAW storages. The quality of the water used for operational activities must be managed in order to avoid potential contamination of water resources. Much of the MAW is likely to come from pit dewatering. As the groundwater is somewhat saline (above the ANZECC 2000 long-term irrigation guidelines for sodium and chloride, as described in SEIS Appendix K1 Updated Mine Hydrogeology Report), its usage for operational activities may possibly slightly increase the salinity of the surrounding environment.

Management and mitigation

Release quality characteristics for reuse of treated contaminated water have been outlined in Table 34. If treated water such as MAW is to be used for dust suppression or irrigation activities these release quality characteristics must be achieved.

MAW and treated wastewater from the site must be managed appropriately to avoid a build-up in storages. Management tactics include the following, as also listed in SEIS Appendix K5:

- Reuse within the mine site;
- Maximise evaporation by either extending the storage areas, or spread water over as many storages as possible;
- Increasing volumes used for dust suppression either by increasing the area or by increasing the volume used per ha; and/or
- Discharge into the Carmichael River or local waterways whenever MAW water quality and volumes in the receiving waterways allow for discharges.

Summary

Minimal impacts to the water quality of surface water resources onsite are expected to be realised from operational water usage if the reuse quality characteristics outlined in Table 34 are achieved. The most likely parameter to be impacted is salinity, should MAW be used for operational water requirements.

6.4 Underground and open cut mining

6.4.1 Overview

Mining operations will require dewatering of open cut and underground mining areas. This activity may have the potential to impact upon surface water quality via changes to the interactions between surface water and groundwater. An assessment of the water chemistry of the Carmichael River and nearby groundwater resources identified that it is likely that the surface water of the Carmichael River is influenced by the nearby groundwater aquifers. Temporal changes in the surface water chemistry also indicate that the influence of groundwater on the Carmichael River is greater in the dry season than in the wet season when rain water is entering the system. Impacts to surface water may also be realised if dewatered material is released untreated to the environment.

6.4.2 Changes to surface water – groundwater interactions

Potential impact

Mining operations will require dewatering of open cut and underground mining areas. This will lower the water table in the mining areas, which may lead to a decrease in the proportion of water that discharges into the Carmichael River. Preliminary groundwater modelling results show a potential for groundwater discharges to the Carmichael River to be reduced significantly compared to pre-development discharges. This decrease in discharge will tend to increase the duration of zero flow and / or low flow periods in the Carmichael River. The reduction in flow of the Carmichael has the potential to have flow on effects to the water quality and EV's including downstream water users. Further information regarding the impacts to groundwater resources is provided in SEIS Volume 4 Appendix K1.

Management and mitigation

Management of indirect impacts to surface water quality will be achieved via management of the groundwater resources. Details regarding the proposed management and mitigation measures for groundwater resources are provided in SEIS Volume 4 Appendix K1.

Summary

Groundwater discharges to the Carmichael River may potentially be reduced by up to seven percent resulting in a decrease in discharges to surface water and an increase in the duration of zero flow and / or low flow periods in the Carmichael River.

6.4.3 Disposal of pit dewatering product

Potential impact

Mining operations will require dewatering of open cut and underground mining areas. Dewatering has the potential to impact surface water quality if the dewatered material is released to the environment.

Management and mitigation

All water from pit dewatering will be managed under the mine water management plan. This plan will include the requirement for the pit dewatering to be contained within the MAW storage dams. All discharges from the MAW dams will be subject to appropriate levels of control and monitoring such that it can be reused or discharged to the receiving water courses without significant detrimental impacts on water quality and flow. Controlled discharges are expected (mean) to be around 3,500 ML per year for the first 40 years of the mine life, while they are expected to be around 6,000 ML per year for the last 20 years of the mine life (refer to Appendix K2 Water Balance Report). Strategies to manage the potential for impact associated with release of water from the MAW dams are identified in Section 6.2.2 and Section 6.3.2. These strategies include:

- The design of the MAW dams will be based on the water balance assessment with sufficient capacity to manage MAW not reused in operational processes such as dust suppression (refer to SEIS Volume 4 Appendix K2 for details on preliminary dam sizing requirements). This will manage the potential for overtopping and uncontrolled releases from the MAW dams.
- Contaminants that have the potential to cause environmental harm will not be released to the environment except under environmental authority permit conditions. Waters to be released to the environment must comply with the contaminant release limits which will be identified in a receiving environment monitoring program. An assessment of the existing water quality of the Study Area identified that the naturally variable conditions onsite are not consistent with the WQOs contained in the QWQG (DERM, 2009a) and the ANZECC Guidelines (ANZECC and ARMCANZ, 2000). Site specific contaminant release limits will be identified to protect the EVs of the region. This should be done following the survey design protocols contained in the QWQG (DERM, 2009a) to ensure that data is scientifically robust to effectively describe seasonal variation of the system. Where appropriate, site specific contaminant release limits will be identified for the parameters identified in Table 34. The data collected as part of this monitoring program can be used to facilitate this process however; additional temporal information will need to be collected to achieve QWQG (DERM, 2009a) survey design protocols.
- Regular inspection and servicing of all water management infrastructure. Ongoing monitoring of the receiving environment will be required to confirm the efficacy of the water management infrastructure. Monitoring requirements will form part of the Receiving Environment Monitoring Program.

Summary

Implementation of the management and mitigation measures will manage the potential for impact to water quality as a result of release of dewatered material. No residual impacts to surface water quality are expected as a result of dewatering activities.

7. Potential impacts and mitigation measures – decommissioning phase

The operational lifespan of the mine is approximately 60 years. There are a number of aspects of relevance to environmental management when decommissioning the mining operation, including:

- Rehabilitation and remediation of open cut pits and voids, and out of pit dumps
- Removal of industrial infrastructure, camp and airstrip.

Details on the approach to decommissioning the mining operation are provided in SEIS Volume 4 Appendix B. With respect to the potential impacts to the environment and associated mitigation for this phase, the decommissioning of the mine will require detailed planning. Planning and subsequent development of a decommissioning environmental management plan should incorporate a phase of impact assessment that includes consideration of the potential impacts to the aquatic ecosystems within and downstream of the site as they occur at the time of decommissioning with reference to pre-mining state, as described herein.

The resultant plan should consider (but not be limited to) incorporation of the following with respect to the management of water resources:

- Remediation and development of the final landform to consider drainage, erosion resistance and potential resultant change to surface water flows (direct and volume) in order to minimise changes to the water quality of the Carmichael River and downstream
- Rehabilitation requirements for any watercourse crossings
- Rehabilitation or re-establishment of riparian zones for watercourses
- Monitoring requirements for water quality and aquatic communities
- Decommissioning and rehabilitation of MAW dams and the potential need to remove residual sediment.

At the time of decommissioning, suitably qualified water scientists and ecologists are to be consulted during planning and implementation to provide appropriate direction on management of the water resources and aquatic ecosystems and to incorporate the relevant policy, legislation and standards of the time.

8. Conclusion

The assessment of the existing surface water quality environment identified that the surface water resources onsite display both spatial and temporal variability. Sampling covering a dry season (2011) and a wet season (2012/2013) provided sufficient information to determine sub-regional WQOs for environmental protection at 95 percent species protection level for the Carmichael River. Provided the WQOs are met at a specified location on the Carmichael River (edge of the discharge mixing zone) during construction and operation of the mine, no adverse impacts will be detected further downstream in the Carmichael River or receiving waters.

Assessment of the potential impacts associated with the construction and operation phases of the Project (Mine) identified that activities have the potential to negatively affect the quality of the water in the Carmichael River Catchment. Measures to mitigate and/or manage potential impacts have been identified, including those that will be implemented through engineering design, management plans and monitoring programs. Implementation of identified measures is considered to substantially reduce the risk of impact to water quality, such that the majority of actions are considered to have no residual risk. Those actions with residual risk to water quality include:

- The mobilisation of pollutants to water resources as a result of a spill outside bunded areas
- The loss of 25 percent of the local catchment and alteration of flows associated with this loss
- Potential flow on effects to water quality as a result of changes to the interaction between groundwater and surface water
- The potential for on-site storages (MAW and sediment dams) to overflow during a storm event greater than the design criteria accommodates resulting in contaminated water being released to the environment.

9. References

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC and ARMCANZ), 2000, The Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

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Appendices

Appendix A – Laboratory documentation

Chain of Custody & Analysis Request

Chain of Custody Number:

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5	LABORATORY BATCH NO.:	
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring			FOR LAB USE ONLY	
CLIENT:	GHD			COOLER SEAL: Yes ... No ...	COOLER TEMP: ..... deg.C
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000			Broken ... Intact ...	
CONTACT:	Anna Boden				
PHONE:	07 3316 3525	FAX:	07 3316 3333	SENT TO:	ALS Laboratory Group
EMAIL:	Anna.Boden@ghd.com				26 Shand Street
INVOICE:	Anna.Boden@ghd.com Sarah.Watkin@ghd.com				Stafford, QLD 4053
					07 3243 7222
DATA NEEDED BY:	ASAP				
REPORT FORMAT:					
EMAIL FORMAT:	ESDAT, EXCEL & PDF				

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

	SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Ultra trace nutrients (UTN - 04) (TP, RP, NH3, NO2, NO3, TKN, TN)	Chlorophyll-a (EP008)	Faecal (Thermotolerant) Coliforms (MF) (MW006)	TDS (EA015H)	TSS (EA025)
1	WQST-130411	W	13/4/11	LOR	As Required	X	X	X	X	X
2	WQ02-130411	W	13/4/11	LOR	As Required	X	X	X	X	X
3	WQ03-130411	W	13/4/11	LOR	As Required	X	X	X	X	X
4	WQ05-130411	W	13/4/11	LOR	As Required	X	X	X	X	X
5	WQ04-130411	W	13/4/11	LOR	As Required	X	X	X	X	X
6	QA01	W	13/4/11	LOR	As Required	X	X	X	X	X
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					

NOTES:

CONTAINED WITHIN 2 ESKIES

URGENT

Environmental Division Brisbane

Work Order

EB1107318

Telephone : +61-7-3243 7222

RELINQUISHED BY:		RECEIVED BY:	
NAME: J KREUGER	DATE: 13/4/11	NAME :	DATE:
OF: GHD Brisbane	TIME: 12:30	OF:	TIME:

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

Chain of Custody & Analysis Request

Chain of Custody Number:

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5 50
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring		
CLIENT:	GHD		
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000		
CONTACT:	Anna Boden		
PHONE:	07 3316 3525	FAX:	07 3316 3333
EMAIL:	Anna.Boden@ghd.com		
INVOICE:	Anna.Boden@ghd.com Sarah.Watkin@ghd.com		
DATA NEEDED BY:	ASAP		
REPORT FORMAT:			
EMAIL FORMAT:	ESDAT, EXCEL & PDF		

LABORATORY BATCH NO.:

FOR LAB USE ONLY

COOLER SEAL: Yes No ...... Broken Intact ......

COOLER TEMP: ..... deg.C

SENT TO: ALS Laboratory Group
26 Shand Street
Stafford, QLD 4053
07 3243 7222

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

	SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Ultra trace nutrients (UTN - 04) (TP, RP, NH3, NO2, NO3, TKN, TN)	Chlorophyll-a (EP008)	Faecal (Thermotolerant) Coliforms (MF) (MW006)	TDS (EA015H)	TSS (EA025)
1	WQ06-140411	W	14/4/11	LOR	As Required	X	X	X	X	X
2	WQ01-140411	W	14/4/11	LOR	As Required	X	X	X	X	X
3	WQ08-140411	W	14/4/11	LOR	As Required	X	X	X	X	X
4	WQ09-140411	W	14/4/11	LOR	As Required	X	X	X	X	X
5	QA02	W	14/4/11	LOR	As Required	X	X	X	X	X
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					

NOTES:

URGENT

Environmental Division
Brisbane
VL Work Order
EB1107452

Telephone : +61-7-3243 7222

RELINQUISHED BY:
NAME: K.TASLE
OF: GHD Brisbane
DATE: 14/4/11
TIME: 11:45am

RECEIVED BY:
NAME: TEHY
OF: ALL
DATE: 15/4
TIME: 7:50

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

Chain of Custody & Analysis Request

Chain of Custody Number:

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5 BQ.
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring		
CLIENT:	GHD		
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000		
CONTACT:	Anna Boden		
PHONE:	07 3316 3525	FAX:	07 3316 3333
EMAIL:	Anna.Boden@ghd.com		
INVOICE:	Anna.Boden@ghd.com Sarah.Watkin@ghd.com		
DATA NEEDED BY:	ASAP		
REPORT FORMAT:			
EMAIL FORMAT:	ESDAT, EXCEL & PDF		

LABORATORY BATCH NO.:

FOR LAB USE ONLY

COOLER SEAL: Yes / No; Broken / Intact

COOLER TEMP: deg C

SENT TO: ALS Laboratory Group
26 Shand Street
Stafford, QLD 4053
07 3243 7222

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

	SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Ultra trace nutrients (UTN - 04) (TP, RP, NH3, NO2, NO3, TKN, TN)	Chlorophyll-a (EP008)	Faecal (Thermotolerant) Coliforms (MF) (MW006)	TDS (EA015H)	TSS (EA025)	Dissolved Metals (W-3 and EG020F)	Total Metals (W-2T and EG020T)	TPH C6-C36 (EP071/080)	PAH (EP075B)	Fluoride - Soluble (EK040)	Major Cations (NT-1)	Major Anions (NT-2)	Dissolved Silicon (ED040F)	Hardness - Total (EA065)	
1	WQ08	W	4/5/11	LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	WQ09	W	4/6/11	LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	WQ06	W	4/5/11	LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	QA01	W	4/5/11	LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															

NOTES: All samples freshwater

Environmental Division
Brisbane
Work Order
EB1108606

Telephone : +61-7-3243 7222

RELINQUISHED BY:		RECEIVED BY:	
NAME: Anna Boden	DATE: 4/5/11	NAME:	DATE:
OF: GHD Brisbane	TIME: 1200	OF:	TIME:

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

Chain of Custody & Analysis Request

Chain of Custody Number:

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring		
CLIENT:	GHD		
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000		
CONTACT:	Anna Boden		
PHONE:	07 3316 3525	FAX:	07 3316 3333
EMAIL:	Anna.Boden@ghd.com		
INVOICE:	Anna.Boden@ghd.com Sarah.Watkin@ghd.com		
DATA NEEDED BY:	ASAP		
REPORT FORMAT:			
EMAIL FORMAT:	ESDAT, EXCEL & PDF		

LABORATORY BATCH NO.:

FOR LAB USE ONLY

COOLER SEAL: Yes No Broken Intact

COOLER TEMP: deg C

SENT TO: ALS Laboratory Group
26 Shand Street
Stafford, QLD 4053
07 3243 7222

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

	SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Ultra trace nutrients (UTN - 04) (TP, RP, NH3, NO2, NO3, TKN, TN)	Chlorophyll-a (EP008)	Faecal (Thermotolerant) Coliforms (MF) (MW006)	TDS (EA015H)	TSS (EA025)	Dissolved Metals (W-3 and EG020F)	Total Metals (W-2T and EG020T)	TPH C6-C36 (EP071/080)	PAH (EP075B)	Fluoride - Soluble (EK040)	Major Cations (NT-1)	Major Anions (NT-2)	Dissolved Silicon (ED040F)	Hardness - Total (EA065)	
1	WQ01	W	5/5/11	LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2	WQ02			LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
3	WQ03			LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
4	WQ04			LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
5	WQ5T			LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
6	QA02			LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															

NOTES:

All samples freshwater.

Environmental Division
Brisbane
Work Order
EB1108729

Telephone : +61-7-3243 7222

URGENT

RELINQUISHED BY:

NAME: Anna Boden DATE: 5/5/11
OF: GHD Brisbane TIME: 1200

RECEIVED BY:

NAME: [illegible] DATE: 06/05/11
OF: ALS TIME: 09:30

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

Chain of Custody & Analysis Request

Chain of Custody Number:

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring		
CLIENT:	GHD		
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000		
CONTACT:	Anna Boden		
PHONE:	07 3316 3525	FAX:	07 3316 3333
EMAIL:	Anna.Boden@ghd.com		
INVOICE:	Anna.Boden@ghd.com Sarah.Watkin@ghd.com		

LABORATORY BATCH NO.:

FOR LAB USE ONLY

COOLER SEAL: Yes / No / Broken / Intact

COOLER TEMP: deg C

SENT TO: ALS Laboratory Group
26 Shand Street
Stafford, QLD 4053
07 3243 7222

DATA NEEDED BY:	ASAP
REPORT FORMAT:	
EMAIL FORMAT:	ESDAT, EXCEL & PDF

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Ultra trace nutrients (UTN - 04) (TP, RP, NH3, NO2, NO3, TKN, TN)	Chlorophyll-a (EP008)	Faecal (Thermotolerant) Coliforms (MF) (MW006)	TDS (EA015H)	TSS (EA025)
WQ01	Water	21/6/11	LOR	As Required	X	X	X	X	X
WQ02	↓	↓	LOR	As Required	X	X	X	X	X
WQ03			LOR	As Required	X	X	X	X	X
WQ04			LOR	As Required	X	X	X	X	X
WQ05			LOR	As Required	X	X	X	X	X
QA1	↓	↓	LOR	As Required	X	X	X	X	X
			LOR	As Required					
			LOR	As Required					
			LOR	As Required					
			LOR	As Required					
			LOR	As Required					
			LOR	As Required					
			LOR	As Required					
			LOR	As Required					
			LOR	As Required					

NOTES:

Please freeze ultratrace nutrient samples immediately upon receipt.

URGENT

Environmental Division
Brisbane
Work Order
EB1111938

Telephone : +61-7-3243 7222

RELINQUISHED BY:

NAME: Jody Kreuger DATE: 21/6/11
OF: GHD Brisbane TIME: 1200

RECEIVED BY:

NAME: [illegible] DATE: 22/06/11
OF: ALS TIME: 08:35

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

Chain of Custody & Analysis Request

Page _1_ of _1_

Chain of Custody Number:

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring		
CLIENT:	GHD		
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000		
CONTACT:	Anna Boden		
PHONE:	07 3316 3525	FAX:	07 3316 3333
EMAIL:	Anna.Boden@ghd.com		
INVOICE:	Anna.Boden@ghd.com Sarah.Watkin@ghd.com		
DATA NEEDED BY:	ASAP		
REPORT FORMAT:			
EMAIL FORMAT:	ESDAT, EXCEL & PDF		

LABORATORY BATCH NO.:

FOR LAB USE ONLY

COOLER SEAL: Yes ..... No ..... Broken ..... Intact .....

COOLER TEMP: ..... deg.C

SENT TO: ALS Laboratory Group
26 Shand Street
Stafford, QLD 4053
07 3243 7222

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Ultra trace nutrients (UTN - 04) (TP, RP, NH3, NO2, NO3, TKN, TN)	Chlorophyll-a (EP008)	Faecal (Thermotolerant) Coliforms (MF) (MW006)	TDS (EA015H)	TSS (EA025)
WQ01	W	21-6-11	LOR	As Required					
WQ02	W		LOR	As Required					
WQ03	W		LOR	As Required					
WQ04	W		LOR	As Required					
WQ05	W		LOR	As Required					
QA1	W		LOR	As Required					
			LOR	As Required					
			LOR	As Required					
			LOR	As Required					
			LOR	As Required					
			LOR	As Required					
			LOR	As Required					
			LOR	As Required					
			LOR	As Required					
			LOR	As Required					

URGENT

NOTES:

Freeze ultra trace nutrient samples upon receipt

Fresh-water Samples

RELINQUISHED BY:
NAME: Jody Kreuger DATE: 21-6-11
OF: GHD Brisbane TIME: 1215

RECEIVED BY:
NAME: [illegible]
OF: ALS
DATE: 22/06/11
TIME: [illegible]

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

Chain of Custody & Analysis Request

Page _1_ of _1_

Chain of Custody Number:

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring		
CLIENT:	GHD		
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000		
CONTACT:	Anna Boden		
PHONE:	07 3316 3525	FAX:	07 3316 3333
EMAIL:	Anna.Boden@ghd.com		
INVOICE:	Anna.Boden@ghd.com Sarah.Watkin@ghd.com		
DATA NEEDED BY:	ASAP		
REPORT FORMAT:			
EMAIL FORMAT:	ESDAT, EXCEL & PDF		

LABORATORY BATCH NO.:

FOR LAB USE ONLY

COOLER SEAL: Yes No ...... Broken Intact ......

COOLER TEMP: ...... deg.C

SENT TO: ALS Laboratory Group
26 Shand Street
Stafford, QLD 4053
07 3243 7222

Environmental Division
Brisbane
Work Order
EB1112105

Telephone : + 61-7-3243 7222

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

	SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Ultra trace nutrients (UTN - 04) (TP, RP, NH3, NO2, NO3, TKN, TN)	Chlorophyll-a (EP008)	Faecal (Thermotolerant) Coliforms (MF) (MW006)	TDS (EA015H)	TSS (EA025)
1	WQ09	Water	22/6/11	LOR	As Required	X	X	X	X	X
2	WQ08	↓	↓	LOR	As Required	X	X	X	X	X
3	WQ06			LOR	As Required	X	X	X	X	X
4	WQST			LOR	As Required	X	X	X	X	X
5	QA[illegible]2			LOR	As Required	X	X	X	X	X
	EXTRA SAMPLE			LOR	As Required					
6	DOONGABOOLA SPRING	W	22/6/11	LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					

NOTES:
FREEZE ULTRATRACE NUTRIENT SAMPLES UPON RECEIPT

SAMPLES ARE FRESHWATER.

URGENT

RELINQUISHED BY:		RECEIVED BY:	
NAME: Robert Cookson	DATE: 22/6/11	NAME:	DATE:
OF: GHD Brisbane	TIME: 1115	OF:	TIME:

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

Chain of Custody & Analysis Request

Chain of Custody Number:

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring		
CLIENT:	GHD		
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000		
CONTACT:	Anna Boden		
PHONE:	07 3316 3525	FAX:	07 3316 3333
EMAIL:	Anna.Boden@ghd.com		
INVOICE:	Anna.Boden@ghd.com Juiie.Keane@ghd.com		
DATA NEEDED BY:	ASAP		
REPORT FORMAT:			
EMAIL FORMAT:	ESDAT, EXCEL & PDF		

LABORATORY BATCH NO.:

FOR LAB USE ONLY

COOLER SEAL: Yes / No ...... Broken / Intact ......

COOLER TEMP: ...... deg.C

SENT TO: ALS Laboratory Group
26 Shand Street
Stafford, QLD 4053
07 3243 7222

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

	SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Ultra trace nutrients (UTN - 04) (TP, RP, NH3, NO2, NO3, TKN, TN)	Chlorophyll-a (EP008)	Faecal (Thermotolerant) Coliforms (MF) (MW006)	TDS (EA015H)	TSS (EA025)	Dissolved Metals (W-3 and EG020F)	Total Metals (W-2T and EG020T)	TPH C6-C36 (EP071/080)	PAH (EP075B)	Fluoride - Soluble (EK040)	Major Cations (NT-1)	Major Anions (NT-2)	Dissolved Silicon (ED040F)	Hardness - Total (EA065)	
1	WQ01	W	26/7	LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2	WQ02	↓	↓	LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
3	WQ03	↓	↓	LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
4	WQ04	↓	↓	LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
5	QA01	↓	↓	LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															

NOTES:

PLEASE FREEZE ULTRATRACE NUTRIENT SAMPLES IMMEDIATELY UPON RECIEPT

All samples freshwater

URGENT

Environmental Division
Brisbane
Work Order
EB1114640

Telephone : + 61-7-3243 7222

RELINQUISHED BY:

NAME: Robert Coulson DATE: 26/7/11
OF: GHD Brisbane TIME: 1230

RECEIVED BY:

NAME: OTO DATE: 27/07/11
OF: ALS TIME: 08:35

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

Chain of Custody & Analysis Request

Page _1_ of _1_

Chain of Custody Number:

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring		
CLIENT:	GHD		
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000		
CONTACT:	Anna Boden		
PHONE:	07 3316 3525	FAX:	07 3316 3333
EMAIL:	Anna.Boden@ghd.com		
INVOICE:	Anna.Boden@ghd.com Julie.Keane@ghd.com		
DATA NEEDED BY:	ASAP		
REPORT FORMAT:			
EMAIL FORMAT:	ESDAT, EXCEL & PDF		

LABORATORY BATCH NO.:

FOR LAB USE ONLY

COOLER SEAL: Yes No ...... Broken Intact ......

COOLER TEMP: ..... deg.C

SENT TO: ALS Laboratory Group
26 Shand Street
Stafford, QLD 4053
07 3243 7222

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

	SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Ultra trace nutrients (UTN - 04) (TP, RP, NH3, NO2, NO3, TKN, TN)	Chlorophyll-a (EP008)	Faecal (Thermotolerant) Coliforms (MF) (MW006)	TDS (EA015H)	TSS (EA025)	Dissolved Metals (W-3 and EG020F)	Total Metals (W-2T and EG020T)	TPH C6-C36 (EP071/080)	PAH (EP075B)	Fluoride - Soluble (EK040)	Major Cations (NT-1)	Major Anions (NT-2)	Dissolved Silicon (ED040F)	Hardness - Total (EA065)
1	WQ09	W	27/7/11	LOR	As Required														
2	WQ08			LOR	As Required														
3	WQ06			LOR	As Required														
4	WQST			LOR	As Required														
5	QA02			LOR	As Required														
				LOR	As Required														
				LOR	As Required														
				LOR	As Required														
				LOR	As Required														
				LOR	As Required														
				LOR	As Required														
				LOR	As Required														
				LOR	As Required														
				LOR	As Required														
				LOR	As Required														

NOTES:
PLEASE FREEZE ULTRATRACE NUTRIENT SAMPLES IMMEDIATELY UPON RECEIPT

ALL SAMPLES FRESHWATER

URGENT

Environmental Division
Brisbane
Work Order
EB1114769

Telephone : + 61-7-3243 7222

RELINQUISHED BY:
NAME: Robert Coulson DATE: 27/7/11
OF: GHD Brisbane TIME: 1230

RECEIVED BY:
NAME: [signature] DATE: 28/7
OF: ALS TIME: 8:35

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

Chain of Custody & Analysis Request

Chain of Custody Number:

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5
PROJECT:	Carmichael Coal Mine and Rail Project - Sediment		
CLIENT:	GHD		
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000		
CONTACT:	Anna Boden		
PHONE:	07 3316 3525	FAX:	07 3316 3333
EMAIL:	Anna.Boden@ghd.com		
INVOICE:	Anna.Boden@ghd.com Julie.Keane@ghd.com		
DATA NEEDED BY:	ASAP		
REPORT FORMAT:			
EMAIL FORMAT:	ESDAT, EXCEL & PDF		

LABORATORY BATCH NO.:

FOR LAB USE ONLY

COOLER SEAL: Yes No ...... Broken Intact ......

COOLER TEMP: ......deg.C

SENT TO: ALS Laboratory Group
26 Shand Street
Stafford, QLD 4053
07 3243 7222

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: ATTN: Bryn Stephens / Dean Sullivan

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

NOTES:

	SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	TOC (EP005)	PSD (EA150)	TPH (EP071/080)	PAH (EP075B)	Metals (S-2T) (EG020T) Al, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Ni, Pb, V, Zn, Mo, Se, Ag, Sr, U, B, Fe	Total Faecal (MW008-S)	Nutrients (NT-8S) (EK071)
1	WQ01	Sed	26/7/11	LOR	As Required	X	X	X	X	X	X	X
2	WQ02	Sed	↓	LOR	As Required	X	X	X	X	X	X	X
3	WQ03	Sed		LOR	As Required	X	X	X	X	X	X	X
4	WQ04	Sed		LOR	As Required	X	X	X	X	X	X	X
5	WQ06	Sed	27/7/11	LOR	As Required	X	X	X	X	X	X	X
6	WQ08	Sed	↓	LOR	As Required	X	X	X	X	X	X	X
7	WQ09	Sed		LOR	As Required	X	X	X	X	X	X	X
8	WQ10	Sed		LOR	As Required	X	X	X	X	X	X	X
9	WQ11	Sed		LOR	As Required	X	X	X	X	X	X	X
10	WQ12	Sed		LOR	As Required	X	X	X	X	X	X	X
11	QA01	Sed	26/7/11	LOR	As Required	X		X	X	X	X	X
12	QA02	Sed	27/7/11	LOR	As Required	X		X	X	X	X	X
13	WQST	Sed	27/7/11	LOR	As Required	X	X	X	X	X	X	X
		Sed		LOR	As Required							
		Sed		LOR	As Required							

9.

8

Environmental Division
Brisbane
Work Order
EB1114957

Telephone : +61-7-3243 7222

RELINQUISHED BY:		RECEIVED BY:	
NAME: R. Coulson	DATE: 28/7/11	NAME: ROWAN MORRISON	DATE: 28/7/11
OF: GHD Brisbane	TIME: 1400	OF: ACIRL	TIME: 1400

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

6

REC: ALS 29/07/11 10:25

GHD

Chain of Custody & Analysis Request

Chain of Custody Number:

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring		
CLIENT:	GHD		
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000		
CONTACT:	Anna Boden		
PHONE:	07 3316 3525	FAX:	07 3316 3333
EMAIL:	Anna.Boden@ghd.com		
INVOICE:	Anna.Boden@ghd.com Julie.Keane@ghd.com		
DATA NEEDED BY:	ASAP		
REPORT FORMAT:			
EMAIL FORMAT:	ESDAT, EXCEL & PDF		

LABORATORY BATCH NO.:

FOR LAB USE ONLY

COOLER SEAL: Yes ..... No ..... Broken ..... Intact .....

COOLER TEMP: ..... deg.C

SENT TO: ALS Laboratory Group
26 Shand Street
Stafford, QLD 4053
07 3243 7222

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: ATTN Bryn Stephens / Dean Sullivan

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

	SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Total Metals (EG020C-T) Al, ~~As~~, Ba, Be, ~~Cd~~, Co, ~~Cr~~, ~~Cu~~, Mn, ~~Ni~~, ~~Pb~~, V, ~~Zn~~, Mo, Se, Ag, Sr, U, B, Fe	Dissolved Metals (EG020C-F) Al, ~~As~~, Ba, Be, ~~Cd~~, Co, ~~Cr~~, ~~Cu~~, Mn, ~~Ni~~, ~~Pb~~, V, ~~Zn~~, Mo, Se, Ag, Sr, U, B, Fe	Fluoride- soluble (EK040)	Major Cations (NT-1)	Major Anions (NT-2)	Ultratrace nutrients (UTN-04)	TPH (C10-36) (EP071/080)	PAH (EP075B)
14	QA03	Sed	27/7/11	LOR	As Required	X	X	X	X	X	X	X	X
15	WQ10	Sed		LOR	As Required	X	X	X	X	X	X	X	X
16	WQ11	Sed		LOR	As Required	X	X	X	X	X	X	X	X
17	WQ12	Sed		LOR	As Required	X	X	X	X	X	X	X	X
		Sed		LOR	As Required								
		Sed		LOR	As Required								
		Sed		LOR	As Required								
		Sed		LOR	As Required								
		Sed		LOR	As Required								
		Sed		LOR	As Required								
		Sed		LOR	As Required								
		Sed		LOR	As Required								
		Sed		LOR	As Required								
		Sed		LOR	As Required								
		Sed		LOR	As Required								

NOTES:

DI Leach all samples

RELINQUISHED BY:		RECEIVED BY:	
NAME: Robert Coulson	DATE: 28/7/11	NAME: ROWAN MORRISON	DATE: 28/7/11
OF: GHD Brisbane	TIME: 1400	OF: ACIRL	TIME: 1600

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

REC: ALS 29/07/11 10:25

Chain of Custody & Analysis Request

Chain of Custody Number:

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring		
CLIENT:	GHD		
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000		
CONTACT:	Anna Boden		
PHONE:	07 3316 3525	FAX:	07 3316 3333
EMAIL:	Anna.Boden@ghd.com		
INVOICE:	Anna.Boden@ghd.com Julie.Keane@ghd.com		
DATA NEEDED BY:	ASAP		
REPORT FORMAT:			
EMAIL FORMAT:	ESDAT, EXCEL & PDF		

LABORATORY BATCH NO.: FOR LAB USE ONLY
COOLER SEAL: Yes No Broken Intact
COOLER TEMP: deg C

SENT TO: ALS Laboratory Group
26 Shand Street
Stafford, QLD 4053
07 3243 7222

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

	SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Ultra trace nutrients (UTN - 04) (TP, RP, NH3, NO2, NO3, TKN, TN)	Chlorophyll-a (EP008)	Faecal (Thermotolerant) Coliforms (MF) (MW006)	TDS (EA015H)	TSS (EA025)
1	WQ01	Water	23/08/2011	LOR	As Required	x	x	x	x	x
2	WQ02	Water	23/08/2011	LOR	As Required	x	x	x	x	x
3	WQ03	Water	23/08/2011	LOR	As Required	x	x	x	x	x
4	WQ04	Water	23/08/2011	LOR	As Required	x	x	x	x	x
5	QA01	Water	23/08/2011	LOR	As Required	x	x	x	x	x
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					

NOTES:

PLEASE FREEZE ULTRA TRACE NUTRIENT SAMPLES IMMEDIATELY UPON RECEIPT

All samples freshwater

Environmental Division
Brisbane
Work Order
EB1117117
Telephone : + 61-7-3243 7222

RELINQUISHED BY:		RECEIVED BY:	
NAME : Robert Coulson	DATE: 23/8/11	NAME : C. Bryant	DATE: 24-8-11.
OF: GHD Brisbane	TIME: 1200	OF: ALS	TIME: 1700

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

GHD

Chain of Custody & Analysis Request

Chain of Custody Number:

Environmental Division Brisbane
Work Order
EB1117183

Matt

Telephone : + 61-7-3243 7222

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring		
CLIENT:	GHD		
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000		
CONTACT:	Anna Boden		
PHONE:	07 3316 3525	FAX:	07 3316 3333
EMAIL:	Anna.Boden@ghd.com		
INVOICE:	Anna.Boden@ghd.com Sarah.Watkin@ghd.com		
DATA NEEDED BY:	ASAP		
REPORT FORMAT:			
EMAIL FORMAT:	ESDAT, EXCEL & PDF		

LABORATORY BATCH NO.:

FOR LAB USE ONLY

COOLER SEAL: Yes No Broken Intact

SENT TO: ALS Laboratory Group
26 Shand Street
Stafford, QLD 4053
07 3243 7222

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

	SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Ultra trace nutrients (UTN - 04) (TP, RP, NH3, NO2, NO3, TKN, TN)	Chlorophyll-a (EP008)	Faecal (Thermotolerant) Coliforms (MF) (MW006)	TDS (EA015H)	TSS (EA025)
1	QA02	W	24/8/11	LOR	As Required	X	X	X	X	X
2	WQ09	↓	↓	LOR	As Required	X	X	X	X	X
3	WQ08			LOR	As Required	X	X	X	X	X
4	WQ06			LOR	As Required	X	X	X	X	X
5	WQ05			LOR	As Required	X	X	X	X	X
6	WQST			LOR	As Required	X	X	X	X	X
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					
				LOR	As Required					

NOTES:

Please FREEZE ultratrace nutrients upon reciept

All samples are freshwater

URGENT HT

RELINQUISHED BY:		RECEIVED BY:	
NAME: Robert Coulson	DATE: 24/8/11	NAME: [illegible]	DATE: 25/08/11
OF: GHD Brisbane	TIME: 12:30pm	OF: ALS	TIME: 08:00

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

4

Chain of Custody & Analysis Request

Chain of Custody Number:

Environmental Division
Brisbane
Work Order
EB1119345

_ of _1_

Telephone : +61-7-3243 7222

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring		
CLIENT:	GHD		
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000		
CONTACT:	Anna Boden		
PHONE:	07 3316 3525	FAX:	07 3316 3333
EMAIL:	Anna.Boden@ghd.com		
INVOICE:	Anna.Boden@ghd.com Julie.Keane@ghd.com		
DATA NEEDED BY:	ASAP		
REPORT FORMAT:			
EMAIL FORMAT:	ESDAT, EXCEL & PDF		

LABORATORY BATCH NO.:
FOR LAB USE ONLY
COOLER SEAL: Yes No Broken Intact

SENT TO: ALS Laboratory Group
26 Shand Street
Stafford, QLD 4053
07 3243 7222

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

	SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Ultra trace nutrients (UTN - 04) (TP, RP, NH3, NO2, NO3, TKN, TN)	Chlorophyll-a (EP008)	Faecal (Thermotolerant) Coliforms (MF) (MW006)	TDS (EA015H)	TSS (EA025)	Dissolved Metals (W-3 and EG020F)	Total Metals (W-3 and EG020T)	TPH C6-C36 (EP071/080)	PAH (EP075B)	Fluoride - Soluble (EK040)	Major Cations (NT-1)	Major Anions (NT-2)	Dissolved Silicon (ED040F)	Hardness - Total (EA065)	
1	WQ01	w	20/09/2011	LOR	As Required	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
2	WQ02	w	20/09/2011	LOR	As Required	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
3	WQ03	w	20/09/2011	LOR	As Required	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
4	WQ04	w	20/09/2011	LOR	As Required	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
5	WQ05	w	20/09/2011	LOR	As Required	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
6	WQ06	w	20/09/2011	LOR	As Required	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
7	WQST	w	20/09/2011	LOR	As Required	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
8	QA01	w	20/09/2011	LOR	As Required	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															

NOTES:

PLEASE FREEZE ULTRA TRACE NUTRIENT SAMPLES IMMEDIATELY UPON RECEIPT

All samples freshwater

HT

URGENT

RELINQUISHED BY:		RECEIVED BY:	
NAME : Robert Coulson	DATE: 20/9/11	NAME : OTO 04	DATE: 21/09/11
OF: GHD Brisbane	TIME: 1200	OF: AJ	TIME: 08:15

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

Chain of Custody & Analysis Request

Chain of Custody Number:

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	**QUOTE:**	BN/505/10 V5
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring		
CLIENT:	GHD		
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000		
CONTACT:	Anna Boden		
PHONE:	07 3316 3525	**FAX:**	07 3316 3333
EMAIL:	Anna.Boden@ghd.com		
INVOICE:	Anna.Boden@ghd.com Julie.Keane@ghd.com		
DATA NEEDED BY:	ASAP		
REPORT FORMAT:			
EMAIL FORMAT:	ESDAT, EXCEL & PDF		

LABORATORY BATCH NO.:

FOR LAB USE ONLY

COOLER SEAL: Yes No ...... Broken Intact ......

COOLER TEMP: ..... deg.C

SENT TO: ALS Laboratory Group
26 Shand Street
Stafford, QLD 4053
07 3243 7222

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Ultra trace nutrients (UTN - 04) (TP, RP, NH3, NO2, NO3, TKN, TN)	Chlorophyll-a (EP008)	Faecal (Thermotolerant) Coliforms (MF) (MW006)	TDS (EA015H)	TSS (EA025)	Dissolved Metals (W-3 and EG020F)	Total Metals (W-2T and EG020T)	TPH C6-C36 (EP071/080)	PAH (EP075B)	Fluoride - Soluble (EK040)	Major Cations (NT-1)	Major Anions (NT-2)	Dissolved Silicon (ED040F)	Hardness - Total (EA065)	
QA01	W	20/9/11	LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
WQ01	↓	↓	LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
WQ02			LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
WQ03			LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
WQ04			LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
WQ05			LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
WQ06			LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
WQST	✓	✓	LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
			LOR	As Required															
			LOR	As Required															
			LOR	As Required															
			LOR	As Required															
			LOR	As Required															
			LOR	As Required															
			LOR	As Required															

SUPERCEDED

NOTES:

PLEASE FREEZE ULTRATRACE NUTRIENT SAMPLES IMMEDIATELY UPON RECEIPT

ALL SAMPLES FRESHWATER

RELINQUISHED BY:

NAME: Robert Coulson DATE: 20-9-11
OF: GHD Brisbane TIME: 1230

RECEIVED BY:

NAME: DATE:
OF: TIME:

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

![GHD]

Chain of Custody & Analysis Request

Chain of Custody Number:

Environmental Division
Brisbane
Work Order
EB1119508

Telephone : + 61-7-3243 7222

GHD Brisbane - 201 Charlotte Street, Brisbane 4000

PROJECT ID:	41/23244/14	QUOTE:	BN/505/10 V5	LABORATORY BATCH NO.:	
PROJECT:	Carmichael Coal Mine and Rail Project - Surface Water Quality Monitoring			FOR LAB USE ONLY	
CLIENT:	GHD			COOLER SEAL:	
POSTAL ADDRESS:	GPO Box 668 Brisbane QLD 4000			Yes	No ......
CONTACT:	Anna Boden			Broken	Intact ......
PHONE:	07 3316 3525	FAX:	07 3316 3333	SENT TO:	ALS Laboratory Group
EMAIL:	Anna.Boden@ghd.com				26 Shand Street
INVOICE:	Anna.Boden@ghd.com Julie.Keane@ghd.com				Stafford, QLD 4053
					07 3243 7222

DATA NEEDED BY:	ASAP
REPORT FORMAT:	
EMAIL FORMAT:	ESDAT, EXCEL & PDF

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water samples and sediment samples (Background sampling)

(EMAIL ADDRESSES PROVIDED ABOVE)

ANALYSIS REQUIRED

	SAMPLE ID	MATRIX	DATE	DETECTION LIMIT	PRESERVATION	Ultra trace nutrients (UTN - 04) (TP, RP, NH3, NO2, NO3, TKN, TN)	Chlorophyll-a (EP008)	Faecal (Thermotolerant) Coliforms (MF) (MW006)	TDS (EA015H)	TSS (EA025)	Dissolved Metals (W-3 and EG020F)	Total Metals (W-2T and EG020T)	TPH C6-C36 (EP071/080)	PAH (EP075B)	Fluoride - Soluble (EK040)	Major Cations (NT-1)	Major Anions (NT-2)	Dissolved Silicon (ED040F)	Hardness - Total (EA065)	
1	QA02	W	21-9-11	LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2	WQ08			LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
3	WQ09			LOR	As Required	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
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				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															
				LOR	As Required															

NOTES:

PLEASE FREEZE ULTRATRACE NUTRIENTS IMMEDIATELY UPON RECEIPT

ALL SAMPLES FRESHWATER

RELINQUISHED BY:				RECEIVED BY:			
NAME:	Robert Coulson	DATE:	21-9-11	NAME:	OTO	DATE:	22/09/11
OF:	GHD Brisbane	TIME:	12 pm	OF:	ALS	TIME:	08:40

PLEASE EMAIL COMPLETED ANALYSIS REQUEST TO: Anna.Boden@ghd.com

URGENT

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

CHAIN OF CUSTODY DOCUMENTATION

4T Consultants Pty Ltd. PO Box 1946, EMERALD QLD 4720

SOURCE		DISPATCH	
SENT BY:	4T Consultants Pty Ltd	TRANSPORT CO:	Australian Air Express
CONTACT:	Rowan Morrison	CONSIGNMENT NO.:	1G817477
CLIENT CODE:	236	DISPATCH DATE:	17/03/13
PROJECT CODE:	SWQ	DISPATCH TIME:	17:00
RELINQUISHED BY:	Rowan Morrison	RESULTS REQ'D:	7 Days PRIORITY NORMAL
P.O Number:			

DATA TRACKING AND REPORTS	
DATE REQUIRED:	24-Mar-13
LAB REPORT TO:	data@4t.com.au
INVOICE TO:	accounts@4t.com.au
Sampling started:	14/03/13
Sampling finished:	14/03/13
ALS QUOTE NO.:	

RECEIPT - TO BE COMPLETED BY LAB	
RECEIVED BY:	Otto A
COMPANY:	ALS
DATE RECEIVED:	18/03/13
TIME RECEIVED:	08:30
COOLER SEAL INTACT:	YES NO
SAMPLES CHILLED:	YES NO
ICE PRESENT:	YES NO

NOTES AND COMMENTS:
Concerns or handling instructions

Please provide TPH results as C6-C9, C10-C14, C15-C28, C29-C36, Total (C10-C36) if applicable Total metals ICPMS - Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Ni, Zn, B, Co, Mn, Mo, Se, Ag, U, V. Dissolved metals ICPM S - Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Ni, Zn, B, Co, Mn, Mo, Se, Ag, U, V

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; V = VOA Vial HCl Preserved; VS = VOA Vial Sulphuric Preserved; SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

MATRIX >> Water: X | Dust | Soil

Total bottles in consignment > 37

Bottle types and quantities in dispatch

ALS ID	SAMPLE ID	DATE	TIME	[illegible]	N	V	AG	HC	S	SP	Z	Total
	BEL01	14/03/2013	15:15	1	1	2	1			1		6
	CT01	14/03/2013	12:50	1	1	2	1			1		6
	DCK01	14/03/2013	10:05	1	1	2	1			1		6
	NCK01	14/03/2013	14:30	1	1	2	1			1		6
	CCK01	14/03/2013	10:40	1	2	2	1			1		7
	CAR02	14/03/2013	13:20	1	1	2	1			1		6
												0
												0
												0
												0
												0
												0
												0
												0
												0
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												0
												0
												0
												0
												0
												0

ANALYSIS REQUIRED including SUITES *(note - suite codes must be listed to attract suite prices)*

SAMPLE ID	pH (EA005)	EC (EA010)	TDS (EA015H)	TSS (EA025H)	Major anions (incl. F) (NT-2A)	Major Cations (NT-1)	Total nitrogen + NO2+NO3+NH (NT-8)	Total metals ICPMS - Al, As, Cd, Cr, Cu, Fe, Pb, Ni, Zn, B, Co, Mn, Mo, Se, Ag, U, V (EG020T)	Dissolved metals ICPM S- Al, As, Cd, Cr, Cu, Fe, Pb, Ni, Zn, B, Co, Mn, Mo, Se, Ag, U, V (EG020F)	Dissolved Mercury (EG035F)	Total Mercury (EG035T)	TPH (C6 - C9) (EP080)	TPH (C10 - C36) (EP071)
BEL01	X	X	X	X	X	X	X	X	X	X	X	X	X
CT01	X	X	X	X	X	X	X	X	X	X	X	X	X
DCK01	X	X	X	X	X	X	X	X	X	X	X	X	X
NCK01	X	X	X	X	X	X	X	X	X	X	X	X	X
CCK01	X	X	X	X	X	X	X	X	X	X	X	X	X
CAR02	X	X	X	X	X	X	X	X	X	X	X	X	X

Environmental Division
Brisbane
Work Order DY
EB1306655
Telephone : + 61-7-3243 7222

17/03/13

Appendix B – Quality assurance/quality control results

1. Quality Assurance/Quality Control Results

Australian Laboratory Services (ALS) was engaged to carry out chemical analysis of water and sediment samples. ALS is a NATA accredited laboratory, and perform Quality Assurance (QA) and Quality Control (QC) procedures to support this certification.

Field duplicate samples were collected (QA01, QA02, QA03) in order to audit laboratory QA/QC procedures. The identity of the parent sample remained anonymous to the laboratory.

Field Duplicates

Results from the primary sample and the corresponding anonymous field duplicate generally exhibited a relatively good correlation across analytes. This indicates a high degree of precision and reliability from the laboratory. Correlation was measured by the Relative Percent Difference (RPD) between the primary sample result and the field duplicate result. A RPD between 0 – 50 % was considered a reliable indication of laboratory accuracy. Samples with a RPD greater than 50 % are identified in Table 1. Some of the large RPDs occurred due to the sample result being below the LOR.

Table 1 Field Duplicate samples with RPD > 50 %

Work Order	Sample Date	Analyte	EQL / LOR	Sample ID	Field Duplicate	RPD
EB1108606	4/05/2011			WQ09	QA01	
		Nitrate (as N) (mg/L)	0.002	0.002	0.004	67
		Aluminium (mg/L)	0.01	0.09	0.04	77
		Copper (mg/L)	0.001	<0.001	0.004	120
		Managanese (filtered) (mg/L)	0.001	0.002	0.001	67
		Zinc (mg/L)	0.005	0.012	<0.005	82
EB1114769	27/07/2011			WQ09	QA02	
		Nitrate (as N) (mg/L)	0.002	0.008	0.003	91
		Arsenic (mg/L)	0.001	0.002	0.001	67
EB1114640	26/07/2011			WQ04	QA01	
		Reactive Phosphorus as P (mg/L)	0.001	0.004	0.002	67
EB1114957 (soil)	26/07/2011			WQ04	QA01	
		Kjeldahl Nitrogen Total (mg/kg)	20	90	150	50
		Nitrogen Total (mg/kg)	20	90	150	50
		Aluminium (mg/kg)	50	1200	2010	50

Work Order	Sample Date	Analyte	EQL / LOR	Sample ID	Field Duplicate	RPD
		Uranium (mg/kg)	0.1	0.1	0.2	67
EB1114957 (soil)	27/07/2011 1			WQ09	QA02	
		TOC (%)	0.02	0.47	1.07	78
		lead (mg/kg)	0.1	6.2	2.8	76
		Arsenic (mg/kg)	0.1	1.1	0.6	59
		Vanadium (mg/kg)	1	22	13	51
EB1114957 (elutriate)	27/07/2011			WQ12	QA03	
		Kjeldahl Nitrogren Total (mg/L)	0.01	0.03	0.05	50
		Lead (mg/L)	0.001	0.002	0.001	67
		Lead (leached) (mg/L)	0.001	0.002	0.001	67
		Iron (mg/L)	0.05	2.43	1.33	59
		Nickel (mg/L)	0.001	0.002	0.001	67
EB1117117	23/08/2011			WQ04	QA01	
		Chlorophyll a (mg/m3)	1	2	1	67
EB1119345	20/09/2011			WQ04	QA01	
		Chlorophyll a (mg/m3)	1	1	2	67
		Chromium (III+VI) (Filtered) (mg/L)	0.001	0.002	0.001	67
		Copper (mg/L)	0.001	0.001	0.002	67
		Nickel (mg/L)	0.001	0.002	0.001	67
		Zinc (Filtered) (mg/L)	0.005	0.04	0.012	108

Holding Time Compliance for Analysis

Some samples from Event 1 (April) and Event 4 (July) were extracted and/or analysed between one and five days past analysis holding times (Table 2).

Table 2 Laboratory Analysis Holding Time Breaches

				Extraction/Preparation			Analysis		
Work Order	**Date Sampled**	**Sample ID**	**Analysis**	**Due for extraction**	**Date extracted**	**Days overdue**	**Due for analysis**	**Date analysed**	**Days overdue**
EB1107452	14/04/2011	WQ01 WQ06 WQ08 WQ09 QA02	Chlorophyll a & Pheophytin a	-	-	-	15/04/2011	18/04/2011	3
EB1107452	14/04/2011	WQ01 WQ06 WQ08 WQ09 QA02	Ultra-trace Nutrients	18/04/2011	15/04/2011	3	15/04/2011	18/04/2011	3
EB1114769	27/07/2011	WQ06 WQ08 WQ09 WQST QA02	Chlorophyll a & Pheophytin a	-	-	-	29/07/2011	1/08/2011	3
EB1114957 (soil)	26/07/2011	WQ01 WQ02 WQ03 WQ04 QA01	Faecal coliforms & E.coli by MPN	-	-	-	28/07/2011	2/08/2011	5

				Extraction/Preparation			Analysis		
Work Order	**Date Sampled**	**Sample ID**	**Analysis**	**Due for extraction**	**Date extracted**	**Days overdue**	**Due for analysis**	**Date analysed**	**Days overdue**
EB1114957 (soil)	27/07/2011	WQ06 WQ08 WQ09 WQ10 WQ11 WQ12 WQST QA02	Faecal coliforms & E.coli by MPN	-	-	-	29/07/2011	2/08/2011	4
EB1114957 (soil)	27/07/2011	WQ10 WQ11 WQ12 QA03	Ultra-trace nutrients	4/08/2011	5/08/2011	1	4/08/2011	5/08/2011	1

Quality Control Samples

Quality control samples included laboratory duplicates, method blanks, laboratory control samples, matrix spikes, and regular sample surrogates. The majority of control sample matrix spikes were able to be determined, and almost all remained within the spike recovery limits. Quality control sample outliers are shown below (Table 3).

Table 3 Laboratory Quality Control Samples with Outliers

Laboratory Quality Control Samples	Work Order	Matrix	Sample ID	Analyte	Data	Limits	Comment
Duplicate RPDs	EB1114957	Soil	QA01	Total Phosphorus as P	40.40%	0 - 20 %	RPD exceed LOR based limits
Duplicate RPDs	EB1114957	Soil	WQ02	Total Phosphorus as P	59%	0 - 20 %	RPD exceed LOR based limits
Laboratory Control Spike (LCS) recoveries	EB1114957	Soil	-	Fluoranthene	119%	64 - 111%	Recovery greater than upper control limit
Regular Sample Surrogates	EB1114957	Soil	WQ12	PAH surrogate 4-Terphenyl-d14	190%	41.8 - 172.2%	Recovery greater than upper data quality objective

Environmental Division

QUALITY CONTROL REPORT

Work Order	: **EB1306655**	Page	: 1 of 12
Client	: **4T CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ROWAN MORRISON	Contact	: Vanessa Turnbull
Address	: PO BOX 1946 EMERALD QLD, AUSTRALIA 4720	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: r.morrison@4t.com.au	E-mail	: vanessa.turnbull@alsenviro.com
Telephone	: +61 7 49824100	Telephone	: 61-7-3552 8660
Facsimile	: ----	Facsimile	: 61-7-3352 3662
Project	: SWQ 236	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-MAR-2013
Sampler	: ----	Issue Date	: 25-MAR-2013
Order number	: ----		
		No. of samples received	: 6
Quote number	: BN/721/12	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

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

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

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
Greg Vogel	Laboratory Manager	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Minh Wills	Organic Chemist	Brisbane Organics
		Brisbane Organics
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics
		Brisbane Inorganics
		Brisbane Inorganics
		Brisbane Inorganics

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 (%)*
EA005P: pH by PC Titrator (QC Lot: 2779690)									
EB1306628-001	Anonymous	EA005-P: pH Value	----	0.01	pH Unit	6.71	6.62	1.4	0% - 20%
EB1306655-006	CAR02	EA005-P: pH Value	----	0.01	pH Unit	7.69	7.75	0.8	0% - 20%
EA010P: Conductivity by PC Titrator (QC Lot: 2779689)									
EB1306628-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	46	46	0.0	0% - 20%
EB1306655-006	CAR02	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	371	370	0.3	0% - 20%
EA015: Total Dissolved Solids (QC Lot: 2779718)									
EB1306631-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	133	133	0.0	0% - 50%
EB1306646-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	339	338	0.4	0% - 20%
EA025: Suspended Solids (QC Lot: 2779719)									
EB1306631-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	11	8	28.6	No Limit
EB1306646-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	20	25	18.8	No Limit
ED037P: Alkalinity by PC Titrator (QC Lot: 2779688)									
EB1306628-001	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	<1	<1	0.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	5	5	0.0	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	5	5	0.0	No Limit
EB1306655-006	CAR02	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	61	61	0.0	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	61	61	0.0	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2779912)									
EB1306601-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	10	9	0.0	No Limit
EB1306601-010	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	9	9	0.0	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2779915)									
EB1306655-006	CAR02	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	5	4	0.0	No Limit
ED045G: Chloride Discrete analyser (QC Lot: 2779911)									
EB1306601-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	588	566	3.8	0% - 20%
EB1306601-010	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	563	563	0.0	0% - 20%
ED093F: Dissolved Major Cations (QC Lot: 2779909)									
EB1306601-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	607	622	2.4	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	6	6	0.0	No Limit
EB1306601-010	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	1	<1	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 (%)*
ED093F: Dissolved Major Cations (QC Lot: 2779909) - continued									
EB1306601-010	Anonymous	ED093F: Magnesium	7439-95-4	1	mg/L	<1	<1	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	609	624	2.3	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	6	6	0.0	No Limit
ED093F: Dissolved Major Cations (QC Lot: 2779913)									
EB1306655-006	CAR02	ED093F: Calcium	7440-70-2	1	mg/L	6	6	0.0	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	6	5	0.0	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	58	56	3.0	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	10	9	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2780696)									
EB1306601-009	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	0.0004	0.0005	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	0.003	0.004	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.004	0.004	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.004	0.004	0.0	0% - 20%
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.052	0.052	0.0	0% - 20%
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.442	0.450	2.0	0% - 20%
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	0.008	0.008	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.003	0.004	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.149	0.149	0.0	0% - 20%
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	1.22	1.20	1.3	0% - 20%
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.77	0.76	0.0	0% - 20%
EB1306623-006	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	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	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: Manganese	7439-96-5	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.003	0.003	0.0	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	0.05	0.05	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2780697)									

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2780697) - continued									
EB1306601-009	Anonymous	EG020B-F: Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020B-F: Uranium	7440-61-1	0.001	mg/L	0.002	0.002	0.0	0% - 20%
EB1306623-006	Anonymous	EG020B-F: Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020B-F: Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 2779511)									
EB1306573-001	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.001	0.002	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.064	0.063	1.7	0% - 20%
		EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	0.043	0.044	3.6	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.03	0.03	0.0	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EB1306576-009	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.001	0.001	0.0	0% - 20%
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.001	0.001	0.0	0% - 20%
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.107	0.104	2.7	0% - 20%
		EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.03	0.03	0.0	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	0.09	0.09	0.0	0% - 20%
		EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 2779512)									
EB1306573-001	Anonymous	EG020B-T: Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020B-T: Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EB1306576-009	Anonymous	EG020B-T: Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020B-T: Uranium	7440-61-1	0.001	mg/L	0.002	0.002	0.0	0% - 20%

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG035F: Dissolved Mercury by FIMS (QC Lot: 2780695)									
EB1306601-008	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EB1306623-007	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2784248)									
EB1306655-001	BEL01	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EB1306749-005	Anonymous	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 2779691)									
EB1306628-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.0	No Limit
EB1306655-006	CAR02	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2782225)									
EB1306453-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	2.70	2.77	2.6	0% - 20%
EB1306644-004	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.06	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2779910)									
EB1306601-001	Anonymous	EK057G: Nitrite as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EB1306601-010	Anonymous	EK057G: Nitrite as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2779914)									
EB1306655-006	CAR02	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: 2782224)									
EB1306453-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.44	0.44	0.0	0% - 20%
EB1306644-004	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.02	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2785704)									
EB1306581-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.0	1.9	6.2	0% - 20%
EB1306655-003	DCK01	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.6	1.7	0.0	0% - 50%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2785703)									
EB1306581-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.38	0.45	17.4	0% - 20%
EB1306655-003	DCK01	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.27	0.27	0.0	0% - 20%
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 2778617)									
EB1306578-001	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EB1306644-002	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QC Lot: 2778617)									
EB1306578-001	Anonymous	EP080: C6 - C10 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EB1306644-002	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
EA005P: pH by PC Titrator (QCLot: 2779690)								
EA005-P: pH Value	----	0.01	pH Unit	----	7 pH Unit	99.8	98	102
EA010P: Conductivity by PC Titrator (QCLot: 2779689)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	4000 µS/cm	103	90	110
EA015: Total Dissolved Solids (QCLot: 2779718)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	293 mg/L	103	80	120
EA025: Suspended Solids (QCLot: 2779719)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	1000 mg/L	85.8	82	120
ED037P: Alkalinity by PC Titrator (QCLot: 2779688)								
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	----	200 mg/L	101	85	115
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2779912)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	102	70	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2779915)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	102	70	130
ED045G: Chloride Discrete analyser (QCLot: 2779911)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	1000 mg/L	105	75	117
ED093F: Dissolved Major Cations (QCLot: 2779909)								
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	----	----	----	----
ED093F: Dissolved Major Cations (QCLot: 2779913)								
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: 2780696)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.500 mg/L	94.3	78	124
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.100 mg/L	99.6	78	122
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.100 mg/L	95.0	87	109
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.100 mg/L	88.9	87	115
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.100 mg/L	96.6	86	118
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.200 mg/L	95.6	85	117
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.100 mg/L	92.5	88	110

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
EG020F: Dissolved Metals by ICP-MS (QCLot: 2780696) - continued								
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.100 mg/L	96.9	80	122
EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.100 mg/L	97.2	88	112
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.100 mg/L	98.0	86	116
EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	0.100 mg/L	91.1	83	113
EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.100 mg/L	92.0	78	115
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.200 mg/L	106	84	118
EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	0.50 mg/L	93.3	73	127
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.50 mg/L	86.0	79	124
EG020F: Dissolved Metals by ICP-MS (QCLot: 2780697)								
EG020B-F: Silver	7440-22-4	0.001	mg/L	<0.001	0.100 mg/L	88.7	78	116
EG020B-F: Uranium	7440-61-1	0.001	mg/L	<0.001	----	----	----	----
EG020T: Total Metals by ICP-MS (QCLot: 2779511)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.500 mg/L	101	80	122
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.100 mg/L	103	80	116
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.100 mg/L	101	84	112
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.100 mg/L	104	87	119
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.100 mg/L	105	87	120
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.200 mg/L	105	85	121
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.100 mg/L	100	89	116
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.100 mg/L	103	86	126
EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.100 mg/L	103	89	114
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.100 mg/L	105	86	120
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.100 mg/L	98.8	77	113
EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.100 mg/L	108	77	117
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.200 mg/L	105	77	119
EG020A-T: Boron	7440-42-8	0.05	mg/L	<0.05	0.500 mg/L	123	74	130
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.500 mg/L	111	81	129
EG020T: Total Metals by ICP-MS (QCLot: 2779512)								
EG020B-T: Silver	7440-22-4	0.001	mg/L	<0.001	0.100 mg/L	106	78	120
EG020B-T: Uranium	7440-61-1	0.001	mg/L	<0.001	----	----	----	----
EG035F: Dissolved Mercury by FIMS (QCLot: 2780695)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.010 mg/L	98.4	79	119
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2784248)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.0100 mg/L	101	78	120
EK040P: Fluoride by PC Titrator (QCLot: 2779691)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	10 mg/L	106	85	117
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2782225)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1.0 mg/L	109	70	120

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
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2779910)								
EK057G: Nitrite as N	----	0.01	mg/L	<0.01	0.5 mg/L	97.9	83	119
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2779914)								
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: 2782224)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	101	70	124
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2785704)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10.0 mg/L	97.7	70	115
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2785703)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	93.8	77	117
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2778617)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	160 µg/L	99.7	71	129
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2778625)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	1275 µg/L	83.4	42	116
EP071: C15 - C28 Fraction	----	100	µg/L	<100	1850 µg/L	98.9	53	135
EP071: C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2778617)								
EP080: C6 - C10 Fraction	----	20	µg/L	<20	185 µg/L	99.8	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2778625)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	1670 µg/L	89.6	47	125
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	1285 µg/L	96.5	47	133
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----

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	SpikeRecovery(%) MS	Recovery Limits (%) Low	Recovery Limits (%) High
ED045G: Chloride Discrete analyser (QCLot: 2779911)							
EB1306601-002	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	101	70	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 2780696)							
EB1306601-011	Anonymous	EG020A-F: Aluminium	7429-90-5	0.500 mg/L	101	70	130
		EG020A-F: Arsenic	7440-38-2	0.100 mg/L	127	70	130
		EG020A-F: Cadmium	7440-43-9	0.100 mg/L	104	70	130
		EG020A-F: Chromium	7440-47-3	0.100 mg/L	92.8	70	130
		EG020A-F: Cobalt	7440-48-4	0.100 mg/L	108	70	130

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 2780696) - continued							
EB1306601-011	Anonymous	EG020A-F: Copper	7440-50-8	0.200 mg/L	104	70	130
		EG020A-F: Lead	7439-92-1	0.100 mg/L	96.2	70	130
		EG020A-F: Manganese	7439-96-5	0.100 mg/L	106	70	130
		EG020A-F: Molybdenum	7439-98-7	0.100 mg/L	99.7	70	130
		EG020A-F: Nickel	7440-02-0	0.100 mg/L	104	70	130
		EG020A-F: Selenium	7782-49-2	0.100 mg/L	82.6	70	130
		EG020A-F: Vanadium	7440-62-2	0.100 mg/L	107	70	130
		EG020A-F: Zinc	7440-66-6	0.200 mg/L	125	70	130
		EG020A-F: Boron	7440-42-8	0.500 mg/L	86.4	70	130
EG020T: Total Metals by ICP-MS (QCLot: 2779511)							
EB1306576-001	Anonymous	EG020A-T: Arsenic	7440-38-2	1.000 mg/L	99.8	70	130
		EG020A-T: Cadmium	7440-43-9	0.500 mg/L	98.6	70	130
		EG020A-T: Chromium	7440-47-3	1.000 mg/L	96.8	70	130
		EG020A-T: Cobalt	7440-48-4	1.000 mg/L	99.5	70	130
		EG020A-T: Copper	7440-50-8	1.000 mg/L	96.7	70	130
		EG020A-T: Lead	7439-92-1	1.000 mg/L	94.1	70	130
		EG020A-T: Manganese	7439-96-5	1.000 mg/L	98.3	70	130
		EG020A-T: Nickel	7440-02-0	1.000 mg/L	95.3	70	130
		EG020A-T: Vanadium	7440-62-2	1.000 mg/L	99.1	70	130
		EG020A-T: Zinc	7440-66-6	1.000 mg/L	98.7	70	130
EG035F: Dissolved Mercury by FIMS (QCLot: 2780695)							
EB1306601-010	Anonymous	EG035F: Mercury	7439-97-6	0.010 mg/L	78.9	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2784248)							
EB1306655-002	CT01	EG035T: Mercury	7439-97-6	0.010 mg/L	88.8	70	130
EK040P: Fluoride by PC Titrator (QCLot: 2779691)							
EB1306628-001	Anonymous	EK040P: Fluoride	16984-48-8	6.1 mg/L	110	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2782225)							
EB1306453-019	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	97.2	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2779910)							
EB1306601-002	Anonymous	EK057G: Nitrite as N	----	0.4 mg/L	99.9	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2782224)							
EB1306453-019	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.4 mg/L	85.1	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2785704)							
EB1306581-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	100	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2785703)							
EB1306581-002	Anonymous	EK067G: Total Phosphorus as P	----	1.0 mg/L	71.3	70	130

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2778617)							
EB1306578-002	Anonymous	EP080: C6 - C9 Fraction	----	40 µg/L	102	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2778617)							
EB1306578-002	Anonymous	EP080: C6 - C10 Fraction	----	40 µg/L	105	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**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike Concentration	Spike Recovery (%) MS	Spike Recovery (%) MSD	Recovery Limits (%) Low	Recovery Limits (%) High	RPDs (%) Value	RPDs (%) Control Limit
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2778617)										
EB1306578-002	Anonymous	EP080: C6 - C9 Fraction	----	40 µg/L	102	----	70	130	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2778617)										
EB1306578-002	Anonymous	EP080: C6 - C10 Fraction	----	40 µg/L	105	----	70	130	----	----
EG020T: Total Metals by ICP-MS (QCLot: 2779511)										
EB1306576-001	Anonymous	EG020A-T: Arsenic	7440-38-2	1.000 mg/L	99.8	----	70	130	----	----
		EG020A-T: Cadmium	7440-43-9	0.500 mg/L	98.6	----	70	130	----	----
		EG020A-T: Chromium	7440-47-3	1.000 mg/L	96.8	----	70	130	----	----
		EG020A-T: Cobalt	7440-48-4	1.000 mg/L	99.5	----	70	130	----	----
		EG020A-T: Copper	7440-50-8	1.000 mg/L	96.7	----	70	130	----	----
		EG020A-T: Lead	7439-92-1	1.000 mg/L	94.1	----	70	130	----	----
		EG020A-T: Manganese	7439-96-5	1.000 mg/L	98.3	----	70	130	----	----
		EG020A-T: Nickel	7440-02-0	1.000 mg/L	95.3	----	70	130	----	----
		EG020A-T: Vanadium	7440-62-2	1.000 mg/L	99.1	----	70	130	----	----
		EG020A-T: Zinc	7440-66-6	1.000 mg/L	98.7	----	70	130	----	----
EK040P: Fluoride by PC Titrator (QCLot: 2779691)										
EB1306628-001	Anonymous	EK040P: Fluoride	16984-48-8	6.1 mg/L	110	----	70	130	----	----
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2779910)										
EB1306601-002	Anonymous	EK057G: Nitrite as N	----	0.4 mg/L	99.9	----	70	130	----	----
ED045G: Chloride Discrete analyser (QCLot: 2779911)										
EB1306601-002	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	101	----	70	130	----	----
EG035F: Dissolved Mercury by FIMS (QCLot: 2780695)										
EB1306601-010	Anonymous	EG035F: Mercury	7439-97-6	0.010 mg/L	78.9	----	70	130	----	----
EG020F: Dissolved Metals by ICP-MS (QCLot: 2780696)										
EB1306601-011	Anonymous	EG020A-F: Aluminium	7429-90-5	0.500 mg/L	101	----	70	130	----	----
		EG020A-F: Arsenic	7440-38-2	0.100 mg/L	127	----	70	130	----	----

Sub-Matrix: **WATER**

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

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike Concentration	Spike Recovery (%) MS	Spike Recovery (%) MSD	Recovery Limits (%) Low	Recovery Limits (%) High	RPDs (%) Value	RPDs (%) Control Limit
EG020F: Dissolved Metals by ICP-MS (QCLot: 2780696) - continued										
EB1306601-011	Anonymous	EG020A-F: Cadmium	7440-43-9	0.100 mg/L	104	----	70	130	----	----
		EG020A-F: Chromium	7440-47-3	0.100 mg/L	92.8	----	70	130	----	----
		EG020A-F: Cobalt	7440-48-4	0.100 mg/L	108	----	70	130	----	----
		EG020A-F: Copper	7440-50-8	0.200 mg/L	104	----	70	130	----	----
		EG020A-F: Lead	7439-92-1	0.100 mg/L	96.2	----	70	130	----	----
		EG020A-F: Manganese	7439-96-5	0.100 mg/L	106	----	70	130	----	----
		EG020A-F: Molybdenum	7439-98-7	0.100 mg/L	99.7	----	70	130	----	----
		EG020A-F: Nickel	7440-02-0	0.100 mg/L	104	----	70	130	----	----
		EG020A-F: Selenium	7782-49-2	0.100 mg/L	82.6	----	70	130	----	----
		EG020A-F: Vanadium	7440-62-2	0.100 mg/L	107	----	70	130	----	----
		EG020A-F: Zinc	7440-66-6	0.200 mg/L	125	----	70	130	----	----
		EG020A-F: Boron	7440-42-8	0.500 mg/L	86.4	----	70	130	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2782224)										
EB1306453-019	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.4 mg/L	85.1	----	70	130	----	----
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2782225)										
EB1306453-019	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	97.2	----	70	130	----	----
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2784248)										
EB1306655-002	CT01	EG035T: Mercury	7439-97-6	0.010 mg/L	88.8	----	70	130	----	----
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2785703)										
EB1306581-002	Anonymous	EK067G: Total Phosphorus as P	----	1.0 mg/L	71.3	----	70	130	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2785704)										
EB1306581-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	100	----	70	130	----	----

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1306655**	Page	: 1 of 12
Client	: 4T CONSULTANTS PTY LTD	Laboratory	: Environmental Division Brisbane
Contact	: MR ROWAN MORRISON	Contact	: Vanessa Turnbull
Address	: PO BOX 1946 EMERALD QLD, AUSTRALIA 4720	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: r.morrison@4t.com.au	E-mail	: vanessa.turnbull@alsenviro.com
Telephone	: +61 7 49824100	Telephone	: 61-7-3552 8660
Facsimile	: ----	Facsimile	: 61-7-3352 3662
Project	: SWQ 236	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 18-MAR-2013
Sampler	: ----	Issue Date	: 25-MAR-2013
Order number	: ----		
		No. of samples received	: 6
Quote number	: BN/721/12	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
EA005P: pH by PC Titrator								
Clear Plastic Bottle - Natural (EA005-P)								
BEL01,	CT01,	**14-MAR-2013**	---	14-MAR-2013	----	**19-MAR-2013**	14-MAR-2013	✘
DCK01,	NCK01,							
CCK01,	CAR02							
EA010P: Conductivity by PC Titrator								
Clear Plastic Bottle - Natural (EA010-P)								
BEL01,	CT01,	**14-MAR-2013**	---	11-APR-2013	----	**19-MAR-2013**	11-APR-2013	✓
DCK01,	NCK01,							
CCK01,	CAR02							
EA015: Total Dissolved Solids								
Clear Plastic Bottle - Natural (EA015H)								
BEL01,	CT01,	**14-MAR-2013**	---	21-MAR-2013	----	**19-MAR-2013**	21-MAR-2013	✓
DCK01,	NCK01,							
CCK01,	CAR02							
EA025: Suspended Solids								
Clear Plastic Bottle - Natural (EA025H)								
BEL01,	CT01,	**14-MAR-2013**	---	21-MAR-2013	----	**19-MAR-2013**	21-MAR-2013	✓
DCK01,	NCK01,							
CCK01,	CAR02							
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P)								
BEL01,	CT01,	**14-MAR-2013**	---	28-MAR-2013	----	**19-MAR-2013**	28-MAR-2013	✓
DCK01,	NCK01,							
CCK01,	CAR02							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G)								
BEL01,	CT01,	**14-MAR-2013**	---	11-APR-2013	----	**19-MAR-2013**	11-APR-2013	✓
DCK01,	NCK01,							
CCK01,	CAR02							

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
ED045G: Chloride Discrete analyser								
Clear Plastic Bottle - Natural (ED045G)								
BEL01,	CT01,	**14-MAR-2013**	---	11-APR-2013	----	**19-MAR-2013**	11-APR-2013	✓
DCK01,	NCK01,							
CCK01,	CAR02							
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Natural (ED093F)								
BEL01,	CT01,	**14-MAR-2013**	---	21-MAR-2013	----	**19-MAR-2013**	21-MAR-2013	✓
DCK01,	NCK01,							
CCK01,	CAR02							
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Natural (EG020A-F)								
BEL01,	CT01,	**14-MAR-2013**	---	10-SEP-2013	----	**19-MAR-2013**	10-SEP-2013	✓
DCK01,	NCK01,							
CAR02								
Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)								
CCK01		**14-MAR-2013**	---	10-SEP-2013	----	**19-MAR-2013**	10-SEP-2013	✓
EG020T: Total Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020A-T)								
BEL01,	CT01,	**14-MAR-2013**	**19-MAR-2013**	10-SEP-2013	✓	**20-MAR-2013**	10-SEP-2013	✓
DCK01,	NCK01,							
CCK01,	CAR02							
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Natural (EG020B-F)								
BEL01,	CT01,	**14-MAR-2013**	---	10-SEP-2013	----	**19-MAR-2013**	10-SEP-2013	✓
DCK01,	NCK01,							
CAR02								
Clear Plastic Bottle - Nitric Acid; Filtered (EG020B-F)								
CCK01		**14-MAR-2013**	---	10-SEP-2013	----	**19-MAR-2013**	10-SEP-2013	✓
EG020T: Total Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020B-T)								
BEL01,	CT01,	**14-MAR-2013**	**19-MAR-2013**	10-SEP-2013	✓	**20-MAR-2013**	10-SEP-2013	✓
DCK01,	NCK01,							
CCK01,	CAR02							
EG035F: Dissolved Mercury by FIMS								
Clear Plastic Bottle - Natural (EG035F)								
BEL01,	CT01,	**14-MAR-2013**	---	11-APR-2013	----	**19-MAR-2013**	11-APR-2013	✓
DCK01,	NCK01,							
CAR02								
Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)								
CCK01		**14-MAR-2013**	---	11-APR-2013	----	**19-MAR-2013**	11-APR-2013	✓

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
EG035T: Total Recoverable Mercury by FIMS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG035T)								
BEL01, DCK01, CCK01,	CT01, NCK01, CAR02	**14-MAR-2013**	**----**	----	----	**21-MAR-2013**	11-APR-2013	✓
EK040P: Fluoride by PC Titrator								
Clear Plastic Bottle - Natural (EK040P)								
BEL01, DCK01, CCK01,	CT01, NCK01, CAR02	**14-MAR-2013**	**---**	11-APR-2013	----	**19-MAR-2013**	11-APR-2013	✓
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G)								
BEL01, DCK01, CCK01,	CT01, NCK01, CAR02	**14-MAR-2013**	**---**	11-APR-2013	----	**21-MAR-2013**	11-APR-2013	✓
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G)								
BEL01, DCK01, CCK01,	CT01, NCK01, CAR02	**14-MAR-2013**	**---**	16-MAR-2013	----	**19-MAR-2013**	16-MAR-2013	✗
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G)								
BEL01, DCK01, CCK01,	CT01, NCK01, CAR02	**14-MAR-2013**	**---**	11-APR-2013	----	**21-MAR-2013**	11-APR-2013	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G)								
BEL01, DCK01, CCK01,	CT01, NCK01, CAR02	**14-MAR-2013**	**22-MAR-2013**	11-APR-2013	✓	**22-MAR-2013**	11-APR-2013	✓
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G)								
BEL01, DCK01, CCK01,	CT01, NCK01, CAR02	**14-MAR-2013**	**22-MAR-2013**	11-APR-2013	✓	**22-MAR-2013**	11-APR-2013	✓
EP080/071: Total Petroleum Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP071)								
BEL01, DCK01, CCK01,	CT01, NCK01, CAR02	**14-MAR-2013**	**18-MAR-2013**	21-MAR-2013	✓	**19-MAR-2013**	27-APR-2013	✓

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
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
Amber VOC Vial - Sulfuric Acid (EP080)								
BEL01, DCK01, CCK01,	CT01, NCK01, CAR02	**14-MAR-2013**	**19-MAR-2013**	28-MAR-2013	✓	**19-MAR-2013**	28-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	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	2	19	**10.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	17	**11.8**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	2	12	**16.7**	**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
Dissolved Metals by ICP-MS - Suite B	EG020B-F	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	3	21	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	19	**10.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	3	21	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH by PC Titrator	EA005-P	2	12	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	3	21	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	2	18	**11.1**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	2	18	**11.1**	**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 Mercury by FIMS	EG035T	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	2	18	**11.1**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite B	EG020B-T	2	19	**10.5**	**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 Volatiles/BTEX	EP080	2	19	**10.5**	**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	19	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	17	**11.8**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	12	**8.3**	**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
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	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	19	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	2	21	**9.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH by PC Titrator	EA005-P	2	12	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	21	**9.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	1	18	**5.6**	**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 / *Analytical Methods*	*Method*	*Count* QC	*Count* Regular	*Rate (%)* Actual	*Rate (%)* Expected	*Evaluation*	*Quality Control Specification*
Laboratory Control Samples (LCS) - Continued							
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 Mercury by FIMS	EG035T	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite B	EG020B-T	1	19	**5.3**	**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	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	19	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	19	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	17	**5.9**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	12	**8.3**	**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
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	2	21	**9.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	19	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	2	21	**9.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	21	**9.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	1	18	**5.6**	**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 Mercury by FIMS	EG035T	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	18	**5.6**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite B	EG020B-T	1	19	**5.3**	**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	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	19	**5.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	19	**5.3**	**5.0**	✓	ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	17	**5.9**	**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
Fluoride by PC Titrator	EK040P	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	19	**5.3**	**5.0**	✓	ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	18	**5.6**	**5.0**	✓	ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	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							
TPH Volatiles/BTEX	EP080	1	19	**5.3**	**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
pH by PC Titrator	EA005-P	WATER	APHA 21st ed. 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Conductivity by PC Titrator	EA010-P	WATER	APHA 21st ed., 2510 B This procedure determines conductivity by automated ISE. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Dissolved Solids (High Level)	EA015H	WATER	In-House, APHA 21st ed., 2540C A gravimetric procedure that determines the amount of \`filterable\` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
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 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 Adsorption 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.

Analytical Methods	Method	Matrix	Method Descriptions
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): 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 Metals by ICP-MS - Suite B	EG020B-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.
Total Metals by ICP-MS - Suite B	EG020B-T	WATER	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): 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)
Total Mercury by FIMS	EG035T	WATER	AS 3550, APHA 21st ed. 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered 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)
Fluoride by PC Titrator	EK040P	WATER	APHA 21st ed., 4500 F--C CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. 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)
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)

Analytical Methods	Method	Matrix	Method Descriptions
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)

Preparation Methods	Method	Matrix	Method Descriptions
Digestion for Total Recoverable Metals	EN25	WATER	USEPA SW846-3005 Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
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

- **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.

Matrix: **WATER**

Method		*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural							
BEL01,	CT01,	----	----	----	19-MAR-2013	14-MAR-2013	**5**
DCK01,	NCK01,						
CCK01,	CAR02						
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural							
BEL01,	CT01,	----	----	----	19-MAR-2013	16-MAR-2013	**3**
DCK01,	NCK01,						
CCK01,	CAR02						

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.**

ALS Group

Environmental Division

Food & Environmental Pharmaceutical

ALS Life Sciences

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **EB1306655**		
Client	: **4T CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ROWAN MORRISON	Contact	: Vanessa Turnbull
Address	: PO BOX 1946 EMERALD QLD, AUSTRALIA 4720	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: r.morrison@4t.com.au	E-mail	: vanessa.turnbull@alsenviro.com
Telephone	: +61 7 49824100	Telephone	: 61-7-3552 8660
Facsimile	: ----	Facsimile	: 61-7-3352 3662
Project	: SWQ 236	Page	: 1 of 3
Order number	: ----		
C-O-C number	: ----	Quote number	: EB20124TCON0260 (BN/721/12)
Site	: ----		
Sampler	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 18-MAR-2013	Issue Date	: 18-MAR-2013 15:52
Client Requested Due Date	: 27-MAR-2013	Scheduled Reporting Date	: **22-MAR-2013**

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 0.6, 0.8°C - Ice present
No. of coolers/boxes	: 2 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
- 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.
- Samples submitted for dissolved metals analysis should be acidified with nitric acid, following field filtration. Additional charges of up to $5.00 will apply to each sample requiring filtration and preservation upon receipt by the laboratory.
- **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.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- **Please be advised that when the samples were received at ALS, some of the bottles were submerged in water in the esky.**
- 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.

ALS Group

Environmental Division

Food & Environmental Pharmaceutical

ALS Life Sciences

CERTIFICATE OF ANALYSIS

Work Order	: **EB1306655**	Page	: 1 of 9
Client	: **4T CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ROWAN MORRISON	Contact	: Vanessa Turnbull
Address	: PO BOX 1946 EMERALD QLD, AUSTRALIA 4720	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: r.morrison@4t.com.au	E-mail	: vanessa.turnbull@alsenviro.com
Telephone	: +61 7 49824100	Telephone	: 61-7-3552 8660
Facsimile	: ----	Facsimile	: 61-7-3352 3662
Project	: SWQ 236	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 18-MAR-2013
Sampler	: ----	Issue Date	: 25-MAR-2013
Site	: ----		
		No. of samples received	: 6
Quote number	: BN/721/12	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

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".**
- **It is recognised that EK061 (Total Kjeldahl Nitrogen) is less than EK055 (Ammonia) for some samples. However, the difference is within experimental variation of the methods.**
- **TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

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
Greg Vogel	Laboratory Manager	Brisbane Inorganics
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Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	BEL01	CT01	DCK01	NCK01	CCK01
			Client sampling date / time	14-MAR-2013 15:15	14-MAR-2013 12:50	14-MAR-2013 10:05	14-MAR-2013 14:30	14-MAR-2013 10:40
Compound	CAS Number	LOR	Unit	EB1306655-001	EB1306655-002	EB1306655-003	EB1306655-004	EB1306655-005
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.87	7.46	7.25	8.34	8.35
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	247	182	247	633	1760
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	375	816	453	380	896
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	283	172	344	75	19
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	3	6
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	69	43	46	90	235
Total Alkalinity as CaCO3	----	1	mg/L	69	43	46	93	241
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	10	7	5	16	11
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	25	23	42	126	436
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	12	8	4	22	13
Magnesium	7439-95-4	1	mg/L	4	4	3	14	7
Sodium	7440-23-5	1	mg/L	32	15	39	66	341
Potassium	7440-09-7	1	mg/L	6	18	6	21	36
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.11	0.49	0.13	<0.01	<0.01
Arsenic	7440-38-2	0.001	mg/L	0.002	0.001	<0.001	0.003	0.002
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	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	0.002	0.003	0.002	0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	0.001	0.002	0.002	0.003	<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	<0.005	<0.005	<0.005	<0.005
Manganese	7439-96-5	0.001	mg/L	0.001	0.104	0.121	<0.001	0.028
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	0.001	<0.001

Analytical Results

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

Compound	CAS Number	LOR	Unit	BEL01	CT01	DCK01	NCK01	CCK01
Client sampling date / time				14-MAR-2013 15:15	14-MAR-2013 12:50	14-MAR-2013 10:05	14-MAR-2013 14:30	14-MAR-2013 10:40
				EB1306655-001	**EB1306655-002**	**EB1306655-003**	**EB1306655-004**	**EB1306655-005**
EG020F: Dissolved Metals by ICP-MS - Continued								
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Boron	7440-42-8	0.05	mg/L	<0.05	**0.11**	<0.05	**0.15**	**0.19**
Iron	7439-89-6	0.05	mg/L	**0.12**	**0.61**	**0.26**	<0.05	<0.05
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**11.8**	**13.8**	**15.4**	**3.03**	**0.15**
Arsenic	7440-38-2	0.001	mg/L	**0.005**	**0.006**	**0.003**	**0.003**	**0.002**
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	**0.007**	**0.017**	**0.019**	**0.006**	<0.001
Copper	7440-50-8	0.001	mg/L	**0.009**	**0.014**	**0.016**	**0.004**	**0.002**
Cobalt	7440-48-4	0.001	mg/L	**0.004**	**0.009**	**0.006**	**0.003**	<0.001
Nickel	7440-02-0	0.001	mg/L	**0.008**	**0.012**	**0.015**	**0.007**	<0.001
Lead	7439-92-1	0.001	mg/L	**0.008**	**0.016**	**0.006**	**0.001**	<0.001
Zinc	7440-66-6	0.005	mg/L	**0.028**	**0.030**	**0.042**	**0.009**	<0.005
Manganese	7439-96-5	0.001	mg/L	**0.258**	**0.561**	**0.382**	**0.227**	**0.211**
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	**0.002**	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	7440-62-2	0.01	mg/L	**0.02**	**0.06**	**0.04**	**0.01**	<0.01
Boron	7440-42-8	0.05	mg/L	**0.06**	**0.14**	**0.06**	**0.19**	**0.25**
Iron	7439-89-6	0.05	mg/L	**10.4**	**25.6**	**21.0**	**3.73**	**0.66**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.2**	**0.1**	**0.2**	**0.4**	**0.5**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**1.06**	**0.43**	**0.84**	**0.15**	**0.11**
EK057G: Nitrite as N by Discrete Analyser								

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	BEL01	CT01	DCK01	NCK01	CCK01
			Client sampling date / time	14-MAR-2013 15:15	14-MAR-2013 12:50	14-MAR-2013 10:05	14-MAR-2013 14:30	14-MAR-2013 10:40
Compound	CAS Number	LOR	Unit	EB1306655-001	EB1306655-002	EB1306655-003	EB1306655-004	EB1306655-005
EK057G: Nitrite as N by Discrete Analyser - Continued								
Nitrite as N	----	0.01	mg/L	<0.01	**0.08**	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.07**	**0.28**	**0.09**	**0.02**	**0.05**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.07**	**0.36**	**0.09**	**0.02**	**0.05**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**1.0**	**2.3**	**1.6**	**1.6**	**0.8**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**1.1**	**2.7**	**1.7**	**1.6**	**0.8**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.30**	**0.61**	**0.27**	**0.16**	**0.06**
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**2.29**	**1.65**	**2.21**	**5.75**	**17.3**
Total Cations	----	0.01	meq/L	**2.47**	**1.84**	**2.30**	**5.66**	**17.0**
Ionic Balance	----	0.01	%	----	----	----	**0.76**	**1.09**
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	**100**	<100
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	**100**	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	20	µg/L	<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	<100	<100	<100
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	**108**	**117**	**119**	**104**	**114**
Toluene-D8	2037-26-5	0.1	%	**109**	**112**	**105**	**108**	**99.3**
4-Bromofluorobenzene	460-00-4	0.1	%	**104**	**106**	**101**	**101**	**96.5**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Client sample ID	**CAR02**	----	----	----	----
			Client sampling date / time	14-MAR-2013 13:20	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1306655-006**	**----**	**----**	**----**	**----**
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.69**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**371**	----	----	----	----
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	**649**	----	----	----	----
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	**154**	----	----	----	----
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	**61**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**61**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**5**	----	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	**81**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**6**	----	----	----	----
Magnesium	7439-95-4	1	mg/L	**6**	----	----	----	----
Sodium	7440-23-5	1	mg/L	**58**	----	----	----	----
Potassium	7440-09-7	1	mg/L	**10**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.17**	----	----	----	----
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	**0.002**	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.001**	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.014**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	<0.001	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	CAR02	----	----	----	----
			Client sampling date / time	14-MAR-2013 13:20	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1306655-006	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued								
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Silver	7440-22-4	0.001	mg/L	<0.001	----	----	----	----
Uranium	7440-61-1	0.001	mg/L	<0.001	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----
Boron	7440-42-8	0.05	mg/L	**0.06**	----	----	----	----
Iron	7439-89-6	0.05	mg/L	**0.45**	----	----	----	----
EG020T: Total Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**14.7**	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.003**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	**0.017**	----	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.012**	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	**0.005**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.012**	----	----	----	----
Lead	7439-92-1	0.001	mg/L	**0.006**	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.036**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.288**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Silver	7440-22-4	0.001	mg/L	<0.001	----	----	----	----
Uranium	7440-61-1	0.001	mg/L	<0.001	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	**0.04**	----	----	----	----
Boron	7440-42-8	0.05	mg/L	**0.09**	----	----	----	----
Iron	7439-89-6	0.05	mg/L	**20.2**	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.2**	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.10**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								

Analytical Results

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

Compound	CAS Number	LOR	Unit	CAR02	----	----	----	----
			Client sampling date / time	14-MAR-2013 13:20	----	----	----	----
				EB1306655-006	**----**	**----**	**----**	**----**
EK057G: Nitrite as N by Discrete Analyser - Continued								
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	**0.06**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.06**	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**1.0**	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**1.1**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.24**	----	----	----	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**3.61**	----	----	----	----
Total Cations	----	0.01	meq/L	**3.57**	----	----	----	----
Ionic Balance	----	0.01	%	**0.52**	----	----	----	----
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	%	**102**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	**98.4**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	Recovery Limits (%) 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

Appendix C – Laboratory results

Table C1 Water Results – Biological Analyses, Major Ions and Physical Parameters and Nutrients

					Biological		Major Ions and Physcial Parameters												Nutrients						
					Chlorophyll a	**Faecal Coliforms**	**Alkalinity (Hydroxide) as CaCO3**	**Alkalinity (total) as CaCO3**	**Anions Total**	**Bicarbonate as CaCO3**	**Cations Total**	**Chloride**	**Fluoride**	**Ionic Balance**	**Silica**	**TDS**	**Hardness as CaCO3**	**TSS**	**Ammonia as N**	**Kjeldahl Nitrogen Total**	**Nitrate (as N)**	**Nitrite (as N)**	**Nitrogen (Total)**	**Reactive Phosphorus as P**	**Sulphate (Filtered)**
					mg/m³	CFU/100mL	µg/L	mg/L	meq/L	mg/L	meq/L	mg/L	mg/L	%	µg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L
Laboratory Limit of Reporting					1	1	1000	1	0.01	1	0.01	1	0.1	0.01	100	5	1	5	5	0.01	0.002	0.002	10	0.001	1
Sampling Event	**Field ID**	**Location Code**	**Sampling Date**	**Work Order**																					
Event 1	QA01	WQ04	13/04/2011	EB1107318	<1	80	-	-	-	-	-	-	-	-	-	505	-	104	8	0.48	0.129	0.002	610	<0.001	-
	WQ02	WQ02	13/04/2011	EB1107318	1	500	-	-	-	-	-	-	-	-	-	604	-	86	<5	0.49	0.133	<0.002	630	<0.001	-
	WQ03	WQ03	13/04/2011	EB1107318	2	170	-	-	-	-	-	-	-	-	-	597	-	73	<5	0.47	0.129	<0.002	600	<0.001	-
	WQ04	WQ04	13/04/2011	EB1107318	1	200	-	-	-	-	-	-	-	-	-	508	-	112	7	0.57	0.128	0.003	700	<0.001	-
	WQ05	WQ05	13/04/2011	EB1107318	17	500	-	-	-	-	-	-	-	-	-	103	-	38	<5	0.88	0.01	<0.002	890	<0.001	-
	WQST	WQST	13/04/2011	EB1107318	16	830	-	-	-	-	-	-	-	-	-	136	-	82	<5	1.53	<0.002	<0.002	1530	0.027	-
	QA02	QA02	14/04/2011	EB1107452	10	1400	-	-	-	-	-	-	-	-	-	58	-	66	388	2.52	0.004	<0.002	2530	0.018	-
	WQ01	WQ01	14/04/2011	EB1107452	1	100	-	-	-	-	-	-	-	-	-	536	-	121	9	0.56	0.145	<0.002	700	0.005	-
	WQ06	WQ06	14/04/2011	EB1107452	4	2000	-	-	-	-	-	-	-	-	-	291	-	176	56	0.79	0.035	<0.002	830	0.009	-
	WQ08	WQ08	14/04/2011	EB1107452	11	1100	-	-	-	-	-	-	-	-	-	76	-	72	419	2.6	0.005	<0.002	2610	0.017	-
	WQ09	WQ09	14/04/2011	EB1107452	18	<2	-	-	-	-	-	-	-	-	-	88	-	15	157	2.26	0.011	0.004	2270	0.02	-
Event 2	QA01	QA01	4/05/2011	EB1108606	52	-	<1000	44	1.02	44	0.93	5	<0.1	-	26,600	99	27	20	774	2.33	0.004	0.005	2340	0.015	<1
	WQ06	WQ06	4/05/2011	EB1108606	4	-	<1000	57	1.48	57	1.45	10	0.2	-	23,100	285	41	68	<5	0.53	0.06	0.003	590	0.011	3
	WQ08	WQ08	4/05/2011	EB1108606	17	1800	<1000	20	0.51	20	0.47	4	<0.1	-	11,700	64	9	33	482	1.92	0.008	0.005	1930	0.006	<1
	WQ09	WQ09	4/05/2011	EB1108606	41	-	<1000	44	1	44	0.9	5	<0.1	-	25,700	88	27	31	774	2.18	0.002	0.005	2190	0.016	<1
	QA02	QA02	5/05/2011	EB1108729	<1	150	<1000	97	-	-	-	252	0.3	-	-	624	82	17	<5	0.18	0.065	0.002	250	0.008	8
	WQ01	WQ01	5/05/2011	EB1108729	<1	10	<1000	324	-	-	-	247	0.4	-	-	630	82	28	<5	0.2	0.147	0.003	350	0.007	9
	WQ02	WQ02	5/05/2011	EB1108729	2	290	<1000	318	-	-	-	252	0.3	-	-	601	79	17	<5	0.19	0.077	0.002	260	0.007	8
	WQ03	WQ03	5/05/2011	EB1108729	2	150	<1000	314	-	-	-	248	0.3	-	-	603	82	19	<5	0.2	0.034	0.002	230	0.006	8
	WQ04	WQ04	5/05/2011	EB1108729	2	2000	<1000	331	-	-	-	248	0.3	-	-	611	82	42	<5	0.29	0.034	<0.002	320	0.007	8
	WQST	WQST	5/05/2011	EB1108729	12	-	<1000	261	-	-	-	4	<0.1	-	-	181	44	267	<5	1.53	<0.002	<0.002	1530	0.008	<1
Event 3	QA01	WQ01	21/06/2011	EB1111938	4	60	-	-	-	-	-	-	-	-	-	557	-	<5	6	0.16	0.043	<0.002	200	0.006	-
	WQ01	WQ01	21/06/2011	EB1111938	2	50	-	-	-	-	-	-	-	-	-	557	-	22	6	0.2	0.054	<0.002	250	0.006	-
	WQ02	WQ02	21/06/2011	EB1111938	1	40	-	-	-	-	-	-	-	-	-	590	-	<5	132	0.12	0.016	<0.002	140	0.017	-
	WQ03	WQ03	21/06/2011	EB1111938	<1	60	-	-	-	-	-	-	-	-	-	583	-	<5	<5	0.12	0.005	<0.002	120	0.004	-
	WQ04	WQ04	21/06/2011	EB1111938	<1	30	-	-	-	-	-	-	-	-	-	590	-	14	<5	0.15	0.002	<0.002	150	0.005	-
	WQ05	WQ05	21/06/2011	EB1111938	19	50	-	-	-	-	-	-	-	-	-	92	-	111	14	0.83	0.004	<0.002	830	0.01	-
	QA02	WQ09	22/06/2011	EB1112105	55	110	-	-	-	-	-	-	-	-	-	92	-	22	46	2.47	0.04	0.006	2520	0.009	-

					Biological		Major Ions and Physcial Parameters												Nutrients						
					Chlorophyll a	Faecal Coliforms	Alkalinity (Hydroxide) as CaCO3	Alkalinity (total) as CaCO3	Anions Total	Bicarbonate as CaCO3	Cations Total	Chloride	Fluoride	Ionic Balance	Silica	TDS	Hardness as CaCO3	TSS	Ammonia as N	Kjeldahl Nitrogen Total	Nitrate (as N)	Nitrite (as N)	Nitrogen (Total)	Reactive Phosphorus as P	Sulphate (Filtered)
					mg/m³	CFU/100mL	µg/L	mg/L	meq/L	mg/L	meq/L	mg/L	mg/L	%	µg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L
Laboratory Limit of Reporting					1	1	1000	1	0.01	1	0.01	1	0.1	0.01	100	5	1	5	5	0.01	0.002	0.002	10	0.001	1
Sampling Event	Field ID	Location Code	Sampling Date	Work Order																					
	WQ06	WQ06	22/06/2011	EB1112105	3	68	-	-	-	-	-	-	-	-	-	228	-	196	76	0.7	0.076	<0.002	780	0.012	-
	WQ08	WQ08	22/06/2011	EB1112105	13	48	-	-	-	-	-	-	-	-	-	90	-	46	69	2.14	0.061	0.008	2210	0.011	-
	WQ09	WQ09	22/06/2011	EB1112105	64	140	-	-	-	-	-	-	-	-	-	100	-	29	48	2.46	0.042	0.006	2510	0.014	-
	WQST	WQST	22/06/2011	EB1112105	17	370	-	-	-	-	-	-	-	-	-	163	-	38	<5	2.11	0.004	<0.002	2110	0.01	-
Event 4	QA01	WQ04	26/07/2011	EB1114640	3	200	<1000	168	13.9	-	12.6	364	0.4	4.96	-	715	103	9	<5	0.23	<0.002	<0.002	230	0.002	14
	WQ01	WQ01	26/07/2011	EB1114640	4	100	<1000	160	12.7	-	11.6	326	0.4	4.67	-	711	93	9	<5	0.28	<0.002	<0.002	280	0.011	14
	WQ02	WQ02	26/07/2011	EB1114640	4	200	<1000	160	12.7	-	11.9	328	0.4	3.52	-	658	93	7	<5	0.23	0.004	<0.002	230	0.006	13
	WQ03	WQ03	26/07/2011	EB1114640	3	200	<1000	166	13.1	-	11.9	337	0.4	4.95	-	593	97	8	<5	0.22	<0.002	<0.002	220	0.005	14
	WQ04	WQ04	26/07/2011	EB1114640	4	20	<1000	170	13.9	-	12.6	361	0.4	4.98	-	703	103	9	<5	0.24	<0.002	<0.002	240	0.004	14
	QA02	WQ09	27/07/2011	EB1114769	26	28	<1000	36	0.89	-	1.01	6	<0.1	-	-	85	27	18	65	2.16	0.003	0.002	2170	0.015	<1
	WQ06	WQ06	27/07/2011	EB1114769	2	36	<1000	63	1.62	-	1.64	10	0.2	-	-	268	48	59	13	0.61	0.022	0.005	640	0.012	4
	WQ08	WQ08	27/07/2011	EB1114769	10	24	<1000	17	0.48	-	0.39	5	<0.1	-	-	31	5	29	411	1.92	0.118	0.016	2050	0.011	<1
	WQ09	WQ09	27/07/2011	EB1114769	19	64	<1000	37	0.91	-	1.01	6	<0.1	-	-	104	27	17	62	2.14	0.008	0.002	2150	0.016	<1
	WQST	WQST	27/07/2011	EB1114769	14	110	<1000	84	1.85	-	1.85	6	<0.1	-	-	149	50	45	<5	2.7	<0.002	<0.002	2700	0.013	<1
Event 5	QA01	WQ04	23/08/2011	EB1117117	1	100	-	-	-	-	-	-	-	-	-	950	-	18	<5	0.33	<0.002	<0.002	330	0.002	-
	WQ01	WQ01	23/08/2011	EB1117117	4	90	-	-	-	-	-	-	-	-	-	932	-	<5	<5	0.25	<0.002	<0.002	250	0.002	-
	WQ02	WQ02	23/08/2011	EB1117117	1	140	-	-	-	-	-	-	-	-	-	960	-	<5	<5	0.35	0.002	<0.002	350	0.002	-
	WQ03	WQ03	23/08/2011	EB1117117	1	74	-	-	-	-	-	-	-	-	-	894	-	<5	<5	0.24	<0.002	<0.002	240	0.001	-
	WQ04	WQ04	23/08/2011	EB1117117	2	60	-	-	-	-	-	-	-	-	-	954	-	25	<5	0.27	<0.002	<0.002	270	0.002	-
	QA02	WQ09	24/08/2011	EB1117183	24	40	-	-	-	-	-	-	-	-	-	117	-	17	<5	2.15	<0.002	<0.002	2150	0.012	-
	WQ05	WQ05	24/08/2011	EB1117183	8	30	-	-	-	-	-	-	-	-	-	234	-	14	56	1.42	0.004	0.003	1430	0.007	-
	WQ06	WQ06	24/08/2011	EB1117183	3	20	-	-	-	-	-	-	-	-	-	378	-	32	12	0.67	0.018	<0.002	690	0.007	-
	WQ08	WQ08	24/08/2011	EB1117183	32	30	-	-	-	-	-	-	-	-	-	129	-	32	20	1.94	0.054	0.014	2010	0.009	-
	WQ09	WQ09	24/08/2011	EB1117183	28	90	-	-	-	-	-	-	-	-	-	136	-	18	<5	2.16	<0.002	<0.002	2160	0.012	-
	WQST	WQST	24/08/2011	EB1117183	20	20	-	-	-	-	-	-	-	-	-	240	-	47	<5	2.8	<0.002	0.002	2800	0.011	-
Event 6	QA01	WQ04	20/09/2011	EB1119345	2	46	<1000	162	12.5	-	12	323	0.4	1.92	-	678	93	25	<5	0.28	<0.002	<0.002	280	0.003	7
	WQ01	WQ01	20/09/2011	EB1119345	<1	74	<1000	172	12.6	-	12.4	318	0.4	1.07	-	697	79	9	<5	0.34	0.003	<0.002	340	0.005	10
	WQ02	WQ02	20/09/2011	EB1119345	<1	11,000	<1000	168	12.9	-	12.4	331	0.4	2.03	-	697	86	6	<5	0.34	<0.002	0.002	340	<0.001	9
	WQ03	WQ03	20/09/2011	EB1119345	<1	200	<1000	164	13.1	-	12.4	343	0.4	2.62	-	689	90	37	<5	0.37	<0.002	0.002	370	0.001	8
	WQ04	WQ04	20/09/2011	EB1119345	1	86	<1000	162	12.6	-	12.2	328	0.4	1.95	-	683	93	16	<5	0.29	<0.002	<0.002	290	0.002	7

					Biological		Major Ions and Physcial Parameters												Nutrients						
					Chlorophyll a	Faecal Coliforms	Alkalinity (Hydroxide) as CaCO3	Alkalinity (total) as CaCO3	Anions Total	Bicarbonate as CaCO3	Cations Total	Chloride	Fluoride	Ionic Balance	Silica	TDS	Hardness as CaCO3	TSS	Ammonia as N	Kjeldahl Nitrogen Total	Nitrate (as N)	Nitrite (as N)	Nitrogen (Total)	Reactive Phosphorus as P	Sulphate (Filtered)
					mg/m³	CFU/100mL	µg/L	mg/L	meq/L	mg/L	meq/L	mg/L	mg/L	%	µg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L
Laboratory Limit of Reporting					1	1	1000	1	0.01	1	0.01	1	0.1	0.01	100	5	1	5	5	0.01	0.002	0.002	10	0.001	1
Sampling Event	**Field ID**	**Location Code**	**Sampling Date**	**Work Order**																					
	WQ05	WQ05	20/09/2011	EB1119345	6	62	<1000	33	0.69	-	0.82	6	<0.1	-	-	211	21	31	10	1.1	<0.002	0.005	1100	0.008	2
	WQ06	WQ06	20/09/2011	EB1119345	2	1400	<1000	69	1.85	-	1.98	13	0.2	-	-	240	60	53	<5	0.65	0.004	<0.002	650	0.007	5
	WQST	WQST	20/09/2011	EB1119345	8	26	<1000	89	2.02	-	2.19	8	<0.1	-	-	168	53	37	<5	1.74	<0.002	<0.002	1740	0.013	1
	QA02	WQ09	21/09/2011	EB1119508	14	<2	<1000	38	0.96	-	0.85	7	<0.1	-	-	93	21	12	104	1.42	0.021	<0.002	1440	0.004	<1
	WQ08	WQ08	21/09/2011	EB1119508	17	130	<1000	34	0.79	-	0.62	4	<0.1	-	-	60	14	34	82	1.32	0.038	<0.002	1360	0.006	<1
	WQ09	WQ09	21/09/2011	EB1119508	12	120	<1000	38	0.96	-	0.85	7	<0.1	-	-	68	21	13	121	1.12	0.021	<0.002	1140	0.004	<1

Table C2 Water Results – Metals (Aluminium to Cobalt)

Sampling Event	Field ID	Location Code	Sampling Date	Work Order	Aluminium	Aluminium (Filtered)	Arsenic	Arsenic (Filtered)	Barium	Barium (Filtered)	Beryllium	Beryllium (Filtered)	Boron	Boron (Filtered)	Cadmium	Cadmium (Filtered)	Calcium (Filtered)	Chromium (III+VI)	Chromium (III+VI) (Filtered)	Cobalt
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Laboratory Limit of Reporting					0.01	0.01	0.001	0.001	0.001	0.001	0.001	0.001	0.05	0.05	0.0001	0.0001	1	0.001	0.001	0.001
Event 1	QA01	WQ04	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ02	WQ02	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ03	WQ03	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ04	WQ04	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ05	WQ05	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQST	WQST	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA02	QA02	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ01	WQ01	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ06	WQ06	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ08	WQ08	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ09	WQ09	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Event 2	QA01	QA01	4/05/2011	EB1108606	0.04	0.02	0.002	0.001	0.062	0.038	<0.001	<0.001	0.05	0.07	<0.0001	<0.0001	6	<0.001	<0.001	0.001
	WQ06	WQ06	4/05/2011	EB1108606	5.46	0.24	0.002	<0.001	0.218	0.128	<0.001	<0.001	<0.05	0.06	<0.0001	<0.0001	10	0.007	<0.001	0.002
	WQ08	WQ08	4/05/2011	EB1108606	0.5	0.04	0.001	<0.001	0.039	0.023	<0.001	<0.001	0.05	0.06	<0.0001	<0.0001	2	<0.001	<0.001	<0.001
	WQ09	WQ09	4/05/2011	EB1108606	0.09	0.02	0.002	0.001	0.062	0.037	<0.001	<0.001	0.05	0.05	<0.0001	<0.0001	6	<0.001	<0.001	0.001
	QA02	QA02	5/05/2011	EB1108729	0.16	0.05	<0.001	<0.001	0.303	0.262	<0.001	<0.001	0.11	0.12	<0.0001	<0.0001	13	<0.001	<0.001	0.001
	WQ01	WQ01	5/05/2011	EB1108729	2.2	0.04	0.002	<0.001	0.339	0.263	<0.001	<0.001	0.12	0.13	<0.0001	<0.0001	13	0.004	<0.001	0.002
	WQ02	WQ02	5/05/2011	EB1108729	0.18	0.05	<0.001	<0.001	0.33	0.26	<0.001	<0.001	0.13	0.13	<0.0001	<0.0001	12	<0.001	<0.001	0.004
	WQ03	WQ03	5/05/2011	EB1108729	0.13	0.05	<0.001	<0.001	0.285	0.241	<0.001	<0.001	0.12	0.11	<0.0001	<0.0001	13	<0.001	<0.001	0.002
	WQ04	WQ04	5/05/2011	EB1108729	0.15	0.05	<0.001	<0.001	0.286	0.242	<0.001	<0.001	0.11	0.11	<0.0001	<0.0001	13	<0.001	<0.001	0.002
	WQST	WQST	5/05/2011	EB1108729	0.11	0.03	0.002	0.001	0.107	0.08	<0.001	<0.001	0.06	0.06	<0.0001	<0.0001	11	<0.001	<0.001	0.002
Event 3	QA01	WQ01	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ01	WQ01	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ02	WQ02	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ03	WQ03	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ04	WQ04	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ05	WQ05	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA02	WQ09	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ06	WQ06	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ08	WQ08	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ09	WQ09	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQST	WQST	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	QA01	WQ04	26/07/2011	EB1114640	0.22	0.02	<0.001	<0.001	-	0.246	-	<0.001	0.17	0.17	0.0001	<0.0001	15	<0.001	<0.001	-
	WQ01	WQ01	26/07/2011	EB1114640	0.08	0.01	<0.001	<0.001	-	0.267	-	<0.001	0.15	0.16	<0.0001	<0.0001	14	<0.001	<0.001	-
	WQ02	WQ02	26/07/2011	EB1114640	0.1	0.02	<0.001	<0.001	-	0.266	-	<0.001	0.15	0.16	<0.0001	<0.0001	14	<0.001	<0.001	-
	WQ03	WQ03	26/07/2011	EB1114640	0.16	0.02	<0.001	<0.001	-	0.247	-	<0.001	0.16	0.16	<0.0001	<0.0001	14	<0.001	<0.001	-
	WQ04	WQ04	26/07/2011	EB1114640	0.2	0.03	<0.001	<0.001	-	0.242	-	<0.001	0.16	0.18	<0.0001	<0.0001	15	<0.001	<0.001	-
Event 4	QA02	WQ09	27/07/2011	EB1114769	0.05	0.03	0.001	<0.001	0.056	0.041	<0.001	<0.001	0.05	0.07	<0.0001	<0.0001	6	<0.001	<0.001	0.001
	WQ06	WQ06	27/07/2011	EB1114769	6.16	0.13	0.002	<0.001	0.234	0.161	<0.001	<0.001	<0.05	0.06	<0.0001	<0.0001	11	0.008	<0.001	0.002
	WQ08	WQ08	27/07/2011	EB1114769	0.99	0.94	0.002	<0.001	0.034	0.026	<0.001	<0.001	<0.05	0.06	<0.0001	<0.0001	2	<0.001	<0.001	<0.001
	WQ09	WQ09	27/07/2011	EB1114769	0.05	0.03	0.002	<0.001	0.054	0.039	<0.001	<0.001	0.05	0.07	<0.0001	<0.0001	6	<0.001	<0.001	0.001
	WQST	WQST	27/07/2011	EB1114769	0.35	0.07	0.003	0.002	0.096	0.211	<0.001	<0.001	0.05	0.09	<0.0001	<0.0001	12	<0.001	<0.001	0.002
	QA01	WQ04	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ01	WQ01	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ02	WQ02	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ03	WQ03	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ04	WQ04	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Event 5	QA02	WQ09	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ05	WQ05	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ06	WQ06	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ08	WQ08	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ09	WQ09	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQST	WQST	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA01	WQ04	20/09/2011	EB1119345	0.54	0.03	<0.001	<0.001	0.29	0.322	<0.001	<0.001	0.14	0.16	<0.0001	<0.0001	14	<0.001	0.001	<0.001
	WQ01	WQ01	20/09/2011	EB1119345	0.29	0.06	<0.001	<0.001	0.287	0.254	<0.001	<0.001	0.16	0.16	<0.0001	<0.0001	12	<0.001	0.002	<0.001
	WQ02	WQ02	20/09/2011	EB1119345	0.31	0.06	<0.001	<0.001	0.296	0.264	<0.001	<0.001	0.16	0.15	<0.0001	<0.0001	13	<0.001	0.002	<0.001
	WQ03	WQ03	20/09/2011	EB1119345	0.29	0.05	<0.001	<0.001	0.293	0.358	<0.001	<0.001	0.14	0.17	<0.0001	<0.0001	13	<0.001	0.002	<0.001
	WQ04	WQ04	20/09/2011	EB1119345	0.52	0.03	<0.001	<0.001	0.274	0.305	<0.001	<0.001	0.13	0.17	<0.0001	<0.0001	14	<0.001	0.002	<0.001
Event 6	WQ05	WQ05	20/09/2011	EB1119345	3.07	2.03	0.003	<0.001	0.106	0.301	<0.001	<0.001	<0.05	0.1	<0.0001	<0.0001	5	0.004	0.002	0.004
	WQ06	WQ06	20/09/2011	EB1119345	4.34	0.14	0.001	<0.001	0.256	0.354	<0.001	<0.001	0.05	0.1	<0.0001	<0.0001	14	0.006	<0.001	0.002
	WQST	WQST	20/09/2011	EB1119345	0.33	0.05	0.002	0.002	0.126	0.222	<0.001	<0.001	0.08	0.1	<0.0001	<0.0001	13	<0.001	<0.001	0.002
	QA02	WQ09	21/09/2011	EB1119508	-	-	0.001	<0.001	-	0.111	-	<0.001	-	-	<0.0001	<0.0001	5	<0.001	<0.001	-
	WQ08	WQ08	21/09/2011	EB1119508	-	-	<0.001	<0.001	-	0.191	-	<0.001	-	-	<0.0001	<0.0001	4	0.002	0.002	-
	WQ09	WQ09	21/09/2011	EB1119508	-	-	<0.001	<0.001	-	0.082	-	<0.001	-	-	<0.0001	<0.0001	5	<0.001	<0.001	-

Table C3 Water Results - Metals (Cobalt to Phosphorus)

Sampling Event	Field ID	Location Code	Sampling Date	Work Order	Cobalt (Filtered)	Copper	Copper (Filtered)	Iron	Iron (Filtered)	Lead	Magnesium (Filtered)	Manganese	Manganese (Filtered)	Mercury	Mercury (Filtered)	Molybdenum	Molybdenum (Filtered)	Nickel	Nickel (Filtered)	Phosphorus
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Laboratory Limit of Reporting					0.001	0.001	0.001	0.05	0.05	0.001	1	0.001	0.001	0.0001	0.0001	0.001	0.001	0.001	0.001	0.005
Event 1	QA01	WQ04	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.027
	WQ02	WQ02	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.034
	WQ03	WQ03	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.019
	WQ04	WQ04	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.024
	WQ05	WQ05	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.077
	WQST	WQST	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.091
	QA02	QA02	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.09
	WQ01	WQ01	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03
	WQ06	WQ06	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.064
	WQ08	WQ08	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.087
	WQ09	WQ09	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.068
Event 2	QA01	QA01	4/05/2011	EB1108606	<0.001	<0.001	0.004	3.25	0.95	<0.001	3	0.287	0.001	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.116
	WQ06	WQ06	4/05/2011	EB1108606	<0.001	0.006	0.005	7.67	0.18	0.003	4	0.212	0.002	<0.0001	<0.0001	<0.001	<0.001	0.006	0.002	0.078
	WQ08	WQ08	4/05/2011	EB1108606	<0.001	0.002	<0.001	0.87	0.06	<0.001	1	0.061	0.002	<0.0001	<0.0001	<0.001	<0.001	0.001	<0.001	0.096
	WQ09	WQ09	4/05/2011	EB1108606	<0.001	<0.001	<0.001	3.05	0.84	<0.001	3	0.274	0.002	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.093
	QA02	QA02	5/05/2011	EB1108729	<0.001	0.006	0.003	3.28	0.15	<0.001	12	0.143	0.096	<0.0001	<0.0001	<0.001	<0.001	0.002	0.001	0.017
	WQ01	WQ01	5/05/2011	EB1108729	0.001	0.005	0.009	7.95	0.16	0.002	12	0.226	0.161	<0.0001	<0.0001	<0.001	<0.001	0.004	0.001	0.025
	WQ02	WQ02	5/05/2011	EB1108729	<0.001	0.032	0.006	2.94	0.14	<0.001	12	0.186	0.103	<0.0001	<0.0001	<0.001	<0.001	0.003	0.001	0.024
	WQ03	WQ03	5/05/2011	EB1108729	<0.001	0.01	0.005	2.48	0.15	<0.001	12	0.136	0.088	<0.0001	<0.0001	<0.001	<0.001	0.002	0.001	0.021
	WQ04	WQ04	5/05/2011	EB1108729	<0.001	0.01	0.004	2.5	0.14	0.001	12	0.228	0.182	<0.0001	<0.0001	<0.001	<0.001	0.002	0.001	0.038
	WQST	WQST	5/05/2011	EB1108729	<0.001	0.007	0.003	0.91	0.14	0.001	4	0.375	0.144	<0.0001	<0.0001	<0.001	<0.001	0.002	0.002	0.159
Event 3	QA01	WQ01	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.013
	WQ01	WQ01	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.011
	WQ02	WQ02	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.009
	WQ03	WQ03	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.005
	WQ04	WQ04	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.009
	WQ05	WQ05	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.168
	QA02	WQ09	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.142
	WQ06	WQ06	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.07
	WQ08	WQ08	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.099
	WQ09	WQ09	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.14
	WQST	WQST	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.202
Event 4	QA01	WQ04	26/07/2011	EB1114640	<0.001	<0.001	<0.001	0.76	0.24	<0.001	16	-	0.021	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.011
	WQ01	WQ01	26/07/2011	EB1114640	<0.001	<0.001	<0.001	0.7	0.21	<0.001	14	-	0.049	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.018

Sampling Event	Field ID	Location Code	Sampling Date	Work Order	Cobalt (Filtered)	Copper	Copper (Filtered)	Iron	Iron (Filtered)	Lead	Magnesium (Filtered)	Manganese	Manganese (Filtered)	Mercury	Mercury (Filtered)	Molybdenum	Molybdenum (Filtered)	Nickel	Nickel (Filtered)	Phosphorus
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Laboratory Limit of Reporting					0.001	0.001	0.001	0.05	0.05	0.001	1	0.001	0.001	0.0001	0.0001	0.001	0.001	0.001	0.001	0.005
	WQ02	WQ02	26/07/2011	EB1114640	<0.001	<0.001	<0.001	0.63	0.27	<0.001	14	-	0.034	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.014
	WQ03	WQ03	26/07/2011	EB1114640	<0.001	<0.001	<0.001	0.65	0.23	<0.001	15	-	0.047	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.007
	WQ04	WQ04	26/07/2011	EB1114640	<0.001	<0.001	<0.001	0.73	0.23	<0.001	16	-	0.022	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.013
	QA02	WQ09	27/07/2011	EB1114769	<0.001	<0.001	<0.001	0.96	0.09	<0.001	3	0.255	0.009	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.135
	WQ06	WQ06	27/07/2011	EB1114769	<0.001	0.006	0.002	8.18	0.06	0.003	5	0.13	0.012	<0.0001	<0.0001	<0.001	<0.001	0.007	0.001	0.088
	WQ08	WQ08	27/07/2011	EB1114769	<0.001	0.002	0.002	1.51	0.53	<0.001	<1	0.048	0.003	<0.0001	<0.0001	<0.001	<0.001	0.002	0.001	0.103
	WQ09	WQ09	27/07/2011	EB1114769	<0.001	<0.001	<0.001	0.87	0.09	<0.001	3	0.246	0.01	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.132
	WQST	WQST	27/07/2011	EB1114769	<0.001	0.003	0.002	1.58	<0.05	0.001	5	0.495	0.007	<0.0001	<0.0001	<0.001	<0.001	0.002	0.002	0.31
Event 5	QA01	WQ04	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.034
	WQ01	WQ01	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.018
	WQ02	WQ02	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.014
	WQ03	WQ03	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.015
	WQ04	WQ04	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.033
	QA02	WQ09	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.167
	WQ05	WQ05	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.272
	WQ06	WQ06	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.101
	WQ08	WQ08	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.142
	WQ09	WQ09	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.167
	WQST	WQST	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.348
Event 6	QA01	WQ04	20/09/2011	EB1119345	<0.001	0.002	<0.001	1.61	0.21	<0.001	14	0.131	0.006	<0.0001	<0.0001	<0.001	<0.001	0.001	<0.001	0.025
	WQ01	WQ01	20/09/2011	EB1119345	<0.001	<0.001	0.001	1.8	0.44	<0.001	12	0.169	0.103	<0.0001	<0.0001	<0.001	<0.001	0.001	<0.001	0.023
	WQ02	WQ02	20/09/2011	EB1119345	<0.001	0.001	<0.001	1.59	0.44	<0.001	13	0.165	0.076	<0.0001	<0.0001	<0.001	<0.001	0.001	<0.001	0.024
	WQ03	WQ03	20/09/2011	EB1119345	<0.001	0.001	0.001	1.17	0.36	<0.001	14	0.158	0.078	<0.0001	<0.0001	<0.001	<0.001	0.001	<0.001	0.019
	WQ04	WQ04	20/09/2011	EB1119345	<0.001	0.001	0.001	1.48	0.21	<0.001	14	0.12	0.007	<0.0001	<0.0001	<0.001	<0.001	0.002	<0.001	0.026
	WQ05	WQ05	20/09/2011	EB1119345	0.001	0.005	0.003	8.76	1.68	0.004	2	0.327	0.101	<0.0001	<0.0001	<0.001	<0.001	0.004	0.002	0.172
	WQ06	WQ06	20/09/2011	EB1119345	<0.001	0.006	0.003	5.87	0.07	0.002	6	0.205	<0.001	<0.0001	<0.0001	<0.001	<0.001	0.006	0.002	0.074
	WQST	WQST	20/09/2011	EB1119345	<0.001	0.002	0.002	1.47	<0.05	0.001	5	0.528	0.006	<0.0001	<0.0001	<0.001	<0.001	0.003	0.002	0.201
	QA02	WQ09	21/09/2011	EB1119508	<0.001	<0.001	<0.001	-	-	<0.001	2	-	0.002	<0.0001	<0.0001	-	-	<0.001	<0.001	0.119
	WQ08	WQ08	21/09/2011	EB1119508	<0.001	0.002	0.002	-	-	0.001	1	-	0.006	<0.0001	<0.0001	-	-	0.002	0.002	0.12
	WQ09	WQ09	21/09/2011	EB1119508	<0.001	0.001	<0.001	-	-	<0.001	2	-	0.003	<0.0001	<0.0001	-	-	<0.001	<0.001	0.087

Table C4 Water Results – Metals (Potassium to Zinc)

Sampling Event	Field ID	Location Code	Sampling Date	Work Order	Potassium (Filtered)	Selenium	Selenium (Filtered)	Silicon (Filtered)	Silver	Silver (Filtered)	Sodium (Filtered)	Strontium	Strontium (Filtered)	Uranium	Uranium (Filtered)	Vanadium	Vanadium (Filtered)	Zinc	Zinc (Filtered)
					mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L
				Laboratory Limit of Reporting	1	0.01	0.01	50	0.001	0.001	1	0.001	0.001	1	1	0.01	0.01	0.005	0.005
Event 1	QA01	WQ04	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ02	WQ02	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ03	WQ03	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ04	WQ04	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ05	WQ05	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQST	WQST	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA02	QA02	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ01	WQ01	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ06	WQ06	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ08	WQ08	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ09	WQ09	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Event 2	QA01	QA01	4/05/2011	EB1108606	10	<0.01	<0.01	12,400	<0.001	<0.001	2	0.077	0.071	<1	<1	<0.01	<0.01	<0.005	<0.005
	WQ06	WQ06	4/05/2011	EB1108606	5	<0.01	<0.01	10,800	<0.001	<0.001	11	0.137	0.113	<1	<1	0.02	<0.01	0.011	<0.005
	WQ08	WQ08	4/05/2011	EB1108606	8	<0.01	<0.01	5470	<0.001	<0.001	2	0.021	0.017	<1	<1	<0.01	<0.01	<0.005	<0.005
	WQ09	WQ09	4/05/2011	EB1108606	10	<0.01	<0.01	12,000	<0.001	<0.001	2	0.074	0.069	<1	<1	<0.01	<0.01	0.012	<0.005
	QA02	QA02	5/05/2011	EB1108729	14	<0.01	<0.01	6880	<0.001	<0.001	164	0.219	0.198	<1	<1	<0.01	<0.01	0.01	0.006
	WQ01	WQ01	5/05/2011	EB1108729	16	<0.01	<0.01	7920	<0.001	<0.001	177	0.205	0.194	<1	<1	<0.01	<0.01	0.008	<0.005
	WQ02	WQ02	5/05/2011	EB1108729	13	<0.01	<0.01	6840	<0.001	<0.001	160	0.231	0.197	<1	<1	<0.01	<0.01	0.008	<0.005
	WQ03	WQ03	5/05/2011	EB1108729	13	<0.01	<0.01	6150	<0.001	<0.001	158	0.218	0.197	<1	<1	<0.01	<0.01	<0.005	<0.005
	WQ04	WQ04	5/05/2011	EB1108729	13	<0.01	<0.01	6090	<0.001	<0.001	162	0.216	0.2	<1	<1	<0.01	<0.01	0.008	<0.005
	WQST	WQST	5/05/2011	EB1108729	18	<0.01	<0.01	9660	<0.001	<0.001	6	0.163	0.148	<1	<1	<0.01	<0.01	0.022	<0.005
Event 3	QA01	WQ01	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ01	WQ01	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ02	WQ02	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ03	WQ03	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ04	WQ04	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ05	WQ05	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA02	WQ09	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ06	WQ06	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ08	WQ08	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ09	WQ09	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQST	WQST	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Event 4	QA01	WQ04	26/07/2011	EB1114640	26	<0.01	<0.01	930	<0.001	<0.001	227	0.22	0.21	<1	<1	-	<0.01	<0.005	<0.005
	WQ01	WQ01	26/07/2011	EB1114640	24	<0.01	<0.01	1880	<0.001	<0.001	209	0.213	0.202	<1	<1	-	<0.01	<0.005	<0.005
	WQ02	WQ02	26/07/2011	EB1114640	24	<0.01	<0.01	1540	<0.001	<0.001	216	0.21	0.203	<1	<1	-	<0.01	<0.005	<0.005

Sampling Event	Field ID	Location Code	Sampling Date	Work Order	Potassium (Filtered)	Selenium	Selenium (Filtered)	Silicon (Filtered)	Silver	Silver (Filtered)	Sodium (Filtered)	Strontium	Strontium (Filtered)	Uranium	Uranium (Filtered)	Vanadium	Vanadium (Filtered)	Zinc	Zinc (Filtered)
					mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L
Laboratory Limit of Reporting					1	0.01	0.01	50	0.001	0.001	1	0.001	0.001	1	1	0.01	0.01	0.005	0.005
	WQ03	WQ03	26/07/2011	EB1114640	25	<0.01	<0.01	1240	<0.001	<0.001	214	0.206	0.197	<1	<1	-	<0.01	<0.005	<0.005
	WQ04	WQ04	26/07/2011	EB1114640	26	<0.01	<0.01	940	<0.001	<0.001	226	0.224	0.207	<1	<1	-	<0.01	<0.005	<0.005
	QA02	WQ09	27/07/2011	EB1114769	13	<0.01	<0.01	11,800	<0.001	<0.001	3	0.062	0.059	<1	<1	<0.01	<0.01	<0.005	<0.005
	WQ06	WQ06	27/07/2011	EB1114769	6	<0.01	<0.01	6350	<0.001	<0.001	12	0.159	0.135	<1	<1	0.02	<0.01	0.012	<0.005
	WQ08	WQ08	27/07/2011	EB1114769	8	<0.01	<0.01	5150	<0.001	<0.001	2	0.022	0.02	<1	<1	<0.01	<0.01	<0.005	<0.005
	WQ09	WQ09	27/07/2011	EB1114769	13	<0.01	<0.01	11,700	<0.001	<0.001	3	0.063	0.058	<1	<1	<0.01	<0.01	<0.005	<0.005
	WQST	WQST	27/07/2011	EB1114769	21	<0.01	<0.01	6430	<0.001	<0.001	7	0.172	0.162	<1	<1	<0.01	<0.01	<0.005	0.021
Event 5	QA01	WQ04	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ01	WQ01	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ02	WQ02	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ03	WQ03	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ04	WQ04	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA02	WQ09	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ05	WQ05	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ06	WQ06	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ08	WQ08	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ09	WQ09	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQST	WQST	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Event 6	QA01	WQ04	20/09/2011	EB1119345	22	<0.01	<0.01	1590	<0.001	<0.001	221	0.227	0.198	<1	<1	<0.01	<0.01	<0.005	0.012
	WQ01	WQ01	20/09/2011	EB1119345	23	<0.01	<0.01	3510	<0.001	<0.001	234	0.205	0.181	<1	<1	<0.01	<0.01	0.005	<0.005
	WQ02	WQ02	20/09/2011	EB1119345	22	<0.01	<0.01	3110	<0.001	<0.001	232	0.208	0.184	<1	<1	<0.01	<0.01	0.005	<0.005
	WQ03	WQ03	20/09/2011	EB1119345	22	<0.01	<0.01	2330	<0.001	<0.001	232	0.218	0.196	<1	<1	<0.01	<0.01	<0.005	0.043
	WQ04	WQ04	20/09/2011	EB1119345	22	<0.01	<0.01	1580	<0.001	<0.001	224	0.218	0.197	<1	<1	<0.01	<0.01	<0.005	0.04
	WQ05	WQ05	20/09/2011	EB1119345	9	<0.01	<0.01	8470	<0.001	<0.001	4	0.104	0.083	<1	<1	0.01	<0.01	0.009	0.031
	WQ06	WQ06	20/09/2011	EB1119345	7	<0.01	<0.01	7320	<0.001	<0.001	14	0.179	0.153	<1	<1	0.01	<0.01	0.01	0.018
	WQST	WQST	20/09/2011	EB1119345	27	<0.01	<0.01	6260	<0.001	<0.001	10	0.194	0.171	<1	<1	<0.01	<0.01	<0.005	0.015
	QA02	WQ09	21/09/2011	EB1119508	12	-	-	12,400	-	-	3	-	-	-	-	-	<0.01	<0.005	0.018
	WQ08	WQ08	21/09/2011	EB1119508	10	-	-	9680	-	-	2	-	-	-	-	-	<0.01	<0.005	<0.005
	WQ09	WQ09	21/09/2011	EB1119508	12	-	-	12,300	-	-	3	-	-	-	-	-	<0.01	<0.005	0.012

Table C5 Water Results – Hydrocarbon analyses

					Hydrocarbons																									
					PAH/Phenols																TPH									
					Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH C10 - C40 (Sum of total)	TPH+C10 - C36 (Sum of total)	TPH C6-C10
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
				Laboratory Limit of Reporting	1	1	1	1	0.5	1	1	1	1	1	1	1	1	1	1	1	100	100	100	20	50	100	50	100	50	0.02
Sampling Event	Field ID	Location Code	Sampling Date	Work Order																										
Event 1	QA01	WQ04	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ02	WQ02	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ03	WQ03	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ04	WQ04	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ05	WQ05	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQST	WQST	13/04/2011	EB1107318	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA02	QA02	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ01	WQ01	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ06	WQ06	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ08	WQ08	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ09	WQ09	14/04/2011	EB1107452	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Event 2	QA01	QA01	4/05/2011	EB1108606	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ06	WQ06	4/05/2011	EB1108606	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ08	WQ08	4/05/2011	EB1108606	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ09	WQ09	4/05/2011	EB1108606	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	QA02	QA02	5/05/2011	EB1108729	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ01	WQ01	5/05/2011	EB1108729	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ02	WQ02	5/05/2011	EB1108729	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ03	WQ03	5/05/2011	EB1108729	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ04	WQ04	5/05/2011	EB1108729	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQST	WQST	5/05/2011	EB1108729	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
Event 3	QA01	WQ01	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ01	WQ01	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ02	WQ02	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ03	WQ03	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ04	WQ04	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ05	WQ05	21/06/2011	EB1111938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA02	WQ09	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

					Hydrocarbons																									
					PAH/Phenols																TPH									
					Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH C10 - C40 (Sum of total)	TPH+C10 - C36 (Sum of total)	TPH C6-C10
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
Laboratory Limit of Reporting					1	1	1	1	0.5	1	1	1	1	1	1	1	1	1	1	1	100	100	100	20	50	100	50	100	50	0.02
Sampling Event	Field ID	Location Code	Sampling Date	Work Order																										
	WQ06	WQ06	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ08	WQ08	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ09	WQ09	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQST	WQST	22/06/2011	EB1112105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Event 4	QA01	WQ04	26/07/2011	EB1114640	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ01	WQ01	26/07/2011	EB1114640	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ02	WQ02	26/07/2011	EB1114640	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ03	WQ03	26/07/2011	EB1114640	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ04	WQ04	26/07/2011	EB1114640	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	QA02	WQ09	27/07/2011	EB1114769	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	60	<100	60	<0.02
	WQ06	WQ06	27/07/2011	EB1114769	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ08	WQ08	27/07/2011	EB1114769	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ09	WQ09	27/07/2011	EB1114769	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQST	WQST	27/07/2011	EB1114769	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
Event 5	QA01	WQ04	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ01	WQ01	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ02	WQ02	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ03	WQ03	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ04	WQ04	23/08/2011	EB1117117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA02	WQ09	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ05	WQ05	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ06	WQ06	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ08	WQ08	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ09	WQ09	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQST	WQST	24/08/2011	EB1117183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Event 6	QA01	WQ04	20/09/2011	EB1119345	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ01	WQ01	20/09/2011	EB1119345	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ02	WQ02	20/09/2011	EB1119345	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ03	WQ03	20/09/2011	EB1119345	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02

					Hydrocarbons																									
					PAH/Phenols																TPH									
					Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH C10 - C40 (Sum of total)	TPH+C10 - C36 (Sum of total)	TPH C6-C10
					µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
Laboratory Limit of Reporting					1	1	1	1	0.5	1	1	1	1	1	1	1	1	1	1	1	100	100	100	20	50	100	50	100	50	0.02
Sampling Event	**Field ID**	**Location Code**	**Sampling Date**	**Work Order**																										
	WQ04	WQ04	20/09/2011	EB1119345	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ05	WQ05	20/09/2011	EB1119345	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ06	WQ06	20/09/2011	EB1119345	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQST	WQST	20/09/2011	EB1119345	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	QA02	WQ09	21/09/2011	EB1119508	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ08	WQ08	21/09/2011	EB1119508	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02
	WQ09	WQ09	21/09/2011	EB1119508	<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<20	<50	<100	<50	<100	<50	<0.02

Table C6 Elutriate Results – Major Ions, Physical Parameters and Nutrients

Sampling Event	Field ID	Location Code	Sampling Date	Work Order	Filter	Alkalinity (Hydroxide) as CaCO3	Alkalinity (total) as CaCO3	Chloride	pH (Final)	Fluoride	Ammonia as N	Kjeldahl Nitrogen Total	Nitrate (as N)	Nitrite (as N)	Nitrogen (Total)	Reactive Phosphorus as P	Sulphate
						Major Ions and Physical Parameters					Nutrients						
						µg/L	mg/L	mg/L	pH unit	mg/L	µg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L
Laboratory Limit of Reporting						1000	1	1	0.1	0.1	5	0.01	0.002	0.002	10	0.001	1
Event 4	QA03	WQ12	27/07/2011	EB1114957		<1000	4	<1	6.4	0.1	86	0.05	<0.002	0.08	70	0.092	2
	QA03	WQ12	27/07/2011	EB1114957	.45µm filter	-	-	-	6.4	-	-	-	-	-	-	-	-
	WQ10	WQ10	27/07/2011	EB1114957		<1000	2	<1	7.5	<0.1	24	0.02	<0.002	0.023	30	0.052	2
	WQ10	WQ10	27/07/2011	EB1114957	.45µm filter	-	-	-	7.5	-	-	-	-	-	-	-	-
	WQ11	WQ11	27/07/2011	EB1114957		<1000	22	<1	9.1	0.1	10	<0.01	0.002	0.016	20	0.105	<1
	WQ11	WQ11	27/07/2011	EB1114957	.45µm filter	-	-	-	9.1	-	-	-	-	-	-	-	-
	WQ12	WQ12	27/07/2011	EB1114957		<1000	3	<1	7.7	<0.1	122	0.03	<0.002	0.11	80	0.077	2
	WQ12	WQ12	27/07/2011	EB1114957	.45µm filter	-	-	-	7.7	-	-	-	-	-	-	-	-

Table C7 Elutriate Results - Metals

Sampling Event	Field ID	Location Code	Sampling Date	Work Order	Filter	Metals: Aluminium	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Molybdenum	Nickel	Phosphorus	Potassium	Selenium	Silver	Sodium	Strontium	Uranium	Vanadium	Zinc
						mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L
Laboratory Limit of Reporting						0.01	0.001	0.001	0.001	0.05	0.0001	1	0.001	0.001	0.001	0.05	0.001	1	0.001	0.001	0.001	0.005	1	0.01	0.001	1	0.001	1	0.01	0.005
Event 4	QA03	WQ12	27/07/2011	EB1114957		2.76	<0.001	0.309	<0.001	0.14	<0.0001	<1	0.002	<0.001	0.002	1.33	0.001	<1	0.009	<0.001	0.001	0.102	<1	<0.01	<0.001	4	0.009	<1	<0.01	0.034
	QA03	WQ12	27/07/2011	EB1114957	.45µm filter	1.14	0.001	0.108	<0.001	0.13	<0.0001	-	<0.001	<0.001	<0.001	0.5	<0.001	-	0.002	<0.001	<0.001	-	-	<0.01	<0.001	-	0.004	<1	<0.01	0.012
	WQ10	WQ10	27/07/2011	EB1114957		1.73	<0.001	0.279	<0.001	0.11	<0.0001	<1	0.003	<0.001	0.002	1.8	0.001	<1	0.023	<0.001	0.002	0.039	<1	<0.01	<0.001	3	0.008	<1	<0.01	0.025
	WQ10	WQ10	27/07/2011	EB1114957	.45µm filter	1.13	<0.001	0.148	<0.001	0.14	<0.0001	-	0.002	<0.001	<0.001	0.9	<0.001	-	0.007	<0.001	<0.001	-	-	<0.01	<0.001	-	0.006	<1	<0.01	0.009
	WQ11	WQ11	27/07/2011	EB1114957		1.04	0.001	0.47	<0.001	0.06	<0.0001	6	0.005	0.002	0.002	1.27	0.002	<1	0.155	<0.001	0.001	0.021	<1	<0.01	<0.001	3	0.047	<1	0.01	0.007
	WQ11	WQ11	27/07/2011	EB1114957	.45µm filter	0.25	0.001	0.397	<0.001	0.05	<0.0001	-	0.003	<0.001	<0.001	0.18	<0.001	-	0.009	<0.001	<0.001	-	-	<0.01	<0.001	-	0.045	<1	<0.01	<0.005
	WQ12	WQ12	27/07/2011	EB1114957		4.24	0.001	0.372	<0.001	0.12	<0.0001	<1	0.003	<0.001	0.003	2.43	0.002	<1	0.014	<0.001	0.002	0.128	<1	<0.01	<0.001	3	0.011	<1	<0.01	0.039
	WQ12	WQ12	27/07/2011	EB1114957	.45µm filter	1.33	<0.001	0.122	<0.001	0.12	<0.0001	-	0.001	<0.001	<0.001	0.62	<0.001	-	0.002	<0.001	<0.001	-	-	<0.01	<0.001	-	0.005	<1	<0.01	0.01

Table C8 Elutriate Results - Hydrocarbons

						Hydrocarbons																							
						PAH/Phenols																TPH							
						Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH C10 - C40 (Sum of total)	TPH+C10 - C36 (Sum of total)
						µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Laboratory Limit of Reporting						1	1	1	1	0.5	1	1	1	1	1	1	1	1	1	1	1	100	100	100	50	100	50	100	50
Sampling Event	Field ID	Location Code	Sampling Date	Work Order	Filter																								
Event 4	QA03	WQ12	27/07/2011	EB1114957		<1	<1	<1	<1	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	120	<100	<50	<100	80	120	80
	QA03	WQ12	27/07/2011	EB1114957	.45µm filter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ10	WQ10	27/07/2011	EB1114957		<1	<1	<1	<1	<0.6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<50	<100	<50	<100	<50
	WQ10	WQ10	27/07/2011	EB1114957	.45µm filter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ11	WQ11	27/07/2011	EB1114957		<1	<1	<1	<1	<0.6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<50	<100	<50	<100	<50
	WQ11	WQ11	27/07/2011	EB1114957	.45µm filter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ12	WQ12	27/07/2011	EB1114957		<1	<1	<1	<1	<0.6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<100	<100	<100	<50	<100	<50	<100	<50
	WQ12	WQ12	27/07/2011	EB1114957	.45µm filter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C9 Sediment Results – Biological Analyses, Nutrients and PSD

					Biological	Nutrients									PSD															
					Faecal Coliforms	Ammonia as N	Kjeldahl Nitrogen Total	Moisture	Nitrate (as N)	Nitrite (as N)	Nitrogen (Total Oxidised)	Nitrogen (Total)	Reactive Phosphorus as P	TOC	+1180µm	+150µm	+19.0mm	+2.36mm	+300µm	+37.5mm	+4.75mm	+425µm	+600µm	+75.0mm	+75µm	+9.5mm	Clay (<2 µm)	Gravel (>2mm)	Silt (2-60 µm)	Sand (0.06-2.00 mm)
					MPN/g	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Laboratory Limit of Reporting						20	20	1	0.1	0.1	0.1	20	0.1	0.02	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sampling Event	Field ID	Location Code	Sampling Date	Work Order																										
Event 4	QA01	WQ04	26/07/2011	EB1114957	4	<20	150	24.3	<0.1	<0.1	<0.1	150	<0.1	0.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA02	WQ09	27/07/2011	EB1114957	>1100	<20	870	38.2	<0.1	<0.1	<0.1	870	<0.1	1.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	WQ01	WQ01	26/07/2011	EB1114957	<3	<20	50	18.7	<0.1	<0.1	<0.1	50	<0.1	0.09	40	97	<1	9	90	<1	<1	81	69	<1	98	<1	1	9	1	89
	WQ02	WQ02	26/07/2011	EB1114957	<3	<20	20	22.8	<0.1	<0.1	<0.1	20	<0.1	0.02	20	98	<1	3	96	<1	<1	85	58	<1	98	<1	1	3	<1	96
	WQ03	WQ03	26/07/2011	EB1114957	<3	<20	30	23	<0.1	<0.1	<0.1	30	<0.1	0.06	24	98	<1	3	97	<1	<1	86	63	<1	98	<1	2	3	<1	95
	WQ04	WQ04	26/07/2011	EB1114957	9	<20	90	25.1	<0.1	<0.1	<0.1	90	<0.1	0.32	<1	78	<1	<1	40	<1	<1	9	1	<1	87	<1	7	<1	5	88
	WQ06	WQ06	27/07/2011	EB1114957	9	40	660	28.1	<0.1	<0.1	<0.1	660	<0.1	0.65	<1	23	<1	<1	8	<1	<1	4	2	<1	47	<1	28	<1	19	53
	WQ08	WQ08	27/07/2011	EB1114957	4	30	110	19.4	<0.1	<0.1	<0.1	110	0.1	0.86	12	62	<1	9	36	<1	4	24	17	<1	80	<1	7	9	11	73
	WQ09	WQ09	27/07/2011	EB1114957	240	<20	1050	39.3	<0.1	<0.1	<0.1	1050	<0.1	0.47	5	62	<1	3	28	<1	<1	15	9	<1	86	<1	6	3	5	86
	WQ10	WQ10	27/07/2011	EB1114957	<3	<20	450	14.3	0.2	<0.1	0.2	450	0.1	0.59	8	73	<1	4	64	<1	2	49	28	<1	76	<1	15	4	8	73
	WQ11	WQ11	27/07/2011	EB1114957	<3	<20	30	17	0.3	<0.1	0.3	30	0.1	0.07	28	94	<1	15	79	<1	6	63	47	<1	96	<1	3	15	<1	82
	WQ12	WQ12	27/07/2011	EB1114957	15	<20	220	18.9	0.1	<0.1	0.1	220	0.2	0.25	7	30	<1	6	17	<1	4	12	9	<1	44	<1	26	6	25	43
	WQ5T	WQ5T	27/07/2011	EB1114957	9	30	940	26.5	<0.1	0.1	0.1	940	0.2	1.12	3	47	<1	1	18	<1	<1	10	6	<1	70	<1	9	1	15	75

Table C10 Sediment Results - Metals

Sampling Event	Field ID	Location Code	Sampling Date	Work Order	Metals: Aluminium (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Chromium (III+VI) (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Manganese (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Nickel (mg/kg)	Phosphorus (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Strontium (mg/kg)	Uranium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
				Laboratory Limit of Reporting	50	0.1	0.1	0.1	50	0.1	0.1	0.1	0.1	50	0.1	0.1	0.1	0.1	0.1	2	1	0.1	0.1	0.1	1	0.1
Event 4	QA01	WQ04	26/07/2011	EB1114957	2010	0.8	36.5	0.2	<50	<0.1	6	2.4	2.8	3680	2.5	63.2	<0.1	<0.1	2.2	64	<1	<0.1	3.6	0.2	12	4.9
	QA02	WQ09	27/07/2011	EB1114957	1900	0.6	27.6	0.2	<50	<0.1	16.6	3.6	2.6	4280	2.8	127	<0.1	0.1	1.8	136	<1	<0.1	3.9	0.2	13	4.4
	WQ01	WQ01	26/07/2011	EB1114957	600	0.3	12.6	<0.1	<50	<0.1	2.2	0.5	0.6	1360	0.9	13.3	<0.1	<0.1	0.6	25	<1	<0.1	1.4	<0.1	4	1.5
	WQ02	WQ02	26/07/2011	EB1114957	380	0.5	6.8	<0.1	<50	<0.1	1.5	0.5	0.3	1090	0.5	11.4	<0.1	<0.1	0.4	21	<1	<0.1	0.6	<0.1	2	0.8
	WQ03	WQ03	26/07/2011	EB1114957	320	0.3	9.8	<0.1	<50	<0.1	1.6	0.6	0.4	1100	0.4	59.1	<0.1	<0.1	0.5	17	<1	<0.1	0.9	<0.1	3	1.1
	WQ04	WQ04	26/07/2011	EB1114957	1200	0.5	24.1	0.2	<50	<0.1	4.5	1.5	1.7	2220	1.8	27.3	<0.1	<0.1	1.4	47	<1	<0.1	2.8	0.1	8	3.5
	WQ06	WQ06	27/07/2011	EB1114957	7950	1.2	188	0.5	<50	<0.1	17.4	5	8.1	9410	8.4	225	<0.1	0.1	6.6	155	<1	<0.1	21.9	0.7	34	12.5
	WQ08	WQ08	27/07/2011	EB1114957	2860	0.9	20.7	0.2	<50	<0.1	24	2.3	3.6	4880	3.3	58.6	<0.1	0.2	3.3	74	<1	<0.1	2.1	0.1	20	2.6
	WQ09	WQ09	27/07/2011	EB1114957	2100	1.1	33.8	0.2	<50	<0.1	20.3	4.4	3.2	6280	6.2	181	<0.1	0.2	2.1	175	<1	<0.1	4.5	0.2	22	4.7
	WQ10	WQ10	27/07/2011	EB1114957	3280	4	31.5	0.4	<50	<0.1	36.6	4.8	5	10,200	5.2	136	<0.1	0.3	5.3	105	<1	<0.1	5.8	0.4	46	4.4
	WQ11	WQ11	27/07/2011	EB1114957	2020	3.1	665	0.5	<50	<0.1	47.1	28	6.2	12,100	22.4	3450	<0.1	0.4	13.1	45	<1	<0.1	12.1	0.2	51	2.7
	WQ12	WQ12	27/07/2011	EB1114957	6090	1.5	17.4	0.7	<50	<0.1	21.1	4.6	12.1	10,900	6.7	87.4	<0.1	0.3	6.2	92	<1	<0.1	7.1	1.6	32	10
	WQ5T	WQ5T	27/07/2011	EB1114957	2100	1.9	89.7	0.5	<50	<0.1	9.9	5.4	6.3	6720	30.2	232	<0.1	0.1	3.9	199	<1	<0.1	10.5	0.2	24	9.7

Table C11 Sediment Results - Hydrocarbons

Sampling Event	Field ID	Location Code	Sampling Date	Work Order	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH C10 - C40 (Sum of total)	TPH+C10 - C36 (Sum of total)	TPH C6-C10
					Hydrocarbons																									
					PAH/Phenols																TPH									
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	-	-	-	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Laboratory Limit of Reporting					0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	50	100	100	10	50	100	100	50	50	10
Event 4	QA01	WQ04	26/07/2011	EB1114957	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<100	<100	<10	<50	<100	<100	<50	<50	<10
	QA02	WQ09	27/07/2011	EB1114957	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<100	<100	<10	<50	<100	<100	<50	<50	<10
	WQ01	WQ01	26/07/2011	EB1114957	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<100	<100	<10	<50	<100	<100	<50	<50	<10
	WQ02	WQ02	26/07/2011	EB1114957	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<100	<100	<10	<50	<100	<100	<50	<50	<10
	WQ03	WQ03	26/07/2011	EB1114957	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<100	<100	<10	<50	<100	<100	<50	<50	<10
	WQ04	WQ04	26/07/2011	EB1114957	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<100	<100	<10	<50	<100	<100	<50	<50	<10
	WQ06	WQ06	27/07/2011	EB1114957	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<100	<100	<10	<50	<100	<100	<50	<50	<10
	WQ08	WQ08	27/07/2011	EB1114957	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<100	<100	<10	<50	<100	<100	<50	<50	<10
	WQ09	WQ09	27/07/2011	EB1114957	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<100	<100	<10	<50	<100	<100	<50	<50	<10
	WQ10	WQ10	27/07/2011	EB1114957	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<100	<100	<10	<50	<100	<100	<50	<50	<10
	WQ11	WQ11	27/07/2011	EB1114957	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<100	<100	<10	<50	<100	<100	<50	<50	<10
	WQ12	WQ12	27/07/2011	EB1114957	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<100	<100	<10	<50	<100	<100	<50	<50	<10
	WQ5T	WQ5T	27/07/2011	EB1114957	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<50	<100	<100	<10	<50	<100	<100	<50	<50	<10

					cas_rn	>C10 - C16 FRAC	>C10 - C40 FRAC	>C16 - C34 FRAC	>C34 - C40 FRAC	11104-93-1	13494-80-9
					Chemical Name	TRH_>C10 - C16	TRH_>C10 - C40	TRH_>C16 - C34	TRH_>C34 - C40	NOx	Tellurium
					Fraction	N	N	N	N	N	D
					Report_Result_Unit	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
sys_loc_code	sample_name	sample_date	REMARK	Point x	Point y	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
BEL01	BEL01	41242.35139		-21.95946	146.656819	50	50	50	50	0.04	0.00250
BEL01	BEL01	41326.375		-21.95946	146.656819	50	110	110	50	0.03	
BEL01	BEL01	41347.63542		-21.95946	146.656819	50	50	50	50	0.07	
BEL01	BEL01	41374.40278		-21.95946	146.656819	50	50	50	50	0.22	
CAR01	CAR01	41213.73958		-22.073631	146.467591	50	50	50	50	0.03	0.00250
CAR01	CAR01	41214.42708		-22.073631	146.467591	50	50	50	50	0.08	0.00250
CAR01	CAR01	41241.68056		-22.073631	146.467591	50	110	110	50	0.05	0.00250
CAR01	CAR01	41373.48958		-22.073631	146.467591	50	110	110	50	0.2	
CAR02	CAR02	41213.69097		-22.097575	146.405555	50	50	50	50	0.04	0.00250
CAR02	CAR02	41241.33542		-22.097575	146.405555	50	50	50	50	0.07	0.00250
CAR02	CAR02	41347.55556		-22.097575	146.405555	50	50	50	50	0.06	
CAR02	CAR02	41373.63542		-22.097575	146.405555	50	50	50	50	0.01	
CAR04	CAR04	41325.56597				50	50	50	50	0.02	
CCK01	CCK01	41214.32292		-22.088734	146.260416	50	50	50	50	0.06	0.00250
CCK01	CCK01	41241.52778		-22.088734	146.260416	50	50	50	50	0.03	0.00250
CCK01	CCK01	41325.51389		-22.088734	146.260416	50	50	50	50	0.03	
CT01	CT01	41213.66528		-22.073631	146.467591	50	50	50	50	0.05	0.0025
CT01	CT01	41241.35764		-22.073631	146.467591	50	50	50	50	0.04	0.0025
CT01	CT01	41262.40278		-22.073631	146.467591	50	50	50	50	0.03	
CT01	CT01	41284.39583		-22.073631	146.467591	50	50	50	50	0.04	0.0025
CT01	CT01	41373.56944		-22.073631	146.467591	50	50	50	50	0.62	
DCK01	DCK01	41213.54514		-22.088832	146.2606	50	100	100	50	0.03	0.0025
DCK01	DCK01	41214.36111		-22.088832	146.2606	50	140	140	50	0.005	0.0025
DCK01	DCK01	41241.41667		-22.088832	146.2606	50	50	50	50	0.08	0.0025
DCK01	DCK01	41262.34375		-22.088832	146.2606	50	50	50	50	0.03	
DCK01	DCK01	41284.32639		-22.088832	146.2606	50	50	50	50	0.02	0.0025
DCK01	DCK01	41325.49306		-22.088832	146.2606	50	50	50	50	0.01	
DCK01	DCK01	41347.42014		-22.088832	146.2606	50	50	50	50	0.09	
ECK02	ECK02	41374.30208		-21.998187	146.346251	50	50	50	50	0.19	
					Global Average	50.000	61.034	61.034	50.000	0.078	0.003
					Median	50.000	50.000	50.000	50.000	0.040	0.003
					Minimum	50.000	51.000	52.000	53.000	54.000	55.000
					Maximum	50.000	140.000	140.000	50.000	0.620	0.003
					20th Percentile	50.000	50.000	50.000	50.000	0.030	0.003
					80th Percentile	50.000	50.000	50.000	50.000	0.080	0.003

13494-80-9	14797-55-8	14797-55-8	14797-65-0	14797-65-0	14808-79-8	14808-79-8	16887-00-6	16984-48-8	16984-48-8	17060-07-0
Tellurium	Nitrate as N	Nitrate as N	Nitrite as N	Nitrite as N	Sulfate	Sulfate	Chloride	Fluoride	Fluoride	1,2-Dichloroethane-D
T	N	N	N	N	D	T	N	N	N	N
mg/L	mg/kg	mg/L	mg/kg	mg/L	mg/L	mg/kg	mg/L	mg/kg	mg/L	%
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
0.0025		0.04		0.005			255		0.4	104
		0.03		0.005			64		0.4	104
		0.07		0.005			25		0.2	108
	0.05	0.22	0.05	0.005	6	50	12	0.5	0.2	98.3
0.0025		0.03		0.005			652		0.5	98.9
0.0025		0.08		0.005			501		0.4	104
0.0025		0.05		0.005			178		0.1	127
	0.05	0.06	0.05	0.14	3	150	158	3	0.4	96
0.0025		0.04		0.005			539		0.5	105
0.0025		0.07		0.005			171		0.2	95.6
		0.06		0.005			81		0.2	106
		0.01		0.005	2		111		0.2	105
		0.02		0.005			334		0.4	114
0.0025		0.06		0.005			348		0.5	97.4
0.0025		0.03		0.005			359		0.5	101
		0.03		0.005			386		0.5	123
0.0025		0.05		0.005			12		0.05	98.6
0.0025		0.04		0.005			13		0.1	113
		0.03		0.005			22		0.1	81.7
0.0025	0.1	0.04	0.05	0.005		150	26	80	0.2	105
	0.2	0.62	0.05	0.005	9	140	29	0.5	0.1	99.2
0.0025		0.03		0.005			78		0.1	97.4
0.0025		0.005		0.005			39		0.05	102
0.0025		0.08		0.005			153		0.3	97.8
		0.03		0.005			191		0.4	89.5
0.0025		0.02		0.005			168		0.3	101
		0.01		0.005			164		0.4	102
		0.09		0.005			42		0.2	119
		0.19		0.005	2		4		0.1	94
0.003	0.100	0.074	0.050	0.010	4.400	122.500	176.379	21.000	0.276	103.014
0.003	0.100	0.040	0.050	0.005	3.700	140.000	155.500	3.000	0.238	102.000
56.000	57.000	58.000	59.000	60.000	61.000	62.000	63.000	64.000	65.000	66.000
0.003	0.200	0.620	0.050	0.140	9.000	150.000	652.000	80.000	0.500	127.000
0.003	0.050	0.030	0.050	0.005	2.000	104.000	25.600	0.500	0.100	97.400
0.003	0.140	0.074	0.050	0.005	6.600	150.000	339.600	33.800	0.400	106.800

2037-26-5	3812-32-6	460-00-4	71-52-3	7429-90-5	7429-90-5	7429-90-5	7429-91-6	7429-91-6	7439-89-6	7439-89-6
Toluene-D8	Carbonate Alkalinity a	4-Bromofluorobenzer	Bicarbonate Alkalinity	Aluminium	Aluminium	Aluminium	Dysprosium	Dysprosium	Iron	Iron
N	N	N	N	D	T	T	D	T	D	T
%	mg/L	%	mg/L	mg/L	mg/kg	mg/L	mg/L	mg/L	mg/L	mg/kg
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
98.2	11	99.7	224	0.005		0.98	0.0005	0.0005	0.025	
103	0.5	108	201	0.04		3.47			0.025	
109	0.5	104	69	0.11		11.8			0.12	
103	0.5	108	62	0.06		20.2			0.025	
97.6	10	100	242	0.005		0.28	0.0005	0.0005	0.09	
98.6	0.5	101	201	0.005		0.84	0.0005	0.0005	0.08	
124	0.5	126	118	0.08		0.99	0.0005	0.0005	0.88	
94.3	0.5	102	170	0.005		6.2			0.28	
103	9	105	219	0.005		0.29	0.0005	0.0005	0.14	
89.8	0.5	88.4	110	0.02		0.31	0.0005	0.0005	0.61	
102	0.5	98.4	61	0.17		14.7			0.45	
92.5	0.5	103	115	0.04		0.88			0.32	
114	0.5	120	186	0.005		0.08			0.22	
95.8	8	97.5	227	0.005		0.56	0.0005	0.0005	0.29	
91.3	3	92.7	239	0.005		0.14	0.0005	0.0005	0.1	
117	10	122	267	0.005		0.07			0.025	
97	0.5	97.6	27	0.17		3.61	0.0005	0.0005	0.87	
104	0.5	104	38	0.25		2.9	0.0005	0.0005	1.08	
83.6	0.5	81	40	0.1		3.96			1.53	
98.6	0.5	106	45	0.81	4610	4.69	0.0005	0.001	2.78	9620
101	0.5	107	49	0.02		22			0.09	
94	0.5	97.2	31	0.07		15	0.0005	0.005	0.58	
97.8	0.5	99.6	53	0.15		11.1	0.0005	0.004	0.58	
90.3	0.5	91.4	107	0.005		0.18	0.0005	0.0005	0.28	
84.7	0.5	83.5	107	0.005		0.04			0.025	
96.9	0.5	104	105	0.02		0.17	0.0005	0.0005	0.13	
104	0.5	104	144	0.005		0.08			0.08	
105	0.5	101	46	0.13		15.4			0.26	
102	0.5	106	16	1.37		16.1			0.59	
99.724	2.155	102.000	121.345	0.127	4610.000	5.414	0.001	0.001	0.433	9620.000
98.600	0.500	102.000	108.500	0.030	4610.000	1.945	0.001	0.001	0.270	9620.000
67.000	68.000	69.000	70.000	71.000	72.000	73.000	74.000	75.000	76.000	77.000
124.000	11.000	126.000	267.000	1.370	4610.000	22.000	0.001	0.005	2.780	9620.000
93.400	0.500	97.380	45.600	0.005	4610.000	0.176	0.001	0.001	0.080	9620.000
104.000	1.500	106.400	208.200	0.138	4610.000	12.960	0.001	0.001	0.598	9620.000

7439-89-6	7439-91-0	7439-91-0	7439-92-1	7439-92-1	7439-92-1	7439-93-2	7439-93-2	7439-94-3	7439-94-3	7439-95-4
Iron	Lanthanum	Lanthanum	Lead	Lead	Lead	Lithium	Lithium	Lutetium	Lutetium	Magnesium
T	D	T	D	T	T	D	T	D	T	D
mg/L	mg/L	mg/L	mg/L	mg/kg	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
1.45	0.0005	0.001	0.0005		0.001	0.002	0.002	0.0005	0.0005	19
4.62			0.0005		0.004					14
10.4			0.0005		0.008					4
23.7			0.0005		0.013					4
1.06	0.0005	0.0005	0.0005		0.0005	0.002	0.002	0.0005	0.0005	35
3.34	0.0005	0.002	0.0005		0.0005	0.002	0.003	0.0005	0.0005	24
7.25	0.0005	0.003	0.0005		0.001	0.001	0.002	0.0005	0.0005	12
20.1			0.0005		0.01					13
1.18	0.0005	0.0005	0.0005		0.0005	0.002	0.002	0.0005	0.0005	27
4.74	0.0005	0.002	0.0005		0.0005	0.002	0.002	0.0005	0.0005	12
20.2			0.0005		0.006					6
5.15			0.0005		0.0005					11
0.64			0.0005		0.0005					17
2.36	0.0005	0.001	0.0005		0.0005	0.003	0.003	0.0005	0.0005	6
0.87	0.0005	0.0005	0.0005		0.0005	0.003	0.003	0.0005	0.0005	6
0.21			0.0005		0.0005					7
7.16	0.0005	0.003	0.0005		0.003	0.0005	0.002	0.0005	0.0005	2
9.2	0.001	0.004	0.0005		0.004	0.0005	0.002	0.0005	0.0005	3
12.2			0.0005		0.005					4
14.4	0.002	0.007	0.002	6.1	0.007	0.001	0.003	0.0005	0.0005	4
45.9			0.0005		0.03					4
25.3	0.001	0.028	0.0005		0.014	0.001	0.008	0.0005	0.0005	5
20.1	0.001	0.024	0.0005		0.013	0.001	0.007	0.0005	0.0005	5
4.95	0.0005	0.0005	0.0005		0.0005	0.001	0.001	0.0005	0.0005	8
3.63			0.0005		0.0005					10
3.25	0.0005	0.0005	0.0005		0.0005	0.001	0.002	0.0005	0.0005	9
1.34			0.0005		0.0005					8
21			0.0005		0.006					3
14.4			0.0005		0.008					0.5
10.003	0.001	0.005	0.001	6.100	0.005	0.002	0.003	0.001	0.001	9.741
6.155	0.001	0.002	0.001	6.100	0.002	0.001	0.002	0.001	0.001	7.500
78.000	79.000	80.000	81.000	82.000	83.000	84.000	85.000	86.000	87.000	88.000
45.900	0.002	0.028	0.002	6.100	0.030	0.003	0.008	0.001	0.001	35.000
1.406	0.001	0.001	0.001	6.100	0.001	0.001	0.002	0.001	0.001	4.000
20.100	0.001	0.005	0.001	6.100	0.008	0.002	0.003	0.001	0.001	13.400

7439-96-5	7439-96-5	7439-96-5	7439-97-6	7439-97-6	7439-97-6	7439-98-7	7439-98-7	7440-00-8	7440-00-8	7440-02-0
Manganese	Manganese	Manganese	Mercury	Mercury	Mercury	Molybdenum	Molybdenum	Neodymium	Neodymium	Nickel
D	T	T	D	T	T	D	T	D	T	D
mg/L	mg/kg	mg/L	mg/L	mg/kg	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
0.048		0.345	0.00005		0.00005	0.001	0.001	0.0005	0.002	0.002
0.002		0.264	0.00005		0.00005	0.001	0.001			0.003
0.001		0.258	0.00005		0.00005	0.0005	0.0005			0.001
0.0005		0.442	0.00005		0.00005	0.0005	0.0005			0.0005
0.616		0.695	0.00005		0.00005	0.0005	0.0005	0.0005	0.0005	0.002
0.545		0.736	0.00005		0.00005	0.0005	0.0005	0.0005	0.002	0.002
1.69		1.96	0.00005		0.00005	0.0005	0.0005	0.0005	0.004	0.002
0.123		1.05	0.00005		0.00005	0.0005	0.0005			0.001
0.178		0.245	0.00005		0.00005	0.0005	0.0005	0.0005	0.0005	0.001
1.48		1.68	0.00005		0.00005	0.0005	0.0005	0.0005	0.002	0.002
0.014		0.288	0.00005		0.00005	0.0005	0.0005			0.001
0.005		1.62	0.00005		0.00005	0.0005	0.0005			0.0005
0.126		0.16	0.00005		0.00005	0.0005	0.0005			0.0005
0.412		0.495	0.00005		0.00005	0.0005	0.0005	0.0005	0.001	0.001
0.028		0.383	0.00005		0.00005	0.0005	0.0005	0.0005	0.0005	0.0005
0.006		0.113	0.00005		0.00005	0.0005	0.0005			0.0005
0.016		0.101	0.00005		0.00005	0.0005	0.0005	0.001	0.005	0.002
0.141		0.316	0.00005		0.00005	0.0005	0.0005	0.001	0.006	0.002
0.217		0.423	0.00005		0.00005	0.0005	0.0005			0.002
0.137	88	0.339	0.00005	0.005	0.00005	0.0005	0.0005	0.002	0.009	0.002
0.028		0.529	0.00005		0.00005	0.0005	0.0005			0.0005
0.246		0.803	0.00005		0.00005	0.0005	0.0005	0.002	0.036	0.003
0.231		0.69	0.00005		0.00005	0.0005	0.0005	0.002	0.031	0.003
0.793		0.868	0.00005		0.00005	0.0005	0.0005	0.0005	0.001	0.002
0.524		0.58	0.00005		0.00005	0.0005	0.001			0.0005
0.508		0.547	0.00005		0.00005	0.0005	0.0005	0.0005	0.0005	0.0005
0.233		0.244	0.00005		0.00005	0.0005	0.0005			0.0005
0.121		0.382	0.00005		0.00005	0.0005	0.0005			0.002
0.002		0.222	0.00005		0.00005	0.0005	0.0005			0.0005
0.292	88.000	0.579	0.000	0.005	0.000	0.001	0.001	0.001	0.007	0.001
0.139	88.000	0.433	0.000	0.005	0.000	0.001	0.001	0.001	0.002	0.001
89.000	90.000	91.000	92.000	93.000	94.000	95.000	96.000	97.000	98.000	99.000
1.690	88.000	1.960	0.000	0.005	0.000	0.001	0.001	0.002	0.036	0.003
0.011	88.000	0.253	0.000	0.005	0.000	0.001	0.001	0.001	0.001	0.001
0.514	88.000	0.763	0.000	0.005	0.000	0.001	0.001	0.001	0.007	0.002

7440-02-0	7440-02-0	7440-09-7	7440-10-0	7440-10-0	7440-17-7	7440-17-7	7440-19-9	7440-19-9	7440-22-4	7440-22-4
Nickel	Nickel	Potassium	Praseodymium	Praseodymium	Rubidium	Rubidium	Samarium	Samarium	Silver	Silver
T	T	D	D	T	D	T	D	T	D	T
mg/kg	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/kg
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
	0.003	18	0.0005	0.0005	0.014	0.016	0.0005	0.0005	0.0005	
	0.005	16							0.0005	
	0.008	6							0.0005	
	0.016	5							0.0005	
	0.002	38	0.0005	0.0005	0.046	0.046	0.0005	0.0005	0.0005	
	0.002	31	0.0005	0.0005	0.047	0.05	0.0005	0.0005	0.0005	
	0.003	12	0.0005	0.0005	0.017	0.019	0.0005	0.0005	0.0005	
	0.008	45							0.0005	
	0.001	32	0.0005	0.0005	0.046	0.047	0.0005	0.0005	0.0005	
	0.003	12	0.0005	0.0005	0.017	0.018	0.0005	0.0005	0.0005	
	0.012	10							0.0005	
	0.002	13							0.0005	
	0.0005	24							0.0005	
	0.001	27	0.0005	0.0005	0.05	0.052	0.0005	0.0005	0.0005	
	0.001	26	0.0005	0.0005	0.06	0.061	0.0005	0.0005	0.0005	
	0.0005	33							0.0005	
	0.004	8	0.0005	0.001	0.003	0.011	0.0005	0.0005	0.0005	
	0.004	7	0.0005	0.002	0.004	0.01	0.0005	0.001	0.0005	
	0.005	14							0.0005	
5.1	0.006	13	0.0005	0.002	0.006	0.015	0.0005	0.002	0.0005	0.05
	0.02	20							0.0005	
	0.016	7	0.0005	0.009	0.005	0.04	0.0005	0.008	0.0005	
	0.015	5	0.0005	0.008	0.004	0.039	0.0005	0.006	0.0005	
	0.002	12	0.0005	0.0005	0.035	0.036	0.0005	0.0005	0.0005	
	0.0005	20							0.0005	
	0.0005	15	0.0005	0.0005	0.039	0.043	0.0005	0.0005	0.0005	
	0.0005	17							0.0005	
	0.015	6							0.0005	
	0.01	2							0.0005	
5.100	0.006	17.034	0.001	0.002	0.026	0.034	0.001	0.002	0.001	0.050
5.100	0.004	14.500	0.001	0.001	0.022	0.038	0.001	0.001	0.001	0.050
100.000	101.000	102.000	103.000	104.000	105.000	106.000	107.000	108.000	109.000	110.000
5.100	0.020	45.000	0.001	0.009	0.060	0.061	0.001	0.008	0.001	0.050
5.100	0.001	7.000	0.001	0.001	0.005	0.016	0.001	0.001	0.001	0.050
5.100	0.011	26.400	0.001	0.002	0.046	0.048	0.001	0.001	0.001	0.050

7440-22-4	7440-23-5	7440-24-6	7440-24-6	7440-27-9	7440-27-9	7440-28-0	7440-28-0	7440-29-1	7440-29-1	7440-30-4
Silver	Sodium	Strontium	Strontium	Terbium	Terbium	Thallium	Thallium	Thorium	Thorium	Thulium
T	D	D	T	D	T	D	T	D	T	D
mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
0.0005	194	0.284	0.34	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
0.0005	76									
0.0005	32									
0.0005	22									
0.0005	420	0.41	0.418	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
0.0005	318	0.272	0.289	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
0.0005	120	0.2	0.218	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
0.0005	111									
0.0005	349	0.31	0.32	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
0.0005	118	0.194	0.202	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
0.0005	58									
0.0005	82									
0.0005	236									
0.0005	285	0.165	0.172	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
0.0005	342	0.184	0.19	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
0.0005	330									
0.0005	8	0.06	0.071	0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.0005
0.0005	9	0.08	0.091	0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.0005
0.0005	11									
0.0005	13	0.114	0.136	0.0005	0.0005	0.0005	0.0005	0.0005	0.002	0.0005
0.0005	17									
0.0005	46	0.089	0.152	0.0005	0.001	0.0005	0.0005	0.0005	0.012	0.0005
0.0005	28	0.059	0.102	0.0005	0.0005	0.0005	0.0005	0.0005	0.01	0.0005
0.0005	112	0.151	0.156	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
0.0005	134									
0.0005	122	0.15	0.166	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
0.0005	132									
0.0005	39									
0.0005	6									
0.001	130.000	0.181	0.202	0.001	0.001	0.001	0.001	0.001	0.002	0.001
0.001	111.500	0.173	0.181	0.001	0.001	0.001	0.001	0.001	0.001	0.001
111.000	112.000	113.000	114.000	115.000	116.000	117.000	118.000	119.000	120.000	121.000
0.001	420.000	0.410	0.418	0.001	0.001	0.001	0.001	0.001	0.012	0.001
0.001	20.000	0.087	0.129	0.001	0.001	0.001	0.001	0.001	0.001	0.001
0.001	255.600	0.274	0.295	0.001	0.001	0.001	0.001	0.001	0.001	0.001

7440-30-4	7440-31-5	7440-31-5	7440-32-6	7440-32-6	7440-36-0	7440-36-0	7440-36-0	7440-38-2	7440-38-2	7440-38-2
Thulium	Tin	Tin	Titanium	Titanium	Antimony	Antimony	Antimony	Arsenic	Arsenic	Arsenic
T	D	T	D	T	D	T	T	D	T	T
mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/kg	mg/L	mg/L	mg/kg	mg/L
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
0.0005	0.0005	0.0005	0.005	0.005	0.0005		0.0005	0.004		0.004
								0.004		0.006
								0.002		0.005
								0.001		0.005
0.0005	0.0005	0.0005	0.005	0.005	0.0005		0.0005	0.0005		0.001
0.0005	0.0005	0.0005	0.005	0.01	0.0005		0.0005	0.0005		0.0005
0.0005	0.0005	0.0005	0.005	0.005	0.0005		0.0005	0.002		0.004
								0.002		0.01
0.0005	0.0005	0.0005	0.005	0.005	0.0005		0.0005	0.0005		0.0005
0.0005	0.0005	0.0005	0.005	0.005	0.0005		0.0005	0.001		0.002
								0.0005		0.003
								0.001		0.004
								0.0005		0.0005
0.0005	0.0005	0.0005	0.005	0.005	0.0005		0.0005	0.002		0.003
0.0005	0.0005	0.0005	0.005	0.005	0.0005		0.0005	0.002		0.003
								0.002		0.002
0.0005	0.0005	0.0005	0.005	0.02	0.0005		0.0005	0.001		0.003
0.0005	0.0005	0.0005	0.005	0.02	0.0005		0.0005	0.001		0.005
								0.002		0.005
0.0005	0.0005	0.0005	0.04	0.03	0.0005	0.25	0.0005	0.003	1.57	0.007
								0.0005		0.01
0.0005	0.0005	0.0005	0.005	0.06	0.0005		0.0005	0.0005		0.003
0.0005	0.0005	0.0005	0.005	0.06	0.0005		0.0005	0.0005		0.003
0.0005	0.0005	0.0005	0.005	0.005	0.0005		0.0005	0.001		0.002
								0.0005		0.001
0.0005	0.0005	0.0005	0.005	0.005	0.0005		0.0005	0.0005		0.001
								0.0005		0.0005
								0.0005		0.003
								0.0005		0.002
0.001	0.001	0.001	0.007	0.016	0.001	0.250	0.001	0.001	1.570	0.003
0.001	0.001	0.001	0.005	0.005	0.001	0.250	0.001	0.001	1.570	0.003
122.000	123.000	124.000	125.000	126.000	127.000	128.000	129.000	130.000	131.000	132.000
0.001	0.001	0.001	0.040	0.060	0.001	0.250	0.001	0.004	1.570	0.010
0.001	0.001	0.001	0.005	0.005	0.001	0.250	0.001	0.001	1.570	0.001
0.001	0.001	0.001	0.005	0.022	0.001	0.250	0.001	0.002	1.570	0.005

7440-39-3	7440-39-3	7440-41-7	7440-41-7	7440-42-8	7440-42-8	7440-43-9	7440-43-9	7440-43-9	7440-45-1	7440-45-1
Barium	Barium	Beryllium	Beryllium	Boron	Boron	Cadmium	Cadmium	Cadmium	Cerium	Cerium
D	T	D	T	D	T	D	T	T	D	T
mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/kg	mg/L	mg/L	mg/L
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
0.149	0.195	0.0005	0.0005	0.2	0.19	0.00005		0.00005	0.0005	0.004
				0.25	0.19	0.00005		0.00005		
				0.025	0.06	0.00005		0.00005		
				0.05	0.07	0.00005		0.00005		
0.407	0.432	0.0005	0.0005	0.26	0.26	0.00005		0.00005	0.0005	0.001
0.356	0.42	0.0005	0.0005	0.2	0.22	0.00005		0.00005	0.0005	0.004
0.275	0.343	0.0005	0.0005	0.1	0.07	0.00005		0.00005	0.001	0.007
				0.16	0.17	0.00005		0.00005		
0.315	0.348	0.0005	0.0005	0.24	0.24	0.00005		0.00005	0.0005	0.0005
0.246	0.29	0.0005	0.0005	0.1	0.08	0.00005		0.0002	0.0005	0.005
				0.06	0.09	0.00005		0.00005		
				0.12	0.11	0.00005		0.0002		
				0.19	0.15	0.00005		0.00005		
0.276	0.313	0.0005	0.0005	0.18	0.19	0.00005		0.00005	0.0005	0.003
0.282	0.332	0.0005	0.0005	0.16	0.19	0.00005		0.00005	0.0005	0.0005
				0.24	0.21	0.00005		0.00005		
0.062	0.097	0.0005	0.0005	0.07	0.07	0.00005		0.00005	0.002	0.008
0.083	0.127	0.0005	0.0005	0.05	0.05	0.00005		0.0003	0.003	0.011
				0.09	0.1	0.00005		0.00005		
0.13	0.211	0.0005	0.0005	0.11	0.11	0.00005	0.05	0.00005	0.004	0.017
				0.19	0.21	0.00005		0.00005		
0.12	0.375	0.0005	0.001	0.06	0.07	0.00005		0.00005	0.003	0.072
0.101	0.362	0.0005	0.001	0.025	0.05	0.00005		0.00005	0.003	0.065
0.284	0.324	0.0005	0.0005	0.06	0.08	0.00005		0.00005	0.0005	0.002
				0.08	0.09	0.00005		0.00005		
0.286	0.327	0.0005	0.0005	0.08	0.08	0.00005		0.00005	0.0005	0.0005
				0.11	0.08	0.00005		0.00005		
				0.025	0.06	0.00005		0.00005		
				0.025	0.025	0.00005		0.00005		
0.225	0.300	0.001	0.001	0.121	0.123	0.000	0.050	0.000	0.001	0.013
0.261	0.326	0.001	0.001	0.105	0.095	0.000	0.050	0.000	0.001	0.005
133.000	134.000	135.000	136.000	137.000	138.000	139.000	140.000	141.000	142.000	143.000
0.407	0.432	0.001	0.001	0.260	0.260	0.000	0.050	0.000	0.004	0.072
0.116	0.208	0.001	0.001	0.056	0.070	0.000	0.050	0.000	0.001	0.001
0.292	0.365	0.001	0.001	0.194	0.190	0.000	0.050	0.000	0.003	0.012

7440-46-2	7440-46-2	7440-47-3	7440-47-3	7440-47-3	7440-48-4	7440-48-4	7440-48-4	7440-50-8	7440-50-8	7440-50-8
Caesium	Caesium	Chromium	Chromium	Chromium	Cobalt	Cobalt	Cobalt	Copper	Copper	Copper
D	T	D	T	T	D	T	T	D	T	T
mg/L	mg/L	mg/L	mg/kg	mg/L	mg/L	mg/kg	mg/L	mg/L	mg/kg	mg/L
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
0.0005	0.0005	0.0005		0.001	0.0005		0.002	0.002		0.003
		0.001		0.004	0.0005		0.003	0.003		0.006
		0.0005		0.007	0.0005		0.004	0.002		0.009
		0.0005		0.021	0.0005		0.008	0.003		0.017
0.0005	0.0005	0.0005		0.0005	0.0005		0.0005	0.0005		0.0005
0.0005	0.0005	0.0005		0.0005	0.001		0.002	0.0005		0.002
0.0005	0.0005	0.0005		0.001	0.001		0.002	0.0005		0.002
		0.0005		0.009	0.002		0.009	0.002		0.006
0.0005	0.0005	0.0005		0.0005	0.0005		0.0005	0.001		0.001
0.0005	0.0005	0.0005		0.0005	0.0005		0.002	0.001		0.002
		0.0005		0.017	0.0005		0.005	0.002		0.012
		0.0005		0.001	0.0005		0.002	0.0005		0.001
		0.0005		0.0005	0.0005		0.0005	0.001		0.002
0.0005	0.0005	0.0005		0.0005	0.0005		0.0005	0.001		0.001
0.0005	0.0005	0.0005		0.0005	0.0005		0.0005	0.001		0.001
		0.001		0.0005	0.0005		0.0005	0.002		0.002
0.0005	0.0005	0.0005		0.004	0.0005		0.002	0.003		0.004
0.0005	0.0005	0.0005		0.004	0.0005		0.002	0.002		0.005
		0.0005		0.005	0.0005		0.003	0.002		0.004
0.0005	0.0005	0.0005	11	0.006	0.0005	5.3	0.003	0.002	5.7	0.005
		0.0005		0.031	0.0005		0.014	0.003		0.024
0.0005	0.004	0.0005		0.021	0.002		0.012	0.002		0.018
0.0005	0.004	0.0005		0.017	0.002		0.012	0.002		0.016
0.0005	0.0005	0.0005		0.0005	0.001		0.002	0.001		0.001
		0.0005		0.0005	0.0005		0.0005	0.0005		0.0005
0.0005	0.0005	0.0005		0.0005	0.0005		0.0005	0.0005		0.0005
		0.0005		0.0005	0.0005		0.0005	0.002		0.002
		0.0005		0.019	0.0005		0.006	0.002		0.016
		0.0005		0.014	0.0005		0.008	0.0005		0.008
0.001	0.001	0.001	11.000	0.006	0.001	5.300	0.004	0.002	5.700	0.006
0.001	0.001	0.001	11.000	0.003	0.001	5.300	0.002	0.002	5.700	0.004
144.000	145.000	146.000	147.000	148.000	149.000	150.000	151.000	152.000	153.000	154.000
0.001	0.004	0.001	11.000	0.031	0.002	5.300	0.014	0.003	5.700	0.024
0.001	0.001	0.001	11.000	0.001	0.001	5.300	0.001	0.001	5.700	0.001
0.001	0.001	0.001	11.000	0.015	0.001	5.300	0.007	0.002	5.700	0.010

7440-52-0	7440-52-0	7440-53-1	7440-53-1	7440-54-2	7440-54-2	7440-55-3	7440-55-3	7440-58-6	7440-58-6	7440-60-0
Erbium	Erbium	Europium	Europium	Gadolinium	Gadolinium	Gallium	Gallium	Hafnium	Hafnium	Holmium
D	T	D	T	D	T	D	T	D	T	D
mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.005	0.005	0.0005
0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.005	0.005	0.0005
0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.005	0.005	0.0005
0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.005	0.005	0.0005
0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.005	0.005	0.0005
0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.005	0.005	0.0005
0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.005	0.005	0.0005
0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.005	0.005	0.0005
0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.005	0.005	0.0005
0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.0005	0.001	0.005	0.005	0.0005
0.0005	0.0005	0.0005	0.0005	0.0005	0.002	0.0005	0.002	0.005	0.005	0.0005
0.0005	0.003	0.0005	0.002	0.0005	0.008	0.0005	0.006	0.005	0.005	0.0005
0.0005	0.002	0.0005	0.002	0.0005	0.006	0.0005	0.005	0.005	0.005	0.0005
0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.005	0.005	0.0005
0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.005	0.005	0.0005
0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.005	0.005	0.001
0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.005	0.001
155.000	156.000	157.000	158.000	159.000	160.000	161.000	162.000	163.000	164.000	165.000
0.001	0.003	0.001	0.002	0.001	0.008	0.001	0.006	0.005	0.005	0.001
0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.005	0.001
0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.005	0.005	0.001

7440-60-0	7440-61-1	7440-61-1	7440-62-2	7440-62-2	7440-62-2	7440-64-4	7440-64-4	7440-65-5	7440-65-5	7440-66-6
Holmium	Uranium	Uranium	Vanadium	Vanadium	Vanadium	Ytterbium	Ytterbium	Yttrium	Yttrium	Zinc
T	D	T	D	T	T	D	T	D	T	D
mg/L	mg/L	mg/L	mg/L	mg/kg	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
0.0005	0.001	0.001	0.005		0.005	0.0005	0.0005	0.0005	0.0005	0.0025
	0.001	0.001	0.005		0.01					0.0025
	0.0005	0.0005	0.005		0.02					0.0025
	0.0005	0.001	0.005		0.04					0.0025
0.0005	0.0005	0.0005	0.005		0.005	0.0005	0.0005	0.0005	0.0005	0.03
0.0005	0.0005	0.0005	0.005		0.005	0.0005	0.0005	0.0005	0.002	0.0025
0.0005	0.0005	0.0005	0.005		0.005	0.0005	0.0005	0.0005	0.002	0.005
	0.0005	0.0005	0.005		0.03					0.0025
0.0005	0.0005	0.0005	0.005		0.005	0.0005	0.0005	0.0005	0.0005	0.006
0.0005	0.0005	0.0005	0.005		0.005	0.0005	0.0005	0.0005	0.002	0.0025
	0.0005	0.0005	0.005		0.04					0.0025
	0.0005	0.0005	0.005		0.005					0.0025
	0.0005	0.0005	0.005		0.005					0.0025
0.0005	0.0005	0.0005	0.005		0.005	0.0005	0.0005	0.0005	0.0005	0.0025
0.0005	0.0005	0.0005	0.005		0.005	0.0005	0.0005	0.0005	0.0005	0.0025
	0.0005	0.0005	0.005		0.005					0.0025
0.0005	0.0005	0.0005	0.005		0.01	0.0005	0.0005	0.0005	0.003	0.0025
0.0005	0.0005	0.0005	0.005		0.02	0.0005	0.0005	0.001	0.004	0.006
	0.0005	0.0005	0.005		0.02					0.0025
0.0005	0.0005	0.0005	0.005	26.5	0.02	0.0005	0.0005	0.002	0.006	0.0025
	0.0005	0.001	0.005		0.1					0.0025
0.0005	0.0005	0.002	0.005		0.05	0.0005	0.002	0.002	0.026	0.0025
0.0005	0.0005	0.002	0.005		0.04	0.0005	0.002	0.001	0.022	0.0025
0.0005	0.0005	0.0005	0.005		0.005	0.0005	0.0005	0.0005	0.0005	0.0025
	0.0005	0.0005	0.005		0.005					0.0025
0.0005	0.0005	0.0005	0.005		0.005	0.0005	0.0005	0.0005	0.0005	0.005
	0.0005	0.0005	0.005		0.005					0.006
	0.0005	0.0005	0.005		0.04					0.0025
	0.0005	0.0005	0.005		0.03					0.0025
0.001	0.001	0.001	0.005	26.500	0.019	0.001	0.001	0.001	0.005	0.004
0.001	0.001	0.001	0.005	26.500	0.008	0.001	0.001	0.001	0.002	0.003
166.000	167.000	168.000	169.000	170.000	171.000	172.000	173.000	174.000	175.000	176.000
0.001	0.001	0.002	0.005	26.500	0.100	0.001	0.002	0.002	0.026	0.030
0.001	0.001	0.001	0.005	26.500	0.005	0.001	0.001	0.001	0.001	0.003
0.001	0.001	0.001	0.005	26.500	0.034	0.001	0.001	0.001	0.004	0.004

7440-66-6	7440-66-6	7440-67-7	7440-67-7	7440-69-9	7440-69-9	7440-70-2	7440-74-6	7440-74-6	7664-41-7	7664-41-7
Zinc	Zinc	Zirconium	Zirconium	Bismuth	Bismuth	Calcium	Indium	Indium	Ammonia	Ammonia
T	T	D	T	D	T	D	D	T	N	N
mg/kg	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/kg	mg/L
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
	0.0025	0.0025	0.0025	0.0005	0.0005	20	0.0005	0.0005		0.07
	0.01					22				0.13
	0.028					12				1.06
	0.044					9			10	0.12
	0.006	0.0025	0.0025	0.0005	0.0005	25	0.0005	0.0005		0.05
	0.01	0.0025	0.0025	0.0005	0.0005	18	0.0005	0.0005		0.08
	0.01	0.0025	0.0025	0.0005	0.0005	14	0.0005	0.0005		0.06
	0.018					15			10	2.96
	0.0025	0.0025	0.0025	0.0005	0.0005	19	0.0005	0.0005		0.07
	0.005	0.0025	0.0025	0.0005	0.0005	13	0.0005	0.0005		0.09
	0.036					6				0.1
	0.008					15				0.03
	0.0025					15				0.1
	0.007	0.0025	0.0025	0.0005	0.0005	12	0.0005	0.0005		0.06
	0.007	0.0025	0.0025	0.0005	0.0005	13	0.0005	0.0005		0.07
	0.0025					13				0.06
	0.01	0.0025	0.0025	0.0005	0.0005	5	0.0005	0.0005		0.05
	0.011	0.0025	0.0025	0.0005	0.0005	6	0.0005	0.0005		0.09
	0.011					9				0.1
9.6	0.035	0.0025	0.0025	0.0005	0.0005	9	0.0005	0.0005	10	0.13
	0.05					9			10	0.21
	0.035	0.0025	0.0025	0.0005	0.0005	6	0.0005	0.0005		0.03
	0.033	0.0025	0.0025	0.0005	0.0005	5	0.0005	0.0005		0.03
	0.007	0.0025	0.0025	0.0005	0.0005	10	0.0005	0.0005		0.08
	0.0025					12				0.1
	0.029	0.0025	0.0025	0.0005	0.0005	11	0.0005	0.0005		0.17
	0.006					11				0.06
	0.042					4				0.84
	0.014					1				0.05
9.600	0.017	0.003	0.003	0.001	0.001	11.690	0.001	0.001	10.000	0.243
9.600	0.010	0.003	0.003	0.001	0.001	11.845	0.001	0.001	10.000	0.085
177.000	178.000	179.000	180.000	181.000	182.000	183.000	184.000	185.000	186.000	187.000
9.600	0.050	0.003	0.003	0.001	0.001	25.000	0.001	0.001	10.000	2.960
9.600	0.006	0.003	0.003	0.001	0.001	6.000	0.001	0.001	10.000	0.056
9.600	0.034	0.003	0.003	0.001	0.001	15.000	0.001	0.001	10.000	0.130

7782-49-2	7782-49-2	7782-49-2	C10 - C14 FRAC	C10 - C36 FRAC	C15 - C28 FRAC	C29 - C36 FRAC	C6 - C10 FRACT	C6 - C9 FRACI	DMO-210-001	EC_F
Selenium	Selenium	Selenium	TPH_C10 - C14	TPH_C10 - C36	TPH_C15 - C28	TPH_C29 - C36	TRH_C6 - C10	TPH_C6 - C9	Hydroxide Alkalinity	Field EC
D	T	T	N	N	N	N	N	N	N	N
mg/L	mg/kg	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µS/cm
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	120	120	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	100	100	25	10	10	0.5	
0.005		0.005	25	110	110	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005	0.3	0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	100	100	25	10	10	0.5	
0.005		0.005	25	140	140	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005		0.005	25	25	50	25	10	10	0.5	
0.005	0.300	0.005	25.000	40.345	61.034	25.000	10.000	10.000	0.500	
0.005	0.300	0.005	25.000	25.000	50.000	25.000	10.000	10.000	0.500	
188.000	189.000	190.000	191.000	192.000	193.000	194.000	195.000	196.000	197.000	198.000
0.005	0.300	0.005	25.000	140.000	140.000	25.000	10.000	10.000	0.500	0.000
0.005	0.300	0.005	25.000	25.000	50.000	25.000	10.000	10.000	0.500	
0.005	0.300	0.005	25.000	25.000	50.000	25.000	10.000	10.000	0.500	

ELECTRICAL CON	GIS-210-010	IONIC BALANCE	K.NITROGEN	K.NITROGEN	MOISTURE_CONT	NOX	PH VALUE	pH_F	TEMP_F	TOTAL ALKALINI
EC	Total Dissolved Solids	Ionic Balance Calculat	Total Kjeldahl Nitroge	Total Kjeldahl Nitroge	Moisture Content	Nitrite + Nitrate as N	pH	Field pH	Field Temp	Total Alkalinity as Ca(
N	T	N	N	N	N	N	N	N	N	N
µS/cm	mg/L	%	mg/kg	mg/L	%	mg/kg	pH Unit	pH Unit	deg C	mg/L
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
1200	915	2.2		0.9			8.41			235
597	588	0.49		2.1			8.25			201
247	375			1			7.87			69
166	474		460	1.2	23.4	0.05	7.71			62
2430	1300	0.85		0.7			8.38			252
1820	993	2.69		0.8			8.17			201
773	555	1.15		1			7.97			118
808	803	0.76	660	4.9	27.1	0.05	8.06			170
2000	1070	2.22		1.4			8.38			228
733	484	0.37		0.7			7.85			110
371	649	0.52		1			7.69			61
563	384	0.74		1.2			7.78			115
1400	735	0.68		0.4			8.18			186
1490	842	2.11		1			8.37			235
1600	1040	4.59		0.8			8.31			242
1680	912	0.53		0.7			8.39			276
106	194			3.1			7.61			27
133	295			1.2			7.55			38
173	299			1.4			7.3			40
178	274		300	1.8	24.1	0.1	7.89			45
212	1290		590	2.5	49.1	0.2	7.39			49
338	423			1.8			7.17			31
200	333			1.8			7.06			53
689	485	1.1		0.5			7.84			107
814	482	1.26		0.2			7.5			107
721	384	0.71		0.3			8.09			105
787	420	1.1		0.2			7.99			144
247	453			1.6			7.25			46
43	403			0.6			7.32			16
776.517	615.655	1.337	502.500	1.269	30.925	0.100	7.853			123.069
705.000	484.500	1.100	502.500	1.000	27.100	0.100	7.861			108.500
199.000	200.000	201.000	202.000	203.000	204.000	205.000	206.000	207.000	208.000	209.000
2430.000	1300.000	4.590	660.000	4.900	49.100	0.200	8.410	0.000	0.000	276.000
191.200	380.400	0.590	396.000	0.660	23.820	0.050	7.456			45.600
1436.000	913.200	2.164	618.000	1.800	35.900	0.140	8.274			211.800

TOTAL ANIONS	TOTAL CATIONS	TOTAL_P	TOTALNITROGEN	TOTALNITROGEN	TSS	TURBIDITY	TURBIDITY_F
Total Anions	Total Cations	Total Phosphorus as P	Total Nitrogen inc TKN	Total Nitrogen inc TKN	Total Suspended Solids	Turbidity	Field Turbidity
N	N	N	N	N	N	N	N
meq/L	meq/L	mg/L	mg/kg	mg/L	mg/L	NTU	NTU
report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text	report_result_text
12	11.5	0.04		0.9	22	0	0
5.9	5.97	0.2		2.1	63	0	0
2.29	2.47	0.3		1.1	283	0	0
1.7	1.86	0.32	460	1.4	621	0	0
23.8	23.4	0.11		0.7	6	0	0
18.5	17.5	0.12		0.9	45	0	0
7.38	7.21	0.03		1	5	0	0
7.92	7.8	0.44	660	5.1	120	0	0
20	19.2	0.05		1.4	5	0	0
7.02	7.08	0.02		0.8	5	0	0
3.61	3.57	0.24		1.1	154	0	0
5.47	5.55	0.2		1.2	44	0	0
13.2	13	0.005		0.4	8	0	0
14.8	14.2	0.1		1.1	11	0	0
15.2	16.7	0.04		0.8	8	0	0
16.6	16.4	0.005		0.7	2.5	0	0
0.9	0.97	0.14		3.2	12	0	0
1.13	1.12	0.11		1.2	16	0	0
1.42	1.61	0.005		1.4	15	0	0
1.63	1.68	0.17	300	1.8	32	0	0
1.98	2.03	0.75	590	3.1	184	0	0
2.86	2.89	0.38		1.8	960	0	0
2.16	2.01	0.33		1.8	817	0	0
6.47	6.34	0.02		0.6	7	0	0
7.57	7.76	0.02		0.2	2.5	0	0
6.88	6.98	0.005		0.3	2.5	0	0
7.54	7.38	0.005		0.2	2.5	0	0
2.21	2.3	0.27		1.7	344	0	0
0.47	0.36	0.26		0.8	189	0	0
7.538	7.477	0.162	502.500	1.338	137.448	0.000	0.000
6.675	6.660	0.115	502.500	1.100	19.000	0.000	0.000
210.000	211.000	212.000	213.000	214.000	215.000	216.000	217.000
23.800	23.400	0.750	660.000	5.100	960.000	0.000	0.000
1.868	1.950	0.020	396.000	0.700	5.000	0.000	0.000
13.840	13.480	0.282	618.000	1.800	186.000	0.000	0.000

Sampling ID	Sampling Date	Description	pH	EC	Total Dissolved Solids (TDS)	Suspended Solids (SS)	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	ED041G: Sulfate as SO4 - Turbidimetric mg/L	ED045G: Chloride mg/L	ED093F: Calcium mg/L	Calcium	Magnesium	Sodium	Potassium
			Physio Chemical Parameters				Alkalinity			Anions			Cations			
	Units			µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	LOR		0.01	1	10	5	1	1	1	1	1	1	1	1	1	1
	Criteria															
BEL01	14/03/2013		7.87	247	375	283	0.5	0.5	69	10	25	12	12	4	32	6
CT01	14/03/2013		7.46	182	816	172	0.5	0.5	43	7	23	8	8	4	15	18
DCK01	14/03/2013		7.25	247	453	344	0.5	0.5	46	5	42	4	4	3	39	6
NCK01	14/03/2013		8.34	633	380	75	0.5	3	90	16	126	22	22	14	66	21
CCK01	14/03/2013		8.35	1760	896	19	0.5	6	235	11	436	13	13	7	341	36
CAR02	14/03/2013		7.69	371	649	154	0.5	0.5	61	5	81	6	6	6	58	10
		Global Average	7.83	573.33	594.83	174.50	0.50	1.83	90.67	9.00	122.17	10.83	10.83	6.33	91.83	16.17
		Median	7.78	309.00	551.00	163.00	0.50	0.50	65.00	8.50	61.50	10.00	10.00	5.00	48.50	14.00
		Minimum	7.25	182.00	375.00	19.00	0.50	0.50	43.00	5.00	23.00	4.00	4.00	3.00	15.00	6.00
		Maximum	8.35	1760.00	896.00	344.00	0.50	6.00	235.00	16.00	436.00	22.00	22.00	14.00	341.00	36.00
		20th Percentile	7.46	247.00	380.00	75.00	0.50	0.50	46.00	5.00	25.00	6.00	6.00	4.00	32.00	6.00
		80th Percentile	8.34	633.00	816.00	283.00	0.50	3.00	90.00	11.00	126.00	13.00	13.00	7.00	66.00	21.00

Sampling ID	Sampling Date	Description	Aluminium	Arsenic	Cadium	Chromium	Copper	Cobalt	Nickel	Lead	Zinc	Manganese	Molybdenum	Selenium	Silver	Uranium	Vanadium	Boron	Iron
			Heavy Metals (Dissolved)																
	Units			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	LOR		0.01	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.01	0.001	0.001	0.01	0.05	0.05
	Criteria																		
BEL01	14/03/2013		0.11	0.002	0.00005	0.0005	0.002	0.0005	0.001	0.0005	0.0025	0.001	0.0005	0.005	0.0005	0.0005	0.005	0.0025	0.12
CT01	14/03/2013		0.49	0.001	0.00005	0.0005	0.003	0.0005	0.002	0.0005	0.0025	0.104	0.0005	0.005	0.0005	0.0005	0.005	0.11	0.61
DCK01	14/03/2013		0.13	0.0005	0.00005	0.0005	0.002	0.0005	0.002	0.0005	0.0025	0.121	0.0005	0.005	0.0005	0.0005	0.005	0.0025	0.26
NCK01	14/03/2013		0.005	0.003	0.00005	0.0005	0.001	0.0005	0.003	0.0005	0.0025	0.0005	0.001	0.005	0.0005	0.0005	0.005	0.15	0.025
CCK01	14/03/2013		0.005	0.002	0.00005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0025	0.028	0.0005	0.005	0.0005	0.0005	0.005	0.19	0.025
CAR02	14/03/2013		0.17	0.001	0.00005	0.0005	0.002	0.0005	0.0005	0.0005	0.0025	0.014	0.0005	0.005	0.0005	0.0005	0.04	0.06	0.45
		Global Average	0.1517	0.0016	0.0001	0.0005	0.0018	0.0005	0.0015	0.0005	0.0025	0.0448	0.0006	0.0050	0.0005	0.0005	0.0108	0.0858	0.2483
		Median	0.1200	0.0015	0.0001	0.0005	0.0020	0.0005	0.0015	0.0005	0.0025	0.0210	0.0005	0.0050	0.0005	0.0005	0.0050	0.0850	0.1900
		Minimum	0.0050	0.0005	0.0001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0025	0.0005	0.0005	0.0050	0.0005	0.0005	0.0050	0.0025	0.0250
		Maximum	0.4900	0.0030	0.0001	0.0005	0.0030	0.0005	0.0030	0.0005	0.0025	0.1210	0.0010	0.0050	0.0005	0.0005	0.0400	0.1900	0.6100
		20th Percentile	0.0050	0.0010	0.0001	0.0005	0.0010	0.0005	0.0005	0.0005	0.0025	0.0010	0.0005	0.0050	0.0005	0.0005	0.0050	0.0025	0.0250
		80th Percentile	0.1700	0.0020	0.0001	0.0005	0.0020	0.0005	0.0020	0.0005	0.0025	0.1040	0.0005	0.0050	0.0005	0.0005	0.0050	0.1500	0.4500

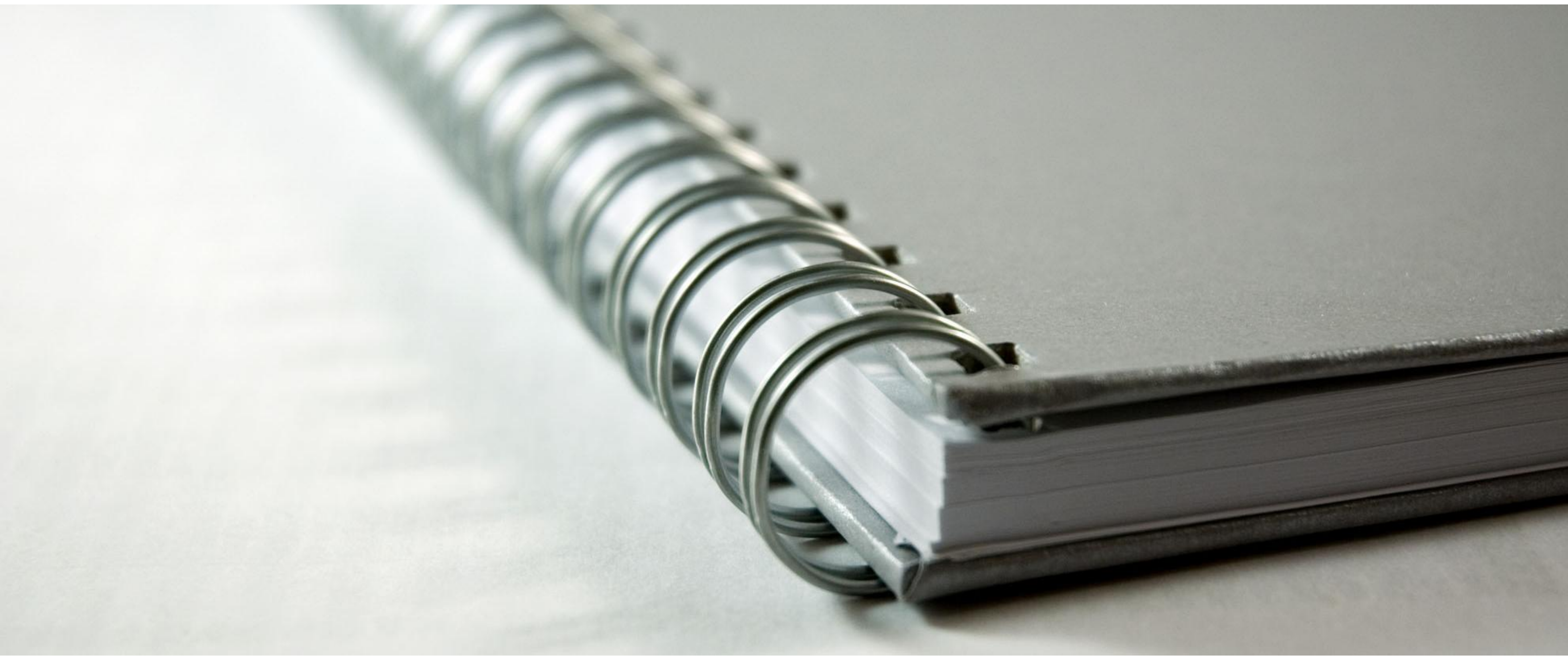
Sampling ID	Sampling Date	Description	Aluminium	Arsenic	Cadmium	Chromium	Copper	Cobalt	Nickel	Lead	Zinc	Manganese	Molybdenum	Selenium	Silver	Uranium	Vanadium	Boron	Iron
			Heavy Metals (Total)																
	Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	LOR		0.01	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.005	0.001	0.001	0.01	0.001	0.001	0.01	0.05	0.05
	Criteria																		
BEL01	14/03/2013		11.8	0.005	0.00005	0.007	0.009	0.004	0.008	0.008	0.028	0.258	0.0005	0.005	0.0005	0.0005	0.02	0.06	10.4
CT01	14/03/2013		13.8	0.006	0.00005	0.017	0.014	0.009	0.012	0.016	0.03	0.561	0.0005	0.005	0.0005	0.0005	0.06	0.14	25.6
DCK01	14/03/2013		15.4	0.003	0.00005	0.019	0.016	0.006	0.015	0.006	0.042	0.382	0.0005	0.005	0.0005	0.0005	0.04	0.06	21
NCK01	14/03/2013		3.03	0.003	0.00005	0.006	0.004	0.003	0.007	0.001	0.009	0.227	0.002	0.005	0.0005	0.0005	0.01	0.19	3.73
CCK01	14/03/2013		0.15	0.002	0.00005	0.0005	0.002	0.0005	0.0005	0.0005	0.0025	0.211	0.0005	0.005	0.0005	0.0005	0.005	0.25	0.66
CAR02	14/03/2013		14.7	0.003	0.00005	0.017	0.012	0.005	0.012	0.006	0.036	0.288	0.0005	0.005	0.0005	0.0005	0.04	0.09	20.2
		Global Average	9.8133	0.0037	0.0001	0.0111	0.0095	0.0046	0.0091	0.0063	0.0246	0.3212	0.0008	0.0050	0.0005	0.0005	0.0292	0.1317	13.5983
		Median	12.8000	0.0030	0.0001	0.0120	0.0105	0.0045	0.0100	0.0060	0.0290	0.2730	0.0005	0.0050	0.0005	0.0005	0.0300	0.1150	15.3000
		Minimum	0.1500	0.0020	0.0001	0.0005	0.0020	0.0005	0.0005	0.0005	0.0025	0.2110	0.0005	0.0050	0.0005	0.0005	0.0050	0.0600	0.6600
		Maximum	15.4000	0.0060	0.0001	0.0190	0.0160	0.0090	0.0150	0.0160	0.0420	0.5610	0.0020	0.0050	0.0005	0.0005	0.0600	0.2500	25.6000
		20th Percentile	3.0300	0.0030	0.0001	0.0060	0.0040	0.0030	0.0070	0.0010	0.0090	0.2270	0.0005	0.0050	0.0005	0.0005	0.0100	0.0600	3.7300
		80th Percentile	14.7000	0.0050	0.0001	0.0170	0.0140	0.0060	0.0120	0.0080	0.0360	0.3820	0.0005	0.0050	0.0005	0.0005	0.0400	0.1900	21.0000

						Nutrients								Ionic Balance			Total Petroleum Hydrocarbons		
Sampling ID	Sampling Date	Description	Dissolved Mercury	Total Recoverable Mercury	Fluoride	Ammonia as N	Nitrate as N	Nitrate as N	Nitrite + Nitrate as N	TKN	Total Nitrogen as N	Total Phosphorus as P	Reactive Phosphorus	Total Anions	Total Cations	Ionic Balance	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction
	Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		meq/L	meq/L	%	µg/L	µg/L	µg/L
	LOR		0.0001	0.0001	0.1	0.01	0.01	0.01	0.01	0.01	0.1	0.1		0.01	0.01	0.01	20	50	100
BEL01	14/03/2013		0.00005	0.00005	0.2	1.06	0.005	0.07	0.07	1	1.1	0.3		2.29	2.47	-	10	25	50
CT01	14/03/2013		0.00005	0.00005	0.1	0.43	0.08	0.28	0.36	2.3	2.7	0.61		1.65	1.84	-	10	25	50
DCK01	14/03/2013		0.00005	0.00005	0.2	0.84	0.005	0.09	0.09	1.6	1.7	0.27		2.21	2.3	-	10	25	50
NCK01	14/03/2013		0.00005	0.00005	0.4	0.15	0.005	0.02	0.02	1.6	1.6	0.16		5.75	5.66	0.76	10	25	50
CCK01	14/03/2013		0.00005	0.00005	0.5	0.11	0.005	0.05	0.05	0.8	0.8	0.06		17.3	17	1.09	10	25	50
CAR02	14/03/2013		0.00005	0.00005	0.2	0.1	0.005	0.06	0.06	1	1.1	0.24		3.61	3.57	0.52	10	25	50
		Global Average	0.00005	0.00005	0.26667	0.44833	0.01750	0.09500	0.10833	1.38333	1.50000	0.27333		5.46833	5.47333	0.79000	10.00000	25.00000	50.00000
		Median	0.00005	0.00005	0.20000	0.29000	0.00500	0.06500	0.06500	1.30000	1.35000	0.25500		2.95000	3.02000	0.76000	10.00000	25.00000	50.00000
		Minimum	0.00005	0.00005	0.10000	0.10000	0.00500	0.02000	0.02000	0.80000	0.80000	0.06000		1.65000	1.84000	0.52000	10.00000	25.00000	50.00000
		Maximum	0.00005	0.00005	0.50000	1.06000	0.08000	0.28000	0.36000	2.30000	2.70000	0.61000		17.30000	17.00000	1.09000	10.00000	25.00000	50.00000
		20th Percentile	0.00005	0.00005	0.20000	0.11000	0.00500	0.05000	0.05000	1.00000	1.10000	0.16000		2.21000	2.30000	0.61600	10.00000	25.00000	50.00000
		80th Percentile	0.00005	0.00005	0.40000	0.84000	0.00500	0.09000	0.09000	1.60000	1.70000	0.30000		5.75000	5.66000	0.95800	10.00000	25.00000	50.00000

Total Petroleum Hydrocarbons		Total Recoverable Hydrocarbons				
C29 - C36 Fraction	C10 - C36 Fraction (sum)	C6 - C10 Fraction	0C10 - C16 Fraction	0C16 - C34 Fraction	0C34 - C40 Fraction	0C10 - C40 Fraction (sum)
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
50	50	20	100	100	100	100
25	25	10	50	50	50	50
25	25	10	50	50	50	50
25	25	10	50	50	50	50
25	25	10	50	50	50	50
25	25	10	50	50	50	50
25	25	10	50	50	50	50
25.00000	25.00000	10.00000	50.00000	50.00000	50.00000	50.00000
25.00000	25.00000	10.00000	50.00000	50.00000	50.00000	50.00000
25.00000	25.00000	10.00000	50.00000	50.00000	50.00000	50.00000
25.00000	25.00000	10.00000	50.00000	50.00000	50.00000	50.00000
25.00000	25.00000	10.00000	50.00000	50.00000	50.00000	50.00000
25.00000	25.00000	10.00000	50.00000	50.00000	50.00000	50.00000

Field Values _ Insitu								
Sample ID	Sampling Date	Description	Temperature	pH	EC	DO	DO	Tubidity
Unit			**°C**	**pH unit**	**µs/cm**	**µs/cm**	**mg/L**	**% sat**
CAR04	14/03/2013	Sample turbid, no odour.	28.7	7.407	312	4.21	53.4	804.94
BEL01	14/03/2013	Creek flowing ~250mm over cease to flow point. Sample turbid. No odour.	28.1	7.806	260	6.54	85.7	577.34
CT01	14/03/2013	Sampled from stagnant pool. Sample turbid. No odour.	28.3	7.361	194	3.87	50.6	828.29
CAR02	14/03/2013	Small, gradual flow. Sample turbid. No odour.	29.5	7.515	397	5.42	70.9	666.03
CAR03	14/03/2013	Creek flowing ~100mm over cease to flow point. Sample turbid. No odour.	24.9	7.472	383	3.09	38.3	696.95
DCK01	14/03/2013	Creek flowing ~50mm over cease to flow point. Sample turbid. No odour.	24.9	7.138	266	3.60	44.8	747.60
NCK01	14/03/2013	Sampled from stagnant pool. Sample slightly turbid. No odour.	32.1	8.512	625	9.91	138.1	77.50
CCK01	14/03/2013	Sampled from stagnant pool. Sample clear. No odour.	28.8	8.053	1725	6.07	79.3	8.29
ECK02	14/03/2013	No flow. No sample collected.	-	-	-	-	-	-
		Global Average	28.16	7.66	520.25	5.34	70.14	550.87
		Median	28.50	7.49	347.50	4.82	62.15	681.49
		Minimum	24.90	7.14	266.00	3.09	38.30	8.29
		Maximum	32.10	8.51	1725.00	9.91	138.10	828.29
		20th Percentile	26.18	7.38	262.40	3.71	47.12	277.44
		80th Percentile	29.22	7.95	533.80	6.35	83.14	782.00

Appendix D – Water Quality Monitoring Program



Adani Mining Pty Ltd

Carmichael Coal Mine and Rail Project SEIS
Surface Water Quality Monitoring Plan

July 2013

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Appendices

1. Introduction

The purpose of this monitoring program is to develop a baseline surface water quality dataset across the Carmichael Coal Mine Project site. The program has been designed around the ANZECC (2000) Water Quality Guidelines, which recommend that two years' worth of monthly sampling data are collected to take into account aquatic ecosystem variability, and therefore, derive appropriate site specific trigger values.

The proposed surface water quality monitoring program will therefore, aim to provide a representative and statistically relevant dataset to assess the pre-mining environment and set realistic water quality targets for the Carmichael Coal Mine Project. It is intended to be dynamic and usable document, reviewed and updated on a regular basis.

2. Quick Reference/Summary points

The following is a summary of the actions that need to be taken in regards to each discrete round of surface water sampling to affect an appropriate level of quality control:

- Pre-arrange access to sampling locations (landholder access arrangement);
- Procure monitoring equipment in advance;
- Advise the Site/Environment Manager prior to sampling at the various sites. It is preferable that 24 hours' notice is provided.
- Inform landholders prior to entering the area for surface water sampling purposes at any site. As noted above it is preferable that at least 24 hours is provided prior to the sampling event. Contact details are provided in Table 2-1 below.

Table 2-1 Landholders contact details

	Property Name 1	Property Name 2
Sample Point		
BEL01		
CAR01		
CAR02		
CAR04		
CCK01		
CT01		
DCK01		

- Refer to Appendix A for the approximate location of each sampling site;
- Take samples opportunistically at approximately monthly intervals. i.e. should there be a second flow event within two weeks of the previous event, there is no need to sample. RSS bottles will need to be inspected and emptied.
- Complete paperwork including Chain of Custody (CoC) forms and field data sheet and file as specified in section 8 for quality assurance purposes.
- Ensure that there is enough sampling equipment for the next sampling event (contact ALS to order more of the consumable sampling equipment - Appendix D). ALS Brisbane can be contacted on 07 3243 7222.

3. Purpose and Scope

This document details the procedure to be implemented to obtain monthly and opportunistic surface water quality samples from the five designated sampling locations shown in Appendix A

Table 3-1 Receiving water monitoring locations

Latitude	Longitude	Name	Long Name	Monitoring station name
-22.1087960	+146.3527180	CAR04	Carmichael River at US GS	Carmichael Upstream GS
-22.0906570	+146.2562410	CCK01	Cattle Creek upstream of Dyllingo confluence	
-22.0888320	+146.2606000	DCK01	Dylingo Ck at Carmichael/Moray Rd	
Downstream sites				
-21.9594600	+146.6568190	BEL01	Belyando River at Carmichael/Moray Rd	
-22.1620320	+146.5285470	BEL02	Belyando River at Bygana Waterhole	Belyando/Bygana Waterhole GS
-22.0740740	+146.4675990	CAR01	Carmichael River far DS. Below 1080	Carmichael Downstream GS
-22.0975750	+146.4055550	CAR02	Carmichael River at Mid GS	Carmichael Mid GS
-22.1071410	+146.3957890	CAR03	Carmichael River at Main Crossing	
-22.1067830	+146.4139080	CT01	Cabbage Tree Creek approx 2.5 km DS of	
-21.9691720	+146.3987390	ECK02	Eight Mile Creek at Carmichael/Moray Rd	
-21.9661140	+146.4865360	NCK01	North Creek at Carmichael/Moray Rd	

This procedure details equipment required, sample collection and analysis methodology, quality assurance/control and documentation requirements of this surface water monitoring program.

4. Definitions

Surface Water (SW) Monitoring Site – A pre-determined location where a surface water quality sample is collected.

SW Field Sheet – The form used to record field observations and data. Appendix C contains a template SW Field Sheet.

NTU – Nephelometric Turbidity Units. Turbidity is a measure of the amount of suspended particles in a water body.

CoC – Chain of Custody documentation (Appendix B) The Chain of Custody form tracks samples by label data (Customer and Project, Location, Operator, and Sample dates).

ALS – Australian Laboratory Services. The NATA accredited laboratory used to analyse the samples.

Laboratory QA/QC – NATA accredited laboratory procedures that include; sample holding times, analytical methods, laboratory duplicates, laboratory control spikes (and recoveries), method blanks, matrix spikes (and recoveries), sample preservation as recorded on CoC, laboratory limit of reporting.

RSS – Rising Stage Sampler. The Rising Stage Sampler is used for automatic collection of samples from ephemeral streams at remote sites and/or sites with access difficulties. These sites are visited by personnel after a flow event.

5. Standards

This surface water monitoring program complies with the following standards:

- NEPM (1999) Schedule B(2) Guideline on Data Collection, Sample Design and Reporting;
- AS/NZS 5667.1:1998 Water quality – Sampling. Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples; and
- AS/NZS 5667.6:1998 Water quality – Sampling. Part 6: Guidance on sampling of rivers and streams.

6. Procuring Equipment

In order to successfully capture statistically representative data from the ephemeral creek network at the Carmichael site; it is recommended that Adani purchase a multifunctional water quality meter that assesses pH, oxidation-reduction potential, turbidity, temperature, dissolved oxygen and electrical conductivity. This meter will need to be kept on site with the other equipment so that it is accessible for each monitoring round. Having the meter on site allows both regular and opportunistic sampling to be conducted. Before each round of monitoring the meter should be calibrated to ensure accurate readings, with the calibration record placed on file to ensure a defensible quality assessment and control dataset is captured.

Clean sample jars/bottles, syringes and filters are required and available through ALS. This requirement is detailed below. Ensure sufficient time is allowed for orders to be processed and items delivered to site.

6.1 Equipment Required

The following is a list of the equipment required to undertake the sampling outlined in this program:

- Clipboard and pencil(s).
- A TPS 90 FLT multi-parameter water quality meter, or equivalent, capable of measuring:
  - Dissolved Oxygen (DO) (% saturation)
  - pH (pH units)
  - Electrical Conductivity (EC) (µS/cm)
  - Oxidation - reduction (redox) potential (mv)
  - Temperature (Temp) (˚C)
  - Turbidity (NTU)

Note: it is important to carry the pH meter's manual for troubleshooting purposes when sampling.

- Clean sample bottles sufficient for the number of samples plus field duplicates. Each sampling location comprises four analytical bottles:
  - 1 x 1 L unpreserved green label (physical parameters),
  - 2 x 60 ml two red labels HNO_3 acid preserved (total and dissolved metals), and
  - 1 x 125 ml H_2SO_4 preserved purple label (nutrients);
- 3 x 1 L bottles for each of the three RSS
- A reach pole or bailer and rope for hard to reach SW sites;
- Esky with frozen ice-bricks;
- Plastic syringe, disposable filters or filter cup and filter papers for dissolved metals filtration in the field;
- Personal Protective Equipment (PPE), including disposable nitrile gloves;
- A copy of this procedure;
- Surface water field sheets and copies of CoC documentation; and
- Reverse Osmosis (RO) or MiliQ water for a field/trip blank.

All required field equipment should be kept in a dedicated location on site, although some equipment including sample bottles, Eskys and filters can be ordered on a just-in-time procurement basis through ALS Brisbane.

6.2 Equipment Return

None of the equipment used for sampling needs to be specifically returned to the labs from which they were purchased. Most of the equipment required for sampling is disposable and only meant to be used once. It is critical that dedicated syringes and sampling equipment are used at each location to ensure that no cross-contamination occurs. The Esky is the only piece of equipment that can be reused, however the samples are sent to the lab in the Esky and another Esky will need to be sent from the lab.

ALS also supplies consignment notes, and the courier service is included in the cost for samples.

The samples should be sent to ALS Brisbane via courier pre-arranged by site staff.

7. Collecting Samples

All sample locations should be assessed under site specific safety procedures. A safety assessment must be completed prior to sampling and included in the surface water monitoring job safety assessment. If additional sampling sites are added, the new site will need to be assessed by the Site/Environmental Manager and/or the Site Safety Supervisor under existing OH&S protocols as required.

A range of factors may preclude sampling on a given day potentially including; inclement weather, safety and/or environmental hazards, in addition to restricted site access by landowners. Any such incidents should be reported to the Site or Environment Manager immediately.

SW sites should be kept free from hazards. If a hazard is identified, it should be noted on the field data sheet, with the Site Manager notified upon the field staff members' return.

7.1 Procedure (in-situ water quality analysis)

This procedure is to be used to test pH, DO, EC, turbidity, red-ox and temperature in the field.

- Setup meter and ensure it is functional and calibrated;
- Place probes into the water body, ensuring there is at least 10 cm of water covering the probe;
- Wait at least one minute for any sediment to settle and for the instrument to initialize, and then allow the parameters to stabilize; and
- Complete field sheets including; date and time, field parameter measurements and any other noteworthy information (e.g. weather conditions, flow depth, approximate flow rate, etc.) (refer to Appendix C).
- Repeat procedure for anomalous readings based on historical data for QA/QC purposes as required.

7.2 Procedure (laboratory samples)

Samples should be collected at the designated surface water monitoring locations after a rainfall event on a monthly basis if possible. For the RSS locations the samples can be directly transferred into the unpreserved green and preserved purple bottles, and also for one total metals preserved red bottle (not filtered in the field)[1]. For the surface water sites the samples can be taken using a dedicated bailer and then transferred into the appropriate containers or the samples can be collected directly using the sample bottles.

Note that one of the two red preserved bottles (dissolved metals) requires the sample to be field filtered through the filter paper and dedicated syringe. This should be done when transferring the sample from the bailer (or an RSS container) into the bottle. The bottle that has the filtered sample should be identified via the tick box on the label stating it is to be analysed for dissolved metals.

The procedure for filtering the samples is as follows:

- Use one dedicated syringe per sample, depending on filterable material in each sample one or more filters will be required;
- Draw up the water using the syringe;
- Place the filter on the syringe;
- Plunge the syringe such that the filtered water sample enters an H_2SO_4 preserved metals sample bottle;
- Detach the filter from the syringe;
- Repeat this process until the bottle is filled (being careful not to overflow the bottle); and
- Replace the filter if it becomes clogged during sampling.

For the RSS the water needs to be transferred from the collection container into a clean 250 mL container. The syringe is then filled from this clean container. For the surface water samples the sample should be initially collected in a clean container and then follow the same procedure as above.

Label each sample bottle, ensuring that the following information is provided (labels are provided on the bottles from ALS):

[1] Note sampling hierarchy for RSS samples in section 7.3

- Date and time sampled;
- Sampling site number (e.g. Site 1);
- Job reference number (e.g. CarmichaelSW);
- Sampler's initials; and
- Analysis required; (distinguishing total or dissolved metals on preserved red bottles).

Note that one set of blind intra-laboratory field duplicate samples is to be collected for every 10 sample sites (1:10) for analysis by ALS. Such samples remain anonymous to the laboratory and should be named Dup 1 etc. The sampler must ensure that the location of the duplicate sample is recorded for QA/QC assessment purposes. Try and rotate the location of the field duplicate each sample round as is reasonably practicable.

Note also that 1 set of blind inter-laboratory duplicate samples per sampling round should be collected for analysis by a separate NATA Accredited Laboratory (e.g. SGS).

Store samples in an ice chilled esky and continue to the next location; repeat. Once the sampling run is completed; proceed by sending the samples to ALS via a courier, for analysis. A completed ALS CoC form (Appendix B) in a waterproof ziplock bag is to be placed in the esky with the samples. The samples should be sent to the following address within 2 days of sampling to ensure that sample holding times are not compromised for QA/QC purposes:

ALS Brisbane
32 Shand Street Stafford QLD 4053
Phone: 07 3243 7222
Email: samples.brisbane@alsglobal.com

Place one full set of field / trip blanks using Reverse Osmosis (RO) or MiliQ water into the esky for analysis to assess for background / travel cross contamination purposes as part of the QA/QC procedure. The analytical suite should be the same as for the field samples.

7.3 Procedure (Rising Stage Sampler)

As noted above, RSSs will be installed at the up and downstream limits of the site along the major drainage line running through the site. These samplers are required due to the ephemeral nature of the creek, thereby allowing samples to be collected opportunistically when water is flowing.

Samples should be taken from the RSS after rainfall events that have resulted in a flow event. Samples need to be transferred from the collection bottles into the appropriate laboratory sample bottle. As the volume of water collected may be limited, priority needs to be given to the testing of parameters as follows:

1. filtered metals;
2. physical parameters;
3. nutrients; and
4. total metals

The above procedure should be carried out for each discrete RSS sample bottle filled in each flow event. Accordingly, each bottle that is filled with a sample must be labelled according to the height level in the sampling equipment (i.e. RSS1-A base bottle, RSS1-B middle, and RSS1-C top etc.).

8. Quality Assurance/Quality Control

A data set must be validated using information sourced from a suitable quality assurance program. Therefore, it is critical that the following Quality Assurance (QA) / Quality Control (QC) procedures are applied during surface water sample collection and analysis including:

1. Field notes to include sampler's name, time, date, field pH, EC, turbidity, redox, DO and temp and any other environmental conditions at the time of sampling including approximate flow rate, water depth, colour, weather etc.;
2. Analytical meter calibration sheet;
3. Sample holding times;
4. Field blind duplicate (1 in 10) (ALS);
5. Field / trip blank;
6. NATA accredited laboratory;
7. CoC documentation. The completed form must accompany the samples from the field to both the primary laboratory (ALS Brisbane) and secondary laboratory (e.g. SGS). The ALS CoC form should request the following analytical suite:
   - EA015: Total dissolved solids
   - EA025: Suspended solids
   - NT-1: Cations (major): (Ca, Mg, Na, K)
   - NT-2: Anions (major): (Cl, SO_4, Alkalinity)
   - EG020F: Dissolved metals (itemise on CoC: As, Ba, Be, Cd, Cr, Co, Cu, Fe, Mn, Ni, Pb, V, Zn)
   - EG020T: Total metals (itemise on CoC: As, Ba, Be, Cd, Cr, Co, Cu, Fe, Mn, Ni, Pb, V, Zn)
   - EG035F: Dissolved mercury
   - EG035T: Total mercury
   - EK061G: Total Kjeldahl Nitrogen
   - EK062G: Total Nitrogen
   - EK067G: Total phosphorous

As noted above, the field blind inter-lab duplicate to a second laboratory should be analysed for the equivalent analytical suite to that described above (excluding the ALS Suite codes).

8. Laboratory internal analytical QA/QC procedures should be requested including:
   - Laboratory duplicates
   - NATA approved analytical methods
   - Sample holding times
   - Method blanks
   - Laboratory control spikes (and percent recovery)
   - Laboratory control spike
   - Matrix spikes (and percent recovery)
   - Sample preservation (as recorded on CoC)
   - Laboratory limit of reporting

9. Document control

For each sampling round the following information is to be saved in hard copy in the Environmental Monitoring – Surface Water Quality folder in the site office and should also be sent electronically to the GHD office (bnemail@ghd.com):

- The equipment calibration sheet from the supplier (if rented) or the field calibration sheet by the Adani sampler if a field meter has been bought;
- A photocopy of the CoC form (signed by Adani and the receiving laboratory).
- The completed field data sheet; and
- The laboratory results including laboratory QA/QC reports.

10. Responsibilities

10.1 Site/Environment Manager

The Site Manager is to ensure that the field staff undertaking the testing are familiar with this procedure and briefed on any relevant community, ecological, environmental or other issues which might affect the sampling process on the given day of testing. They are also responsible for ensuring field staff are suitably trained to perform their role.

It is also the role of the Site Manager to follow up and deal with any potential hazards identified by the field staff.

10.2 Field Staff

Field staff using this procedure are to ensure that:

- they complete safety assessment of each site, identifying any potential risks;
- equipment is arranged and functional;
- access to the surface water sampling sites is confirmed; and
- the sample collection and testing is conducted, documented and entered as per this procedure.
- Copies of field sheets and laboratory results are forwarded to GHD for interpretation and reporting

Any requirement for modification to this procedure should be communicated to the Site Manager, such that revision can occur.

10.3 GHD

GHD will interpret the laboratory results and report findings every six months during the initial monitoring period. At the end of the monitoring period, GHD are to provide a report summarising the data collected and providing, where possible, site specific water quality objectives and trigger values for the Carmichael Coal Mine Project.

11. Invoicing

Invoices relating to the Environmental Monitoring Program are to be directed to Adani Mining Pty Ltd for the attention of XXXX

12. References

ANZECC (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. National Water Quality Management Strategy Paper No. 4, Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) October 2000

AS/NZS 5667.1:1998 Water quality – Sampling. Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples; and

AS/NZS 5667.6:1998 Water quality – Sampling. Part 6: Guidance on sampling of rivers and streams.

Map of Surface Water Monitoring (SW) Sites – Appendix A

NEPM (1999) Schedule B(2) Guideline on Data Collection, Sample Design and Reporting;

USGS National Handbook of Recommended Methods for Water-Data Acquisition, 1977.

Appendices

Appendix A - Surface Water Monitoring Site Map

To be updated in later stages

Appendix B - ALS Chain of Custody Form

ALS Environmental

CHAIN OF CUSTODY

ALS Laboratory: please tick →

❑ADELAIDE 21 Burma Road Pooraka SA 5095
Ph: 08 8359 0890 E: adelaide@alsglobal.com

❑BRISBANE 32 Shand Street Stafford QLD 4053
Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

❑GLADSTONE 46 Callemondah Drive Clinton QLD 4680
Ph: 07 7471 5600 E: gladstone@alsglobal.com

❑MACKAY 78 Harbour Road Mackay QLD 4740
Ph: 07 4944 0177 E: mackay@alsglobal.com

❑MELBOURNE 2-4 Westall Road Springvale VIC 3171
Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

❑MUDGEE 27 Sydney Road Mudgee NSW 2850
Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

❑NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304
Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com

❑NOWRA 4/13 Geary Place North Nowra NSW 2541
Ph: 024423 2063 E: nowra@alsglobal.com

❑PERTH 10 Hod Way Malaga WA 6090
Ph: 08 9209 7655 E: samples.perth@alsglobal.com

❑SYDNEY 277-289 Woodpark Road Smithfield NSW 2164
Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

❑TOWNSVILLE 14-15 Desma Court Bohle QLD 4818
Ph: 07 4796 0600 E: townesville.environmental@alsglobal.com

❑WOLLONGONG 99 Kenny Street Wollongong NSW 2500
Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT:

OFFICE:

PROJECT:

ORDER NUMBER:

PROJECT MANAGER: **CONTACT PH:**

SAMPLER: **SAMPLER MOBILE:**

COC emailed to ALS? (YES / NO) **EDD FORMAT (or default):**

Email Reports to (will default to PM if no other addresses are listed):

Email Invoice to (will default to PM if no other addresses are listed):

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)

☐ Standard TAT **(List due date):**

☐ Non Standard or urgent TAT **(List due date):**

ALS QUOTE NO.:

COC SEQUENCE NUMBER (Circle)

COC:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
OF:	**1**	**2**	**3**	**4**	**5**	**6**	**7**

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
Random Sample Temperature on Receipt:	˚C		
Other comment:			

RELINQUISHED BY:	**RECEIVED BY:**	**RELINQUISHED BY:**	**RECEIVED BY:**
DATE/TIME:	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	**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 CONTAINERS**									Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
				TOTAL										

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.

Appendix C - Surface Water Quality- Example Field Data Sheet

Surface Water Sampling Record

Project No. ______________________ Date: ______________________

Sampling Officer ______________________ Time: ______________________

Project Name: ______________________

Site: ______________________

Coordinates/GPS (if available): ______________________

Sampling method (i.e. grab, bucket, RSS): ______________________

Detailed Sample Location Description: ______________________

Environmental Observations

Weather ______________________

Vegetation ______________________

Slope ______________________

Erosion ______________________

Other ______________________

Field Measurements

pH ______________________

Conductivity (uS/cm) ______________________

Redox (mV) ______________________

DO (% sat) ______________________

Turbidity (NTU) ______________________

Temp (°C) ______________________

Hydrological Data

General Flow Measurement (i.e. flow depth/speed) ______________________

Other (e.g. debris, colour) ______________________

Sample No.	No. of Containers	Preservative (i.e. bottle type)	Duplicate (Y or N)	Comments

Field Supervisor Checked (Sign and Date)

Appendix D - ALS Bottle and Laboratory Equipment Order Form

ALS BRISBANE - SAMPLE CONTAINER REQUEST FORM

Attention: Bottle Preparation **Facsimile:** +61 (07) 32437181 **E-mail:** bottles.brisbane@alsglobal.com

Client:	**Date Required by Client:**
Contact:	**Time Required by Client:**
Telephone:	ALS Use ONLY
Delivery Address:	Date Received by ALS:
	Time Received by ALS:
	*Courier Charge? Y / N

*Please Note: Cost recovery charges may apply for urgent deliveries when insufficient notice is received. For regional deliveries, please allow 3-5 working days for delivery.

OTHER INSTRUCTIONS: ....

....

☐ **Hard esky – medium (<26L)** ☐ **Hard esky – small**

QUALITY CONTROL SAMPLE CONTAINERS

No.	Label Colour	Container Type (* sample containers supplied with teflon lined lids)	Test Parameter(s)
	Orange	1 x **150ml** wide mouth glass jar	Trip **BLANK SOIL** (BTEX)
	Orange	**Trip/Field Spike (soil) – duplicate jars (control and field spike) of sand spiked with unleaded petrol. Both control and field spike to be analysed for TRH/BTEX** (provided under CoC conditions with ice)	Trip **SPIKE SOIL** (Min. 24hr notice required) (C_6-C_9, BTEX compounds). **Please return to ALS lab of issue.**
	Purple	2 x **40ml** Amber glass vial (Sulfuric Acid preserved) Trip Blank	Trip **BLANK WATER** (BTEX)
	Purple	2 x **40ml** Amber glass vial (Sulfuric Acid preserved) Trip Spike (provided under CoC conditions with ice)	Trip **SPIKE WATER** (BTEX)
	-	1 x **500mL** Amber glass bottle	Rinsate: Semi-Volatile Organics
	-	1 x **1L** Opaque plastic 'natural' bottle	Rinsate: Metals and Inorganics
	-	1 x **500ml** Amber glass bottle	Rinsate: Volatile Organics & TOC/DOC

SOLID MATRIX SAMPLE CONTAINERS (Soil / Sludge / Sediment / Dusts)

No.	Label Colour	Container Type (* sample containers supplied with teflon lined lids)	Test Parameter(s)
	Orange	1 x **150ml** wide mouth glass jar	TRH/BTEXN/PAH & Metals, **or** **ZHE only**, **or** Dioxins **or** TBT plus TOC, **or** Herbicides, PFOS/PFOA, Ultra trace OC/OP/PCB **or** PBDE's
	Orange	1 x **250ml** wide mouth glass jar (Please contact ALS for sediment container requirements)	Test parameters **including TCLP and ZHE**

	Green	1 x **250g** resealable plastic bag (**samples should be frozen**)	Acid Sulfate Soils
	Black on White	1 x **250g** resealable plastic bag	Asbestos, Particle Sizing
		1 x **100g** paper bag	Total Sulfur or Total Fluoride, Sulfide
	Black	1 x **120ml** sterile wide mouth plastic jar	Microbiological tests
	Turquoise	1 x **4 L** clear glass (*$CuSO_4$ solution)*	Dust Deposition gauges

AQUEOUS MATRIX SAMPLE CONTAINERS (WATER)

Volumes listed below are recommended based on "clean" waters. Please contact ALS for further advice on sample volumes.

INORGANICS

No.	Label Colour	Container Type (*Preservation*)	Test Parameter(s)
	Green	1 x **250ml** plastic (*none*)	**Sample Collection Pocket Guide Suite:1** Alkalinity, EC, pH, Cations, Cl, SO4, F, Hardness, Nitrite, Nitrate, Reactive P, Silica, plus TDS(Calc.only), Acidity
	Green	1 x **500ml** plastic (*none*)	**Sample Collection Pocket Guide Suite:2** Suite 1(above) + Colour, Turbidity, std. level TDS, TSS
	Green	1 x **1,000ml** plastic (*none*)	**Sample Collection Pocket Guide Suite 3:** Suite 1 + 2 (as above) + Low level TDS, TSS + BOD
	Green	1 x **1,000ml** White plastic (*none*)	Chlorophyll a (Standard LOR)
	Green	1 x **1,000ml** White plastic (*none*)	Asbestos
	Light Green & White stripe	1 x **60ml** plastic *(none)*	Total Nitrogen and Total Phosphorus – **ULTRA TRACE**
	Turquoise & White stripe	1 x **60ml** plastic *(none)*	Reactive P, Nitrate, Nitrite, Ammonia, Silica (Field filtered) – **ULTRA TRACE**
	Yellow	1 x **125ml** plastic (*Zinc Acetate and NaOH*)	Sulfide
	Yellow & Light Blue	2 x **125mL** plastic bottles; Yellow (*Zinc Acetate and NaOH)* plus Light Blue *(Aluminum Chloride*)	Unionized Sulfide
	Light Orange	1 x **250ml** plastic (*EDTA and Zinc Acetate*)	Sulfite, Thiosulfate
	Brown & Green Stripe	1 x **500ml** Amber glass (*HCHO to be added upon receipt at the laboratory*)NOTE 1	Surfactants (NIS or MBAS)
	Blue	1 x **250ml** White plastic (*NaOH*)	Total, Free and WAD Cyanide; Cyanate
	Blue & White Stripe	1 x **250ml** White plastic Sulfide pretreatment bottle (*$Pb(OAC)_2$*)*NOTE2*	Total, Free and WAD Cyanide; Cyanate
	Purple	1 x **125ml** plastic (*Sulfuric acid*)	COD, Ammonia, TN, NOx, TKN, TP or Total Phenols
	Purple	1 x **40ml** Glass vial (*Sulfuric acid*)	TOC
	Purple	1 x **40ml** Glass vial (*Sulfuric acid*)	DOC (Field Filtered)
	Purple	1 x **1,000ml** wide mouth glass jar (*Sulfuric acid*)	Oil & Grease

MICRO & ALGAE

No.	Label Colour	Container Type (*Preservation*)	Test Parameter(s)
	Grey	1 x **250ml** Sterile plastic jar/lid *(With $Na_2S_2O_3$)*	Multiple 'Micro' Tests
	Dark Green	1 x **1,000ml** White plastic (*Lugol's solution*)	Algae

METALS & RADIONUCLIDES

No.	Label Colour	Container Type (*Preservation*)	Test Parameter(s)
	Red	1 x **60ml** plastic (*Nitric acid*)	Heavy Metals **Dissolved** (Field Filtered) or **Total**
	Red & Green stripe	1 x **60ml** plastic *(none) AIRFREIGHT OPTION*	Heavy Metals **Dissolved** (Field Filtered) or **Total**
	Red on White	1 x **125ml** plastic (*Spec Pure nitric acid*)	ORC Metals in Fresh and Saline water **Dissolved** (Field Filtered) or **Total**

	Red & Green stripe	1 x **125ml** plastic *(none) AIRFREIGHT OPTION*	ORC Metals in Fresh and Saline water **Dissolved** (Field Filtered) <u>or</u> **Total**
	Maroon on White	1 x **60ml** plastic (*Spec Pure HCl acid*)	As and Se Speciation **(Field Filtered)**
	Maroon	1 x **60ml** plastic (*Hydrochloric acid*)	Ferrous Iron (Field Filtered)
	Blue	1 x **60ml** plastic (*Sodium Hydroxide*)	Hexavalent Chromium **(extended holding time) –** Field filtration required for dissolved Hex' Cr
	Red & Green stripe	1 x **1,000ml** plastic (*none*) *AIRFREIGHT OPTION*	Gross alpha/ Gross beta
		2 x **1,000ml** plastic *(none) AIRFREIGHT OPTION*	Radium 226, Radium 228

AQUEOUS MATRIX SAMPLE CONTAINERS (WATER) continued…

ORGANICS			
No.	**Label Colour**	**Container Type (*Preservation*)**	**Test Parameter(s)**
Pairs	Purple	2 x **40ml** Amber vials *(Sulfuric Acid) (suitable for Air Freight)*	TPH/TRH(C6-C10) plus BTEX, BTEXN, VOCs, Alcohols, Gases **or** Methane **or** CWG (VOC) speciation
	Orange	1 x **100ml** (unpres') Amber for primary analysis 2 x additional **100ml** Amber glass bottles for laboratory duplicates and matrix spikes.	***Standard level*** OC/OP/PCB <u>plus</u> ***Standard level*** PAHs plus ***standard level*** Phenols <u>plus</u> TRH(C_{10}-C_{40}) plus standard level SVOC (8270 list)
	Orange	1 x **100ml** Amber glass *(unpres') includes QC*	***Herbicides including*** Glyphosate/AMPA, Phenoxy Acids, Amitrole, metsulfuron methyl, Carbamates and Diuron ***(Standard level) plus Ultra trace*** Multi-residue Pesticides Suite **(EP234) , <u>or</u>** Explosives ***(Standard level)***
	Orange	1 x **500ml** Amber *(unpres')* for primary analysis 2 x additional **500ml** Amber glass bottles for laboratory duplicates and matrix spikes.	***Enhanced level or Ultra-trace*** PAHs plus any standard level TPH and SVOCs **<u>or</u>** TBT **<u>or</u>** ***Ultra trace*** *OC/OP/PCBs* **<u>or</u>** Synthetic Pyrethroids **<u>or</u>** HRAF: TPH Aliphatic/Aromatic Speciation/TPH(C_{10}-C_{40}) **<u>or</u>** CWG TRH Speciation (SVOC fractions only)
	Orange	2 x **500ml** Amber glass *(unpres')* for primary analysis 4 x additional **500ml** Amber glass bottles for laboratory duplicates and matrix spikes.	Dioxins & Furans **<u>or</u>** PBDEs **<u>or</u>** ***Ultra trace*** Phenols **<u>or</u>** ***ultra trace*** phenols <u>*and*</u> any level PAHs/TRH **<u>or</u>** ***<u>Super</u> Ultra-trace*** *PAHs* + other std SVOCs/TRH
	Grey	1 x **125ml** plastic (PTFE free) (unpres' *however $Na_2S_2O_3$ may be added for chlorinated water*)	PFOS & PFOA **<u>or</u>** Paraquat & Diquat
	Brown & Green Stripe	1 x **500ml** Amber glass (*HCHO to be added upon receipt at the laboratory*)[NOTE1]	Alkylphenol Ethoxylates
	Orange	1 x **500ml** Amber glass *(unpres')* for primary analysis 2 x additional **500ml** Amber glass bottles for laboratory duplicates and matrix spikes.	***Ultra trace*** Explosives **<u>or</u>** ***Ultra trace*** Phenoxy Acid herbicides **<u>or</u>** Nitrocellulose **<u>or</u>** ***Low level*** Multi-residue screen by LC/MS **(EP209)**

SPECIALIST CATCHMENT, RECYCLED, DRINKING WATER MONITORING

No.	Label Colour	Container Type (*Preservation*)	Test Parameter(s)
	Black on White	1 x 40ml vial *(EDA)*	Oxyhalides
Pairs	Green	2 x **40ml** Amber vials (none)	MIB/Geosmin
Pairs	Grey	2 x **40ml** Amber vials (*none, however $Na_2S_2O_3$ may be added for chlorinated water*)	Acrylamide, Acrolein
Pairs	Dark Blue &	2 x **40ml** Amber vials *(Ammonium Chloride)*	Chloroacetic Acids

	White stripe		
Pairs	Purple	2 x **40ml** Amber vials *(Sulfuric Acid, $Na_2S_2O_3$ may be added for chlorinated water)*	Acrylonitrile or Alcohols or Pyridine
	Grey	1 x **125ml** plastic (PTFE free) (*none, however $Na_2S_2O_3$ may be added for chlorinated water*)	PFOS & PFOA, **or** Paraquat & Diquat,
	Grey	1 x **500ml** Amber glass (*none, however $Na_2S_2O_3$ may be added for chlorinated water*)	NDMA
	Orange	1 x **500mL** Amber glass (unpres')	***Super Ultra-trace*** Multiresidue Pesticides Suite **(EP234LL)**
		2 x **500ml** Amber glass *(none)* for primary analysis 4 x additional **500ml** Amber glass bottles for laboratory duplicates and matrix spikes.	***Super Ultra-trace*** *OC/OP/PCB*, **or** Ultra trace Multi Residue Screens **(EP215)**

Important Notes:

- NOTE1 If high sulfide contamination is suspected a **sulfide pretreatment bottle** must be used during the collection of these samples.

ALS use only	Packed by:		Dispatch Time / Date:
Number of Eskies:		Consignment Note Number:	
Courier Company:		Consignment Dispatched by (date/ Sign):	

GHD

OfficeAddressLine1
OfficeAddressLine2
T: OfficeTelephone F: OfficeFax E: OfficeEmail

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	Metcalfe					

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Appendix E – Mellaluka and Doongmabulla Springs

Sampling analysis results summary tables

Summary Table - Doongmabulla Springs: Water Quality Analysis Results, Field Measurements

			Field						
			Dissolved Oxygen (% saturated) (Field)	Dissolved Oxygen (Field)	Electrical Conductivity (Field)	pH (Field)	TDS (Field)	Temp (Field)	Turbidity (Field)
			%S	mg/L	uS/cm	pH_Units	PPM	oC	NTU
Field_ID	**LocCode**	**Sampled_Date-Time**							
Cattle Creek	Cattle Creek	24/06/2012	-	3.95	935	7.25	-	16.7	-
DS1	DS1	22/05/2012	0.1	-	497	7.98	333	35.5	-1.7
DS1	DS1	24/06/2012	-	0.46	409	6.36	-	26.4	-
DS10	DS10	24/05/2012	0	-	301.5	6.87	202	28.3	3.1
DS10	DS10	22/06/2012	-	0.43	70	6.2	-	25.6	-
DS2A	DS2A	22/06/2012	-	0.22	4.9	5.42	-	-	-
DS3A	DS3A	24/06/2012	-	10.4	604	7.64	-	17.6	-
DS4	DS4	24/06/2012	-	5.41	368	6.34	-	18.5	-
DS5	DS5	24/06/2012	-	3.35	286	7.15	-	25.6	-
DS5B	DS5B	23/05/2012	1	-	204.5	7.6	137	27.2	7.5
DS5B	DS5B	24/06/2012	-	8.55	284	7.27	-	23.2	-
DS6	DS6	24/06/2012	-	4.03	289	6.45	-	23.9	-
DS7	DS7	24/06/2012	-	4.9	330	6.34	-	21.6	-
DS8	DS8	24/06/2012	-	11.29	639	7.73	-	21.3	-
DS9A	DS9A	24/06/2012	-	4.5	353	6.38	-	21.8	-
Dylingo Creek	Dylingo Creek	24/06/2012	-	6.16	510	6.84	-	19	-

Statistical Summary

Number of Results	3	13	16	16	3	15	3
Number of Detects	3	13	16	16	3	15	3
Minimum Concentration	1	0.22	4.9	5.42	137	16.7	-1.7
Minimum Detect	0.1	0.22	4.9	5.42	137	16.7	ND
Maximum Concentration	1	11.29	935	7.98	333	35.5	7.5
Maximum Detect	1	11.29	935	7.98	333	35.5	7.5
Average Concentration	0.37	4.9	380	6.9	224	23	3
Median Concentration	0.1	4.5	341.5	6.855	202	23.2	3.1
Standard Deviation	0.55	3.6	225	0.7	100	4.9	4.6
Number of Guideline Exceedances	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0

Summary Table - Doongmabulla Springs: Water Quality Analysis Results, Major Ions and Alkalinity

			Alkalinity							Major Ions									
			Alkalinity (total) as CaCO3	Alkalinity (Bicarbonate as CaCO3)	Alkalinity (Carbonate as CaCO3)	Alkalinity (Hydroxide) as CaCO3	Bicarbonate	Carbonate	Hardness as CaCO3 (Filtered)	Calcium (Filtered)	Chloride	Magnesium (Filtered)	Potassium (Filtered)	Sodium (Filtered)	Sulphate	Sulphate (Filtered)	Anions Total	Cations Total	Ionic Balance
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	%
EQL			1	1	1	1			1	1	1	1	1	1	1	1	0.01	0.01	0.01
Field_ID	**LocCode**	**Sampled_Date-Time**																	
DS1	DS1	24/05/2012	118	118	<1	<1	144	<1.2	16	3	137	2	16	128	10	-	6.43	6.29	1.12
DS1	DS1	24/06/2012	113	113	<1	<1	-	-	16	3	137	2	14	124	-	8	6.29	6.07	1.83
DS10	DS10	24/05/2012	123	123	<1	<1	150.1	<1.2	40	11	86	3	20	83	8	-	5.05	4.92	1.34
DS10	DS10	22/06/2012	123	123	<1	<1	-	-	40	11	93	3	22	85	-	7	5.23	5.06	1.68
DS11C	DS11C	24/05/2012	230	230	<1	<1	280.6	<1.2	30	4	3	5	55	87	<1	-	4.68	5.8	10.7
DS2A	DS2A	22/06/2012	48	48	<1	<1	-	-	67	2	259	15	20	146	-	6	8.39	8.2	1.18
DS3A	DS3A	24/06/2012	173	173	<1	<1	-	-	7	3	191	<1	6	198	-	<1	8.84	8.92	0.36
DS4	DS4	24/06/2012	152	152	<1	<1	-	-	<1	<1	79	<1	9	119	-	<1	5.27	5.41	1.28
DS5	DS5	24/06/2012	155	155	<1	<1	-	-	<1	<1	40	<1	9	89	-	<1	4.23	4.1	1.54
DS5B	DS5B	23/05/2012	147	147	<1	<1	179.3	<1.2	<1	<1	36	<1	11	86	<1	-	3.95	4.02	0.82
DS5B	DS5B	24/06/2012	157	157	<1	<1	-	-	<1	<1	42	<1	9	95	-	<1	4.32	4.36	0.42
DS6	DS6	24/06/2012	156	156	<1	<1	-	-	<1	<1	45	<1	9	92	-	<1	4.39	4.23	1.84
DS7	DS7	24/06/2012	154	154	<1	<1	-	-	<1	<1	60	<1	8	102	-	<1	4.77	4.64	1.41
DS8	DS8	24/06/2012	182	182	<1	<1	-	-	14	4	162	1	5	184	-	<1	8.21	8.41	1.21
DS9A	DS9A	24/06/2012	151	151	<1	<1	-	-	<1	<1	80	<1	8	113	-	<1	5.27	5.12	1.52
CATTLE CREEK	CATTLE CREEK	24/06/2012	196	196	<1	<1	-	-	94	18	339	12	28	234	-	11	13.7	12.8	3.52
DUP1	DYLINGO CREEK	24/06/2012	111	111	<1	<1	-	-	60	11	173	8	12	132	-	7	7.24	7.26	0.06
DYLINGO CREEK	DYLINGO CREEK	24/06/2012	110	110	<1	<1	-	-	60	11	172	8	14	133	-	8	7.22	7.35	0.9
Statistical Summary																			
Number of Results			18	18	18	18	4	4	18	18	18	18	18	18	4	14	18	18	18
Number of Detects			18	18	0	0	4	0	11	11	18	10	18	18	2	6	18	18	18
Minimum Concentration			48	48	<1	<1	144	<1.2	<1	<1	3	<1	5	83	<1	<1	3.95	4.02	0.06
Minimum Detect			48	48	ND	ND	144	ND	7	2	3	1	5	83	8	6	3.95	4.02	0.06
Maximum Concentration			230	230	<1	<1	280.6	<1.2	94	18	339	15	55	234	10	11	13.7	12.8	10.7
Maximum Detect			230	230	ND	ND	280.6	ND	94	18	339	15	55	234	10	11	13.7	12.8	10.7
Average Concentration			144	144	0.5	0.5	189	0.6	25	4.7	119	3.5	15	124	4.8	3.6	6.3	6.3	1.8
Median Concentration			151.5	151.5	0.5	0.5	164.7	0.6	15	3	89.5	1.5	11.5	116	4.25	0.5	5.27	5.605	1.31
Standard Deviation			40	40	0	0	63	0	29	5.3	87	4.4	12	43	5	3.9	2.4	2.2	2.3
Number of Guideline Exceedances			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

			Inorganics				
			Electrical conductivity *(lab)	Fluoride	pH (Lab)	Silica	Total Dissolved Solids (est.)
			uS/cm	mg/L	pH_Units	mg/L	mg/L
EQL			1	0.1	0.01	0.1	1

Field_ID	LocCode	Sampled_Date-Time	Electrical conductivity *(lab)	Fluoride	pH (Lab)	Silica	Total Dissolved Solids (est.)
DS1	DS1	24/05/2012	635	0.2	7.48	-	413
DS1	DS1	24/06/2012	647	0.2	7.32	15.6	420
DS10	DS10	24/05/2012	502	0.5	7.5	-	326
DS10	DS10	22/06/2012	538	0.6	7.34	14.7	350
DS11C	DS11C	24/05/2012	612	0.5	7.61	-	398
DS2A	DS2A	22/06/2012	886	1	6.29	51.2	576
DS3A	DS3A	24/06/2012	889	0.3	7.99	4.4	578
DS4	DS4	24/06/2012	526	0.3	7.54	15.3	342
DS5	DS5	24/06/2012	419	0.5	7.69	15	272
DS5B	DS5B	23/05/2012	376	0.4	8.01	-	244
DS5B	DS5B	24/06/2012	416	0.5	7.86	14.2	270
DS6	DS6	24/06/2012	426	0.4	7.31	15.2	277
DS7	DS7	24/06/2012	472	0.3	7.5	15.1	307
DS8	DS8	24/06/2012	807	0.3	7.69	12.8	524
DS9A	DS9A	24/06/2012	534	0.4	7.99	16.4	347
CATTLE CREEK	CATTLE CREEK	24/06/2012	1370	0.4	7.59	16	890
DUP1	DYLINGO CREEK	24/06/2012	745	0.3	7.51	14.6	484
DYLINGO CREEK	DYLINGO CREEK	24/06/2012	742	0.2	7.39	15.2	482

Statistical Summary

Statistic	Electrical conductivity *(lab)	Fluoride	pH (Lab)	Silica	Total Dissolved Solids (est.)
Number of Results	18	18	18	14	18
Number of Detects	18	18	18	14	18
Minimum Concentration	376	0.2	6.29	4.4	244
Minimum Detect	376	0.2	6.29	4.4	244
Maximum Concentration	1370	1	8.01	51.2	890
Maximum Detect	1370	1	8.01	51.2	890
Average Concentration	641	0.41	7.5	17	417
Median Concentration	575	0.4	7.525	15.15	374
Standard Deviation	243	0.19	0.38	10	158
Number of Guideline Exceedances	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0

Summary Table - Doongmabulla Springs: Water Quality Analysis Results, Dissolved Metals

			Metals											
			Arsenic (Filtered)	Cadmium (Filtered)	Chromium (III+VI) (Filtered)	Cobalt (Filtered)	Copper (Filtered)	Iron (Filtered)	Lead (Filtered)	Manganese (Filtered)	Mercury (Filtered)	Nickel (Filtered)	Vanadium (Filtered)	Zinc (Filtered)
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL			0.001	0.0001	0.001	0.001	0.001	0.05	0.001	0.001	0.0001	0.001	0.01	0.005
Field_ID	**LocCode**	**Sampled_Date-Time**												
DS1	DS1	24/06/2012	0.002	<0.0001	<0.001	0.002	<0.001	0.79	<0.001	0.055	<0.0001	<0.001	<0.01	0.007
DS10	DS10	22/06/2012	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	0.136	<0.0001	<0.001	<0.01	0.005
DS3A	DS3A	24/06/2012	<0.001	<0.0001	<0.001	<0.001	0.001	0.58	<0.001	0.028	<0.0001	0.001	<0.01	0.014
DS4	DS4	24/06/2012	<0.001	<0.0001	<0.001	<0.001	<0.001	0.16	<0.001	0.004	<0.0001	<0.001	<0.01	0.007
DS5	DS5	24/06/2012	0.002	<0.0001	<0.001	<0.001	<0.001	0.23	<0.001	0.008	<0.0001	<0.001	<0.01	0.008
DS5B	DS5B	24/06/2012	0.002	<0.0001	<0.001	<0.001	<0.001	0.21	<0.001	0.005	<0.0001	<0.001	<0.01	0.006
DS6	DS6	24/06/2012	<0.001	<0.0001	<0.001	<0.001	<0.001	0.27	<0.001	0.019	<0.0001	<0.001	<0.01	0.007
DS7	DS7	24/06/2012	0.002	<0.0001	<0.001	<0.001	<0.001	0.14	<0.001	0.005	<0.0001	<0.001	<0.01	0.006
DS8	DS8	24/06/2012	<0.001	<0.0001	0.001	<0.001	0.003	0.6	<0.001	0.02	<0.0001	0.001	<0.01	0.009
DS9A	DS9A	24/06/2012	0.001	<0.0001	<0.001	<0.001	<0.001	0.06	<0.001	0.002	<0.0001	<0.001	<0.01	0.013
CATTLE CREEK	CATTLE CREEK	24/06/2012	<0.001	<0.0001	<0.001	0.001	<0.001	0.33	<0.001	0.255	<0.0001	0.001	<0.01	0.007
DUP1	DYLINGO CREEK	24/06/2012	<0.001	<0.0001	<0.001	0.001	0.001	0.25	<0.001	0.284	<0.0001	0.001	<0.01	0.012
DYLINGO CREEK	DYLINGO CREEK	24/06/2012	<0.001	<0.0001	<0.001	0.001	0.001	0.26	<0.001	0.29	<0.0001	0.001	<0.01	0.008
Statistical Summary														
Number of Results			13	13	13	13	13	13	13	13	13	13	13	13
Number of Detects			5	0	1	4	4	12	0	13	0	5	0	13
Minimum Concentration			<0.001	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	0.002	<0.0001	<0.001	<0.01	0.005
Minimum Detect			0.001	ND	0.001	0.001	0.001	0.06	ND	0.002	ND	0.001	ND	0.005
Maximum Concentration			0.002	<0.0001	0.001	0.002	0.003	0.79	<0.001	0.29	<0.0001	0.001	<0.01	0.014
Maximum Detect			0.002	ND	0.001	0.002	0.003	0.79	ND	0.29	ND	0.001	ND	0.014
Average Concentration			0.001	0.00005	0.00054	0.00073	0.00081	0.3	0.0005	0.085	0.00005	0.00069	0.005	0.0084
Median Concentration			0.0005	0.00005	0.0005	0.0005	0.0005	0.25	0.0005	0.02	0.00005	0.0005	0.005	0.007
Standard Deviation			0.00071	0	0.00014	0.00044	0.00069	0.22	0	0.11	0	0.00025	0	0.0028
Number of Guideline Exceedances			0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)			0	0	0	0	0	0	0	0	0	0	0	0

				Hardness corrected metals												
				Cadmium -Calculated by Hardness	Cadmium -Calculated by Hardness (Filtered)	Chromium -Calculated by Hardness	Chromium -Calculated by Hardness (Filtered)	Copper -Calculated by Hardness	Copper -Calculated by Hardness (Filtered)	Hardness Calculated (Filtered)	Lead -Calculated by Hardness	Lead -Calculated by Hardness (Filtered)	Nickel -Calculated by Hardness	Nickel -Calculated by Hardness (Filtered)	Zinc -Calculated by Hardness	Zinc -Calculated by Hardness (Filtered)
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL																
ADWG 2011 Health																
ANZECC (2000) Ecosystems Fresh Water (95%)				0.2	0.2	1	1	1.4	1.4		3.4	3.4	11	11	8	8
LocCode	**Sampled_Date-Time**	**Area**	**SDG**													
Bores																
10-SB	7/04/2013	Storie"s bore	EB1308583	<0.05571	<0.05571	<0.5833	<0.5833	1.716	1.144	57.89	<0.4339	<0.4339	0.5719	1.144	13.15	13.15
11-IB	7/04/2013	Ironbark bore	EB1308583	<0.2498	<0.2498	4.648	4.648	2.397	2.397	10.73	<3.692	<3.692	<2.397	2.397	52.73	14.38
12-MB	7/04/2013	Middle bore	EB1308583	<0.02249	<0.02249	<0.2529	<0.2529	3.366	0.4809	160.4	<0.1189	<0.1189	<0.2404	<0.2404	9.378	4.569
13-BB1	7/04/2013	Blue"s bore #1	EB1308583	<0.06685	<0.06685	<0.6901	<0.6901	0.6808	<0.6808	47.16	<0.563	<0.563	<0.6808	<0.6808	9.531	<3.404
1-MSHB	1/04/2013	Mellaluka homestead bore	EB1307970	<0.04901	<0.04901	<0.5183	<0.5183	1.012	0.506	66.86	<0.3614	<0.3614	1.012	1.012	8.096	4.048
8-BB2	7/04/2013	Blue"s bore #2	EB1308583	<0.01932	<0.01932	<0.2199	<0.2199	0.208	0.208	190.3	<0.09575	<0.09575	0.208	0.416	4.576	5.2
9-3MB	7/04/2013	3 mile bore	EB1308583	<0.1629	<0.1629	6.27	6.27	3.187	1.594	17.34	<2.006	<2.006	<1.594	1.594	54.18	25.5
Springs																
3-MSHD	1/04/2013	Mellaluka homestead dam	EB1307970	<0.03282	<0.03282	0.3582	<0.3582	0.69	0.345	104.9	<0.2039	<0.2039	0.69	0.69	3.105	2.07
4-MSHP	1/04/2013	Mellaluka homestead pool	EB1307970	0.2182	<0.07272	10.44	<0.7457	9.59	<0.7377	42.91	<0.6348	<0.6348	17.71	0.7377	71.56	3.689
6-LS	1/04/2013	Lignum Spring	EB1307970	<0.009973	<0.009973	0.5978	<0.1196	0.8849	<0.1106	744.5	0.2236	<0.03727	1.327	0.4424	6.637	0.7743
7-SS	1/04/2013	Storie"s Spring	EB1307970	<0.02151	<0.02151	<0.2427	<0.2427	0.4609	<0.2304	168.7	<0.1116	<0.1116	0.2304	<0.2304	3.687	6.683
Statistical Summary																
Number of Results				11	11	11	11	11	11	11	11	11	11	11	11	11
Number of Detects				1	0	5	2	11	7	11	1	0	7	8	11	10
Minimum Concentration				<0.009973	<0.009973	<0.2199	<0.1196	0.208	<0.1106	10.73	<0.09575	<0.03727	0.208	<0.2304	3.105	0.7743
Minimum Detect				0.2182	ND	0.3582	4.648	0.208	0.208	10.73	0.2236	ND	0.208	0.416	3.105	0.7743
Maximum Concentration				<0.2498	<0.2498	10.44	6.27	9.59	2.397	744.5	<3.692	<3.692	17.71	2.397	71.56	25.5
Maximum Detect				0.2182	ND	10.44	6.27	9.59	2.397	744.5	0.2236	ND	17.71	2.397	71.56	25.5
Average Concentration				0.051	0.035	2.1	1.2	2.2	0.69	147	0.39	0.38	2.2	0.82	22	7.4
Median Concentration				0.024505	0.024505	0.34505	0.25915	1.012	0.36885	66.86	0.21695	0.1807	0.69	0.69	9.378	4.569
Standard Deviation				0.066	0.037	3.5	2.2	2.7	0.73	208	0.55	0.56	5.2	0.69	25	7.4
Number of Guideline Exceedances				2	1	3	2	5	2	0	1	1	1	0	7	3
Number of Guideline Exceedances(Detects Only)				1	0	3	2	5	2	0	0	0	1	0	7	3

				Field					Inorganics								Nutrients					
				Dissolved Oxygen (Field)	Electrical Conductivity (Field)	Oxygen Redox Potential (Field)	pH (Field)	Temp (Field)	Electrical conductivity *(lab)	Fluoride	Kjeldahl Nitrogen Total	pH (Lab)	Sodium Absorption Ratio (Filtered)	Sulphide	TOC	Total Dissolved Solids (est.)	Ammonia as N	Nitrate (as N)	Nitrite (as N)	Nitrogen (Total Oxidised)	Nitrogen (Total)	Phosphorus
				mg/L	uS/cm	mV	pH_Units	oC	uS/cm	mg/L	mg/L	pH_Units	-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL									1	0.1	0.1	0.01	0.01	0.1	1	1	0.01	0.01	0.01	0.01	0.1	0.01
ADWG 2011 Health										1.5												
ANZECC (2000) Ecosystems Fresh Water (95%)																						
LocCode	**Sampled_Date-Time**	**Area**	**SDG**																			
Bores																						
10-SB	7/04/2013	Storie"s bore	EB1308583	6.44	1241	101	6.46	28.6	1240	0.3	<0.1	7.38	13.5	-	-	806	0.04	0.12	<0.01	0.12	0.1	<0.01
11-IB	7/04/2013	Ironbark bore	EB1308583	6.51	291	100	6.25	28.7	432	0.3	<0.1	7.15	11.4	-	-	281	0.05	0.17	<0.01	0.17	0.2	<0.01
12-MB	7/04/2013	Middle bore	EB1308583	4.78	3190	-25	6.78	29.2	3480	0.6	<0.1	7.78	24.9	<0.1	1	2260	0.11	0.03	<0.01	0.03	<0.1	0.02
13-BB1	7/04/2013	Blue"s bore #1	EB1308583	6.38	551	21	6.62	28.5	866	0.3	<0.1	7.38	9.69	-	-	563	0.06	0.02	<0.01	0.02	<0.1	<0.01
1-MSHB	1/04/2013	Mellaluka homestead bore	EB1307970	6.35	741	13	5.6	28.2	929	0.1	<0.1	6.42	8.35	<0.1	8	604	<0.01	0.31	<0.01	0.31	0.3	<0.01
8-BB2	7/04/2013	Blue"s bore #2	EB1308583	2.24	1982	-21	6.52	28.6	3160	0.4	<0.1	7.43	19	-	-	2050	0.12	0.02	<0.01	0.02	<0.1	0.07
9-3MB	7/04/2013	3 mile bore	EB1308583	4.56	586	90	6.22	29.2	969	0.4	<0.1	7.09	20.7	<0.1	<1	630	0.05	0.45	<0.01	0.45	0.4	<0.01
Springs																						
3-MSHD	1/04/2013	Mellaluka homestead dam	EB1307970	7.84	1497	37	6.61	31.8	1430	0.3	-	7.54	10.9	<0.1	28	930	-	-	-	-	-	-
4-MSHP	1/04/2013	Mellaluka homestead pool	EB1307970	1.73	681	-55	5.73	26.2	693	0.1	-	6.48	8.03	<0.1	11	450	-	-	-	-	-	-
6-LS	1/04/2013	Lignum Spring	EB1307970	0.04	11820	-360	7.36	28	12,000	1.8	-	7.92	39.8	<0.1	103	7800	-	-	-	-	-	-
7-SS	1/04/2013	Storie"s Spring	EB1307970	0.65	3500	-240	6.61	30.1	3390	0.7	-	7.67	22.4	<0.1	55	2200	-	-	-	-	-	-
Statistical Summary																						
Number of Results				11	11	11	11	11	11	11	7	11	11	7	7	11	7	7	7	7	7	7
Number of Detects				11	11	11	11	11	11	11	0	11	11	0	6	11	6	7	0	7	4	2
Minimum Concentration				0.04	3.19	-360	5.6	26.2	432	0.1	<0.1	6.42	8.03	<0.1	<1	281	<0.01	0.02	<0.01	0.02	<0.1	<0.01
Minimum Detect				0.04	3.19	ND	5.6	26.2	432	0.1	ND	6.42	8.03	ND	1	281	0.04	0.02	ND	0.02	0.1	0.02
Maximum Concentration				7.84	1982	101	7.36	31.8	12,000	1.8	<0.1	7.92	39.8	<0.1	103	7800	0.12	0.45	<0.01	0.45	0.4	0.07
Maximum Detect				7.84	1982	101	7.36	31.8	12,000	1.8	ND	7.92	39.8	ND	103	7800	0.12	0.45	ND	0.45	0.4	0.07
Average Concentration				4.3	690	-31	6.4	29	2599	0.48	0.05	7.3	17	0.05	30	1689	0.062	0.16	0.005	0.16	0.16	0.016
Median Concentration				4.78	586	13	6.52	28.6	1240	0.3	0.05	7.38	13.5	0.05	11	806	0.05	0.12	0.005	0.12	0.1	0.005
Standard Deviation				2.7	650	145	0.49	1.4	3318	0.47	0	0.48	9.6	0	38	2156	0.04	0.17	0	0.17	0.14	0.024
Number of Guideline Exceedances				0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)				0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

LocCode	Sampled_Date-Time	Area	SDG	Alkalinity (total) as CaCO3	Alkalinity (Bicarbonate as CaCO3)	Alkalinity (Carbonate as CaCO3)	Alkalinity (Hydroxide) as CaCO3	Bicarbonate	Carbonate	Hardness as CaCO3 (Filtered)	Calcium (Filtered)	Chloride	Anions Total	Magnesium (Filtered)	Cations Total	Ionic Balance	Potassium (Filtered)	Sodium (Filtered)	Sulphate (Filtered)
				Alkalinity							**Major Ions**								
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	mg/L	meq/L	%	mg/L	mg/L	mg/L
EQL				1	1	1	1			1	1	1	0.01	1	0.01	0.01	1	1	1
ADWG 2011 Health																			500
ANZECC (2000) Ecosystems Fresh Water (95%)																			
Bores																			
10-SB	7/04/2013	Storie''s bore	EB1308583	59	59	<1	<1	71.98	<1.2	58	10	352	12	8	11.6	1.7	8	236	44
11-IB	7/04/2013	Ironbark bore	EB1308583	38	38	<1	<1	46.36	<1.2	11	1	114	4.18	2	4.03	1.87	3	86	10
12-MB	7/04/2013	Middle bore	EB1308583	208	208	<1	<1	253.8	<1.2	160	28	932	31.9	22	35.1	4.74	11	726	69
13-BB1	7/04/2013	Blue''s bore #1	EB1308583	48	48	<1	<1	58.56	<1.2	47	9	239	7.99	6	7.75	1.55	6	153	14
1-MSHB	1/04/2013	Mellaluka homestead bore	EB1307970	27	27	<1	<1	32.94	<1.2	67	7	262	8.6	12	8.32	1.65	6	157	32
8-BB2	7/04/2013	Blue''s bore #2	EB1308583	126	126	<1	<1	153.7	<1.2	190	35	880	28	25	30.2	3.74	8	602	32
9-3MB	7/04/2013	3 mile bore	EB1308583	61	61	<1	<1	74.42	<1.2	17	2	276	9.34	3	9.11	1.24	6	198	16
Springs																			
3-MSHD	1/04/2013	Mellaluka homestead dam	EB1307970	66	66	<1	<1	80.52	<1.2	105	14	416	13.1	17	13.5	1.58	12	256	3
4-MSHP	1/04/2013	Mellaluka homestead pool	EB1307970	25	25	<1	<1	30.5	<1.2	43	4	200	6.39	8	6.25	1.14	5	121	12
6-LS	1/04/2013	Lignum Spring	EB1307970	597	597	<1	<1	728.3	<1.2	745	107	4100	128	116	125	1.04	54	2500	<1
7-SS	1/04/2013	Storie''s Spring	EB1307970	251	251	<1	<1	306.2	<1.2	169	28	889	30.9	24	33.6	4.19	44	670	40
Statistical Summary																			
Number of Results				11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Number of Detects				11	11	0	0	11	0	11	11	11	11	11	11	11	11	11	10
Minimum Concentration				25	25	<1	<1	30.5	<1.2	11	1	114	4.18	2	4.03	1.04	3	86	<1
Minimum Detect				25	25	ND	ND	30.5	ND	11	1	114	4.18	2	4.03	1.04	3	86	3
Maximum Concentration				597	597	<1	<1	728.3	<1.2	745	107	4100	128	116	125	4.74	54	2500	69
Maximum Detect				597	597	ND	ND	728.3	ND	745	107	4100	128	116	125	4.74	54	2500	69
Average Concentration				137	137	0.5	0.5	167	0.6	147	22	787	25	22	26	2.2	15	519	25
Median Concentration				61	61	0.5	0.5	74.42	0.6	67	10	352	12	12	11.6	1.65	8	236	16
Standard Deviation				170	170	0	0	207	0	208	30	1139	35	32	35	1.3	17	697	21
Number of Guideline Exceedances				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LocCode	Aluminium	Aluminium (Filtered)	Arsenic	Arsenic (Filtered)	Boron	Boron (Filtered)	Cadmium	Cadmium (Filtered)	Chromium (III+VI)	Chromium (III+VI) (Filtered)	Cobalt	Cobalt (Filtered)	Copper	Copper (Filtered)	Iron	Iron (Filtered)	Lead	Lead (Filtered)	Manganese	Manganese (Filtered)	Mercury
	Metals																				
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL	0.01	0.01	0.001	0.001	0.05	0.05	0.0001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.05	0.05	0.001	0.001	0.001	0.001	0.0001
ADWG 2011 Health			0.01	0.01	4	4	0.002	0.002					2	2			0.01	0.01	0.5	0.5	0.001
ANZECC (2000) Ecosystems Fresh Water (95%)	0.055	0.055			0.37	0.37	0.0002	0.0002	0.001	0.001			0.0014	0.0014			0.0034	0.0034	1.9	1.9	0.00006
Bores																					
10-SB	0.15	<0.01	<0.001	<0.001	0.21	0.19	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.003	0.002	0.14	<0.05	<0.001	<0.001	0.02	0.018	<0.0001
11-IB	<0.01	<0.01	<0.001	<0.001	0.14	0.12	<0.0001	<0.0001	0.002	0.002	<0.001	<0.001	0.001	0.001	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	<0.0001
12-MB	<0.01	<0.01	<0.001	<0.001	0.46	0.45	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.014	0.002	1.1	0.96	<0.001	<0.001	0.088	0.083	<0.0001
13-BB1	<0.01	<0.01	<0.001	<0.001	0.12	0.12	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.46	0.42	<0.001	<0.001	0.03	0.03	<0.0001
1-MSHB	<0.01	<0.01	<0.001	<0.001	0.15	0.16	<0.0001	<0.0001	<0.001	<0.001	0.001	0.001	0.002	0.001	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	<0.0001
8-BB2	<0.01	<0.01	0.008	0.008	0.39	0.32	<0.0001	<0.0001	<0.001	<0.001	0.001	0.001	0.001	0.001	4	3.87	<0.001	<0.001	0.042	0.04	<0.0001
9-3MB	0.03	<0.01	<0.001	<0.001	0.3	0.27	<0.0001	<0.0001	0.004	0.004	<0.001	<0.001	0.002	0.001	0.07	<0.05	<0.001	<0.001	<0.001	<0.001	<0.0001
Springs																					
3-MSHD	0.5	0.12	<0.001	<0.001	0.27	0.28	<0.0001	<0.0001	0.001	<0.001	0.001	<0.001	0.002	0.001	0.56	0.17	<0.001	<0.001	0.145	0.098	<0.0001
4-MSHP	0.53	0.02	<0.001	<0.001	0.12	0.13	0.0003	<0.0001	0.014	<0.001	0.006	<0.001	0.013	<0.001	0.14	<0.05	<0.001	<0.001	0.006	0.003	<0.0001
6-LS	3.89	0.02	0.013	0.007	0.83	0.84	<0.0001	<0.0001	0.005	<0.001	0.007	0.002	0.008	<0.001	26.6	2.64	0.006	<0.001	2.12	1.23	<0.0001
7-SS	0.16	0.01	<0.001	<0.001	0.48	0.48	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.25	0.12	<0.001	<0.001	0.518	0.353	<0.0001
Statistical Summary																					
Number of Results	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Number of Detects	6	4	2	2	11	11	1	0	5	2	5	3	11	7	9	6	1	0	8	8	0
Minimum Concentration	<0.01	<0.01	<0.001	<0.001	0.12	0.12	<0.0001	<0.0001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.05	<0.05	<0.001	<0.001	<0.001	<0.001	<0.0001
Minimum Detect	0.03	0.01	0.008	0.007	0.12	0.12	0.0003	ND	0.001	0.002	0.001	0.001	0.001	0.001	0.07	0.12	0.006	ND	0.006	0.003	ND
Maximum Concentration	3.89	0.12	0.013	0.008	0.83	0.84	0.0003	<0.0001	0.014	0.004	0.007	0.002	0.014	0.002	26.6	3.87	0.006	<0.001	2.12	1.23	<0.0001
Maximum Detect	3.89	0.12	0.013	0.008	0.83	0.84	0.0003	ND	0.014	0.004	0.007	0.002	0.014	0.002	26.6	3.87	0.006	ND	2.12	1.23	ND
Average Concentration	0.48	0.019	0.0023	0.0018	0.32	0.31	7.3E-05	0.00005	0.0026	0.001	0.0017	0.0007	0.0045	0.001	3	0.76	0.001	0.0005	0.27	0.17	0.00005
Median Concentration	0.03	0.005	0.0005	0.0005	0.27	0.27	0.00005	0.00005	0.0005	0.0005	0.0005	0.0005	0.002	0.001	0.25	0.12	0.0005	0.0005	0.03	0.03	0.00005
Standard Deviation	1.1	0.034	0.0042	0.0028	0.22	0.22	7.5E-05	0	0.0041	0.0011	0.0024	0.0005	0.0049	0.0006	7.9	1.3	0.0017	0	0.63	0.37	0
Number of Guideline Exceedances	5	1	1	0	4	3	1	0	4	2	0	0	8	2	0	0	1	0	2	1	11
Number of Guideline Exceedances(Detects Only)	5	1	1	0	4	3	1	0	4	2	0	0	8	2	0	0	1	0	2	1	0

				Mercury (Filtered)	Molybdenum	Molybdenum (Filtered)	Nickel	Nickel (Filtered)	Selenium	Selenium (Filtered)	Silver	Silver (Filtered)	Uranium	Uranium (Filtered)	Vanadium	Vanadium (Filtered)	Zinc	Zinc (Filtered)
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL				0.0001	0.001	0.001	0.001	0.001	0.01	0.01	0.001	0.001	0.001	0.001	0.01	0.01	0.005	0.005
ADWG 2011 Health				0.001	0.05	0.05	0.02	0.02	0.01	0.01	0.1	0.1	0.017	0.017				
ANZECC (2000) Ecosystems Fresh Water (95%)				0.00006			0.011	0.011	0.005	0.005	0.00005	0.00005					0.008	0.008
LocCode	**Sampled_Date-Time**	**Area**	**SDG**															
Bores																		
10-SB	7/04/2013	Storie"s bore	EB1308583	<0.0001	<0.001	<0.001	0.001	0.002	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	0.023	0.023
11-IB	7/04/2013	Ironbark bore	EB1308583	<0.0001	<0.001	<0.001	<0.001	0.001	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	0.022	0.006
12-MB	7/04/2013	Middle bore	EB1308583	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	0.039	0.019
13-BB1	7/04/2013	Blue"s bore #1	EB1308583	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	0.014	<0.005
1-MSHB	1/04/2013	Mellaluka homestead bore	EB1307970	<0.0001	<0.001	<0.001	0.002	0.002	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	0.016	0.008
8-BB2	7/04/2013	Blue"s bore #2	EB1308583	<0.0001	0.001	<0.001	0.001	0.002	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	0.022	0.025
9-3MB	7/04/2013	3 mile bore	EB1308583	<0.0001	<0.001	<0.001	<0.001	0.001	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	0.034	0.016
Springs																		
3-MSHD	1/04/2013	Mellaluka homestead dam	EB1307970	<0.0001	<0.001	<0.001	0.002	0.002	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	0.009	0.006
4-MSHP	1/04/2013	Mellaluka homestead pool	EB1307970	<0.0001	<0.001	<0.001	0.024	0.001	<0.01	<0.01	<0.001	<0.001	0.004	<0.001	<0.01	<0.01	0.097	0.005
6-LS	1/04/2013	Lignum Spring	EB1307970	<0.0001	0.001	<0.001	0.012	0.004	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	0.06	0.007
7-SS	1/04/2013	Storie"s Spring	EB1307970	<0.0001	<0.001	<0.001	0.001	<0.001	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	0.016	0.029
Statistical Summary																		
Number of Results				11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Number of Detects				0	2	0	7	8	0	0	0	0	1	0	0	0	11	10
Minimum Concentration				<0.0001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	0.009	<0.005
Minimum Detect				ND	0.001	ND	0.001	0.001	ND	ND	ND	ND	0.004	ND	ND	ND	0.009	0.005
Maximum Concentration				<0.0001	0.001	<0.001	0.024	0.004	<0.01	<0.01	<0.001	<0.001	0.004	<0.001	<0.01	<0.01	0.097	0.029
Maximum Detect				ND	0.001	ND	0.024	0.004	ND	ND	ND	ND	0.004	ND	ND	ND	0.097	0.029
Average Concentration				0.00005	0.0006	0.0005	0.0041	0.0015	0.005	0.005	0.0005	0.0005	0.0008	0.0005	0.005	0.005	0.032	0.013
Median Concentration				0.00005	0.0005	0.0005	0.001	0.001	0.005	0.005	0.0005	0.0005	0.0005	0.0005	0.005	0.005	0.022	0.008
Standard Deviation				0	0.0002	0	0.0074	0.001	0	0	0	0	0.0011	0	0	0	0.026	0.0094
Number of Guideline Exceedances				11	0	0	2	0	11	11	11	11	0	0	0	0	11	5
Number of Guideline Exceedances(Detects Only)				0	0	0	2	0	0	0	0	0	0	0	0	0	11	5

	BTEX & MAH								TPH											PAH	
	Benzene	BTEX (Sum of Total) - Calc	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Xylenes (Sum of Total) - Calc	F1 minus BTEX (C6-C10)	C10 - C14 Fraction	C10 - C16 Fraction	C10 - C36 (Sum of Total) - Calc	C10 - C40 (Sum of Total) - Calc	C15 - C28 Fraction	C16 - C34 Fraction	C29 - C36 Fraction	C34 - C40 Fraction	C6 - C 9 Fraction	C6 - C10 Fraction	Naphthalene	PAHs (Sum of Total) - Calc
	µg/L	µg/L	µg/L	µg/L	µg/Lf	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L
EQL	1		2	2	2	2	2		0.02	0.05	0.1			0.1	0.1	0.05	0.1	0.02	0.02	5	
ADWG 2011 Health	1		300	800			600	600													0.01
ANZECC (2000) Ecosystems Fresh Water (95%)	950					350														16	
Bores																					
10-SB	<1	<7	<2	<2	<2	<2	<2	<2	<0.02	<0.05	<0.1	<0.2	<0.3	<0.1	<0.1	<0.05	<0.1	<0.02	<0.02	<5	<5
11-IB	<1	<7	<2	<2	<2	<2	<2	<2	<0.02	<0.05	<0.1	<0.2	<0.3	<0.1	<0.1	<0.05	<0.1	<0.02	<0.02	<5	<5
12-MB	<1	<7	<2	<2	<2	<2	<2	<2	<0.02	<0.05	<0.1	<0.2	<0.3	<0.1	<0.1	<0.05	<0.1	<0.02	<0.02	<5	<5
13-BB1	<1	<7	<2	<2	<2	<2	<2	<2	<0.02	<0.05	<0.1	<0.2	<0.3	<0.1	<0.1	<0.05	<0.1	<0.02	<0.02	<5	<5
1-MSHB	<1	<7	<2	<2	<2	<2	<2	<2	<0.02	<0.05	<0.1	<0.2	<0.3	<0.1	<0.1	<0.05	<0.1	<0.02	<0.02	<5	<5
8-BB2	<1	<7	<2	<2	<2	<2	<2	<2	<0.02	<0.05	<0.1	<0.2	<0.3	<0.1	<0.1	<0.05	<0.1	<0.02	<0.02	<5	<5
9-3MB	<1	<7	<2	<2	<2	<2	<2	<2	<0.02	<0.05	<0.1	<0.2	<0.3	<0.1	<0.1	<0.05	<0.1	<0.02	<0.02	<5	<5
Springs																					
3-MSHD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-MSHP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6-LS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7-SS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Statistical Summary																					
Number of Results	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Number of Detects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Concentration	<1	<7	<2	<2	<2	<2	<2	<2	<0.02	<0.05	<0.1	<0.2	<0.3	<0.1	<0.1	<0.05	<0.1	<0.02	<0.02	<5	<5
Minimum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum Concentration	<1	<7	<2	<2	<2	<2	<2	<2	<0.02	<0.05	<0.1	<0.2	<0.3	<0.1	<0.1	<0.05	<0.1	<0.02	<0.02	<5	<5
Maximum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Concentration	0.5	3.5	1	1	1	1	1	1	0.01	0.025	0.05	0.1	0.15	0.05	0.05	0.025	0.05	0.01	0.01	2.5	2.5
Median Concentration	0.5	3.5	1	1	1	1	1	1	0.01	0.025	0.05	0.1	0.15	0.05	0.05	0.025	0.05	0.01	0.01	2.5	2.5
Standard Deviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Field Duplicates (WATER)
Filter: [Sampled_Date-Time] >= #01 Apr 2013# and [Sampled_Date-Time]

Chem_Group	ChemName	Units	EQL	SDG: EB1307970 Field_ID: 1-MSHB Sampled_Date-Time: 1/04/2013	SDG: EB1307970 Field_ID: 2-MSHB Sampled_Date-Time: 1/04/2013	RPD	SDG: EB1307970 Field_ID: 4-MSHP Sampled_Date-Time: 1/04/2013	SDG: EB1307970 Field_ID: 5-MSHP Sampled_Date-Time: 1/04/2013	RPD
Alkalinity	Alkalinity (total) as CaCO3	mg/l	1	27.0	27.0	0	25.0	22.0	13
	Alkalinity (Bicarbonate as CaCO3)	mg/l	1	27.0	27.0	0	25.0	22.0	13
	Alkalinity (Carbonate as CaCO3)	mg/l	1	<1.0	<1.0	0	<1.0	<1.0	0
	Alkalinity (Hydroxide) as CaCO3	mg/l	1	<1.0	<1.0	0	<1.0	<1.0	0
	Hardness as CaCO3 (Filtered)	mg/l	1	67.0	64.0	5	43.0	43.0	0
BTEX & MAH	Benzene	µg/L	1	<1.0	<1.0	0			
	Ethylbenzene	µg/L	2	<2.0	<2.0	0			
	Toluene	µg/L	2	<2.0	<2.0	0			
	Xylene (m & p)	µg/Lf	2	<2.0	<2.0	0			
	Xylene (o)	µg/L	2	<2.0	<2.0	0			
	Xylene Total	µg/L	2	<2.0	<2.0	0			
Inorganics	Electrical conductivity *(lab)	uS/cm	1	929.0	931.0	0	693.0	690.0	0
	Fluoride	mg/l	0.1	0.1	0.1	0	0.1	0.1	0
	Kjeldahl Nitrogen Total	mg/l	0.1	<0.1	<0.1	0			
	pH (Lab)	pH_Units	0.01	6.42	6.44	0	6.48	6.33	2
	Sodium Absorption Ratio (Filtered)	-	0.01	8.35	9.11	9	8.03	7.9	2
	Sulphide	mg/l	0.1	<0.1	<0.1	0	<0.1	<0.1	0
	TOC	mg/l	1	8.0	7.0	13	11.0	10.0	10
	Total Dissolved Solids (est.)	mg/l	1	604.0	605.0	0	450.0	448.0	0
LAB CALC-Report with Caution	BTEX (Sum of Total)	µg/L	1	<1.0	<1.0	0			
	C10 - C36 (Sum of Total)	µg/L	50	<50.0	<50.0	0			
	C10 - C40 (Sum of Total)	µg/L	100	<100.0	<100.0	0			
Major Ions	Calcium (Filtered)	mg/l	1	7.0	6.0	15	4.0	4.0	0
	Chloride	mg/l	1	262.0	262.0	0	200.0	200.0	0
	Anions Total	meq/L	0.01	8.6	8.6	0	6.39	6.33	1
	Magnesium (Filtered)	mg/l	1	12.0	12.0	0	8.0	8.0	0
	Cations Total	meq/L	0.01	8.32	8.72	5	6.25	6.19	1
	Ionic Balance	%	0.01	1.65	0.71	80	1.14	1.16	2
	Potassium (Filtered)	mg/l	1	6.0	5.0	18	5.0	6.0	18
	Sodium (Filtered)	mg/l	1	157.0	168.0	7	121.0	119.0	2
	Sulphate (Filtered)	mg/l	1	32.0	32.0	0	12.0	12.0	0
Metals	Aluminium (Filtered)	mg/l	0.01	<0.01	<0.01	0	0.02	0.02	0
	Aluminium	mg/l	0.01	<0.01	<0.01	0	0.53	0.31	52
	Arsenic (Filtered)	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Arsenic	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Boron (Filtered)	mg/l	0.05	0.16	0.13	21	0.13	0.14	7
	Boron	mg/l	0.05	0.15	0.15	0	0.12	0.12	0
	Cadmium (Filtered)	mg/l	0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	0
	Cadmium	mg/l	0.0001	<0.0001	<0.0001	0	0.0003	0.0002	40
	Chromium (III+VI) (Filtered)	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Chromium (III+VI)	mg/l	0.001	<0.001	<0.001	0	0.014	0.008	55
	Cobalt (Filtered)	mg/l	0.001	0.001	0.001	0	<0.001	<0.001	0
	Cobalt	mg/l	0.001	0.001	0.001	0	0.006	0.004	40
	Copper (Filtered)	mg/l	0.001	0.001	0.002	67	<0.001	0.002	67
	Copper	mg/l	0.001	0.002	0.002	0	0.013	0.01	26
	Iron (Filtered)	mg/l	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Iron	mg/l	0.05	<0.05	<0.05	0	0.14	0.09	43
	Lead (Filtered)	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Lead	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Manganese (Filtered)	mg/l	0.001	<0.001	<0.001	0	0.003	0.003	0
	Manganese	mg/l	0.001	<0.001	<0.001	0	0.006	0.004	40
	Mercury (Filtered)	mg/l	0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	0
	Mercury	mg/l	0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	0
	Molybdenum (Filtered)	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Molybdenum	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Nickel (Filtered)	mg/l	0.001	0.002	0.002	0	0.001	0.001	0
	Nickel	mg/l	0.001	0.002	0.002	0	0.024	0.012	67
	Selenium (Filtered)	mg/l	0.01	<0.01	<0.01	0	<0.01	<0.01	0
	Selenium	mg/l	0.01	<0.01	<0.01	0	<0.01	<0.01	0
	Silver (Filtered)	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Silver	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Uranium (Filtered)	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Uranium	mg/l	0.001	<0.001	<0.001	0	0.004	0.002	67
	Vanadium (Filtered)	mg/l	0.01	<0.01	<0.01	0	<0.01	<0.01	0
	Vanadium	mg/l	0.01	<0.01	<0.01	0	<0.01	<0.01	0
	Zinc (Filtered)	mg/l	0.005	0.008	0.007	13	0.005	0.014	95
	Zinc	mg/l	0.005	0.016	0.008	67	0.097	0.053	59
Nutrients	Ammonia as N	mg/l	0.01	<0.01	<0.01	0			
	Nitrate (as N)	mg/l	0.01	0.31	0.32	3			
	Nitrite (as N)	mg/l	0.01	<0.01	<0.01	0			
	Nitrogen (Total Oxidised)	mg/l	0.01	0.31	0.32	3			
	Nitrogen (Total)	mg/l	0.1	0.3	0.3	0			
	Phosphorus	mg/l	0.01	<0.01	0.02	67			
PAH	Naphthalene	µg/L	5	<5.0	<5.0	0			
TPH	F1 minus BTEX (C6-C10)	mg/l	0.02	<0.02	<0.02	0			
	C10 - C14 Fraction	mg/l	0.05	<0.05	<0.05	0			
	C10 - C16 Fraction	mg/l	0.1	<0.1	<0.1	0			
	C15 - C28 Fraction	mg/l	0.1	<0.1	<0.1	0			
	C16 - C34 Fraction	mg/l	0.1	<0.1	<0.1	0			
	C29 - C36 Fraction	mg/l	0.05	<0.05	<0.05	0			
	C34 - C40 Fraction	mg/l	0.1	<0.1	<0.1	0			
	C6 - C 9 Fraction	mg/l	0.02	<0.02	<0.02	0			
	C6 - C10 Fraction	mg/l	0.02	<0.02	<0.02	0			

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 30 (1-10 x EQL); 30 (10-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

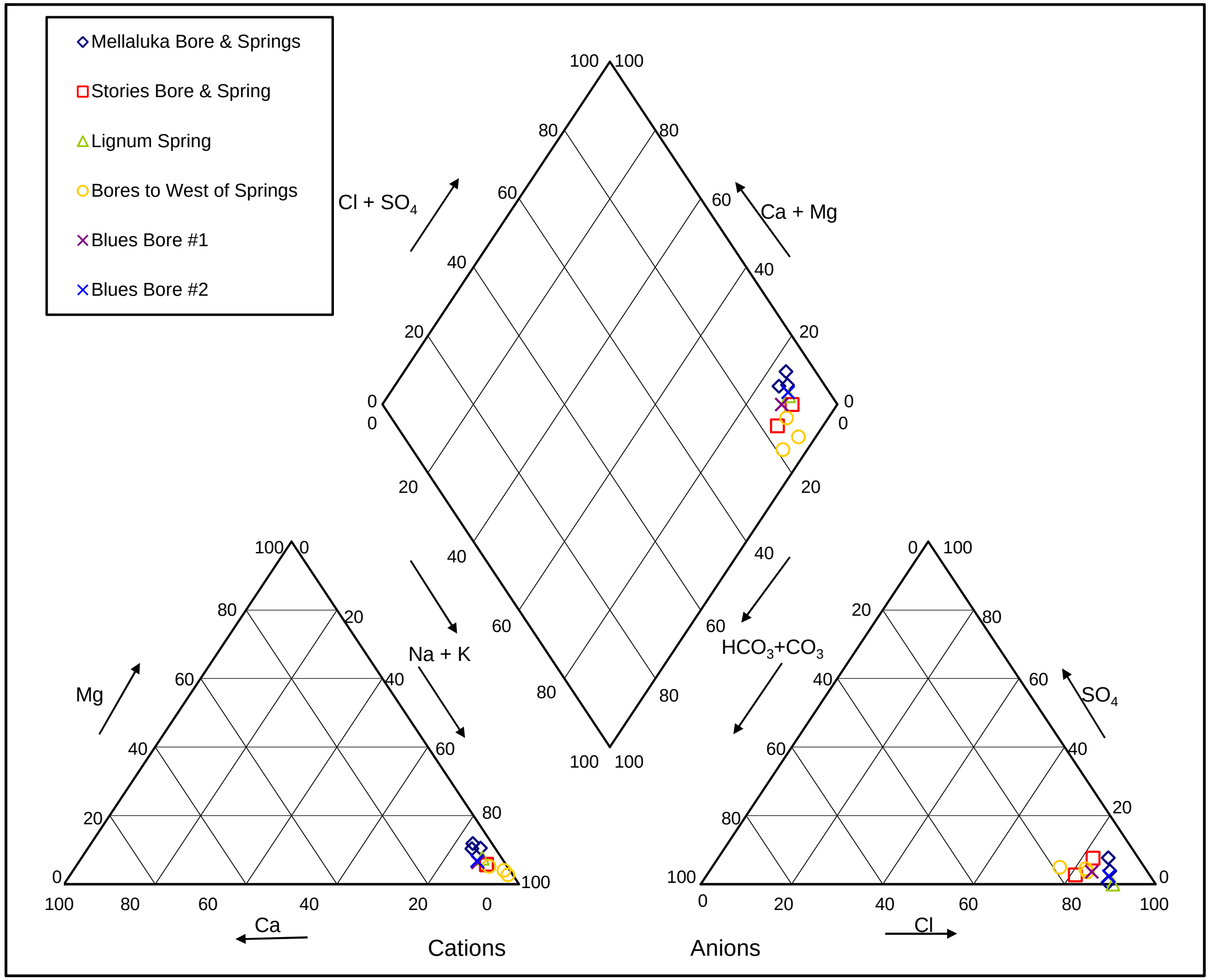
Contents
Lab Duplicates with high RPDs

SDG	Matrix_Type	Lab_Duplicate	Field_ID	Depth	Sampled_Date-Time	Method_Name	Compound	Parent_Result	Dupe_Result	Result_Unit	EQL	RPD
EB1307970	WATER	3327929-008_EB1307970			3/04/2013	EP080/071: Total Petroleum Hydrocarbons	C15 - C28 Fraction	2000	4540	µg/L	100 µg/L	78
EB1307970	WATER	3327929-008_EB1307970			3/04/2013	EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft	>C16 - C34 Fraction	1530	4140	µg/L	100 µg/L	92
EB1307970	WATER	3327929-008_EB1307970			3/04/2013	EP080/071: Total Petroleum Hydrocarbons	C29 - C36 Fraction	290	780	µg/L	50 µg/L	92
EB1307970	WATER	3327929-008_EB1307970			3/04/2013	EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft	>C34 - C40 Fraction	130	310	µg/L	100 µg/L	82
EB1307970	WATER	3328272-015_EB1307970			2/04/2013	ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	Sulfate as SO4 - Turbidimetric	<1	2	mg/L	1 mg/L	67
EB1307970	WATER	3329074-039_EB1307970	1-MSHB	1-MSHB	1/04/2013	EG020T: Total Metals by ICP-MS	Copper	0.002	0.001	mg/L	0.001 mg/L	67
EB1307970	WATER	3335488-021_EB1307970			2/04/2013	EK055G: Ammonia as N by Discrete Analyser	Ammonia as N	0.03	0.05	mg/L	0.01 mg/L	50
EB1308583	WATER	3345894-009_EB1308583			8/04/2013	EG020F: Dissolved Metals by ICP-MS	Zinc	0.015	0.029	mg/L	0.005 mg/L	64
EB1308583	WATER	3345894-027_EB1308583			8/04/2013	EG020F: Dissolved Metals by ICP-MS	Molybdenum	0.002	0.001	mg/L	0.001 mg/L	67
EB1308583	WATER	3345907-021_EB1308583			8/04/2013	EG020T: Total Metals by ICP-MS	Zinc	0.007	0.01	mg/L	0.005 mg/L	35
EB1308583	WATER	3346407-034_EB1308583	12-MB	12-MB	7/04/2013	EK067G: Total Phosphorus as P by Discrete Analyser	Total Phosphorus as P	0.02	0.03	mg/L	0.01 mg/L	40

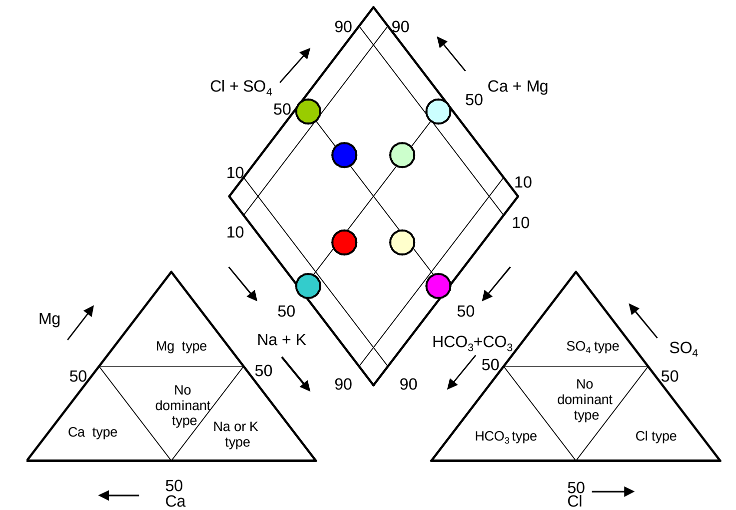
Adani Mining

Mellaluka Bore and Spring Monitoring - Field Observations

Water source	Site	Site Number	Site Code	Easting	Northing	Comments
Bore	Mellaluka homestead bore	1 and 2	MSHB			No odour or discernable colour. Water collected from hose directly connected to bore.
Spring	Mellaluka homestead dam	3	MSHD	446740	7531884	Water sampled from upwelling spring. No odour. Dam used by dogs, pigs and numerous birds
Spring	Mellaluka homestead pool	4 and 5	MSHP	446822	7531900	Sulphurous odour. Water clear. Lots of peat.
Spring	Lignum Spring	6	LS	445879	7537853	Black, turbid water. Some slight sulphurous smell. Sample taken from centre pool (protected from animals by high vegetation). Aquatic vegetation had been recently sprayed with pesticide.
Spring	Storie's Spring	7	SS	446606	7534256	Spring seems to be less exposed to cattle, but pigs were evident. Vegetation recently sprayed with pesticide. Water shallow and slightly turbid. No discernable odour.
Bore	Blue's bore #2	8	BB2	444270	7542867	Cloudy water with slight sulphurous smell.
Bore	3 mile bore	9	3MB	441717	7532436	Water clear, no discernable smell. Sample taken from bore head, direct from outlet.
Bore	Storie's bore	10	SB	446258	7534429	Water clear with no discernable smell.
Bore	Ironbark bore	11	IB	441487	7528898	Water clear with no discernable smell.
Bore	Middle bore	12	MB	443924	7534892	Water clear with no discernable smell.
Bore	Blue's bore #1	13	BB1	446121	7549416	Water has cloudy appearance. Slight sulphurous smell.



WATER TYPE CATEGORISATION



WATER TYPE SUB-FIELDS

- Ca + Mg, Na + K type
- Ca + Mg type
- HCO_3, Cl + SO_4 type
- HCO_3 + CO_3 type
- Na + K, Ca + Mg type
- Na + K type
- Cl + SO_4, HCO_3 type
- Cl + SO_4 type

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Piper Diagram - Grouped by Area

Chart 3 of 3

Date: 01/07/13

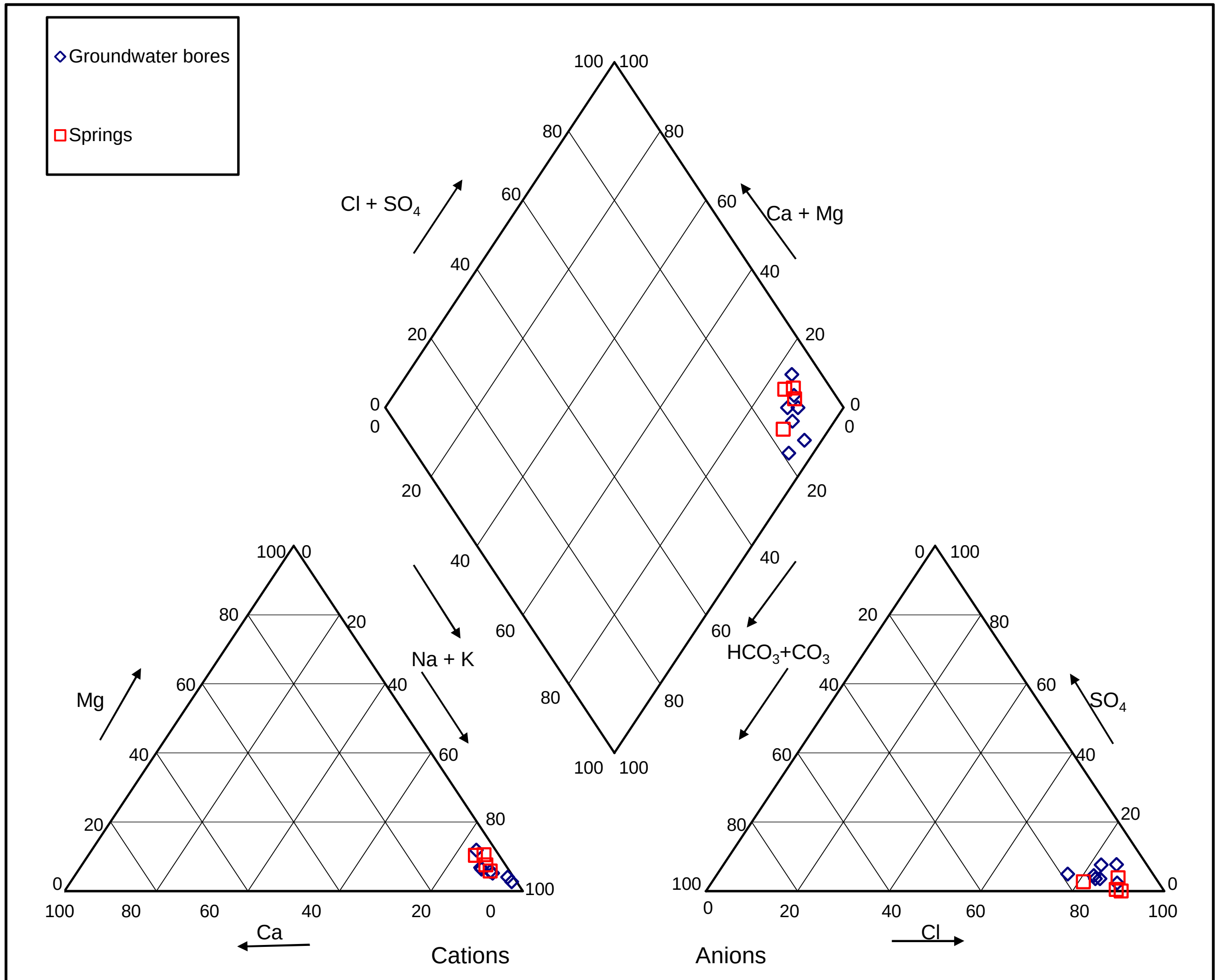
G:\41\24415\60 Mellaluka and Doongmabulla\Water Quality Data\Piper plot\[Mellaluka_Locationl_piperplot.xls]PIPER

Project: Carmichael Coal Project

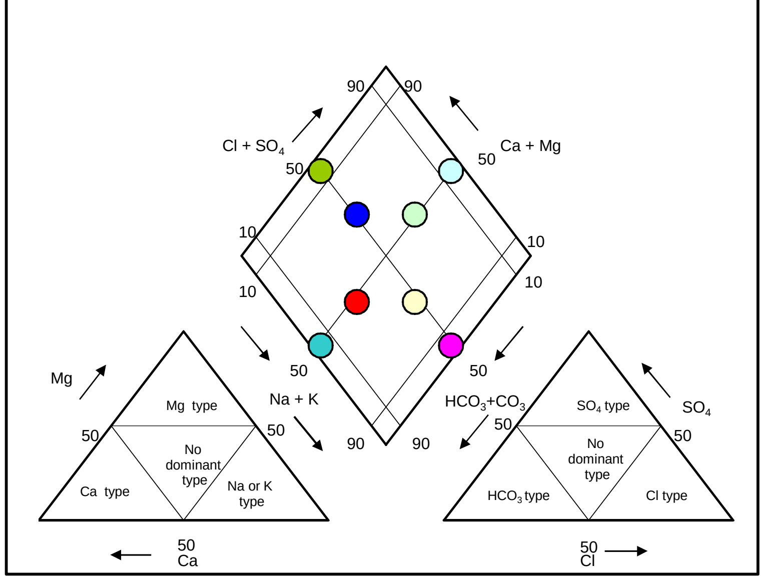
Project No: 41-24415-60

Description: Mellaluka Springs and Groundwater Report

Client: Adani Mining



WATER TYPE CATEGORISATION



WATER TYPE SUB-FIELDS

- Ca + Mg, Na + K type
- Ca + Mg type
- HCO_3, Cl + SO_4 type
- HCO_3 + CO_3 type
- Na + K, Ca + Mg type
- Na + K type
- Cl + SO_4, HCO_3 type
- Cl + SO_4 type

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Piper Diagram - Grouped by Bores and Springs

Chart 1 of 3

Date: 01/07/13

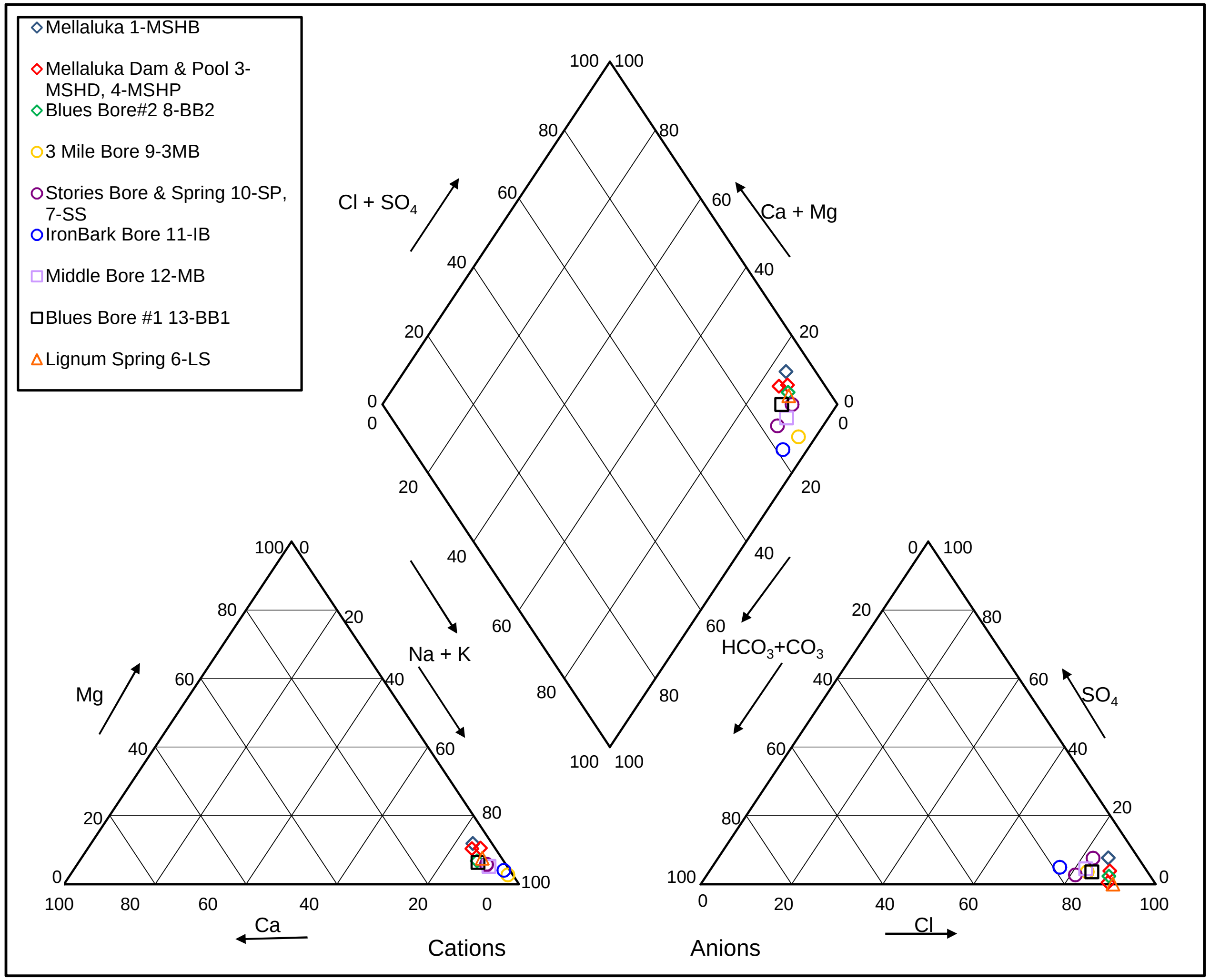
G:\41\24415\60 Mellaluka and Doongmabulla\Water Quality Data\Piper plot\[Mellaluka_Locationl_piperplot.xls]PIPER

Project: Carmicael Coal Project

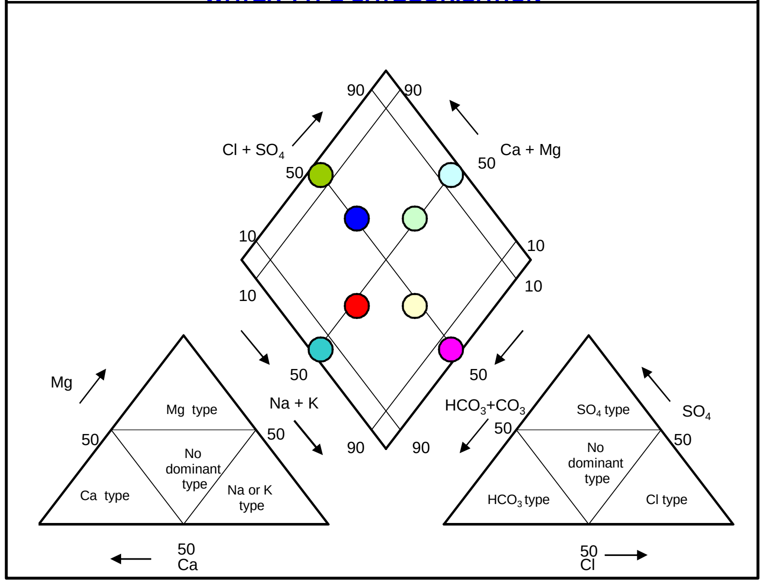
Description: Mellaluka Springs and Groundwater Report

Project No: 41-24415-60

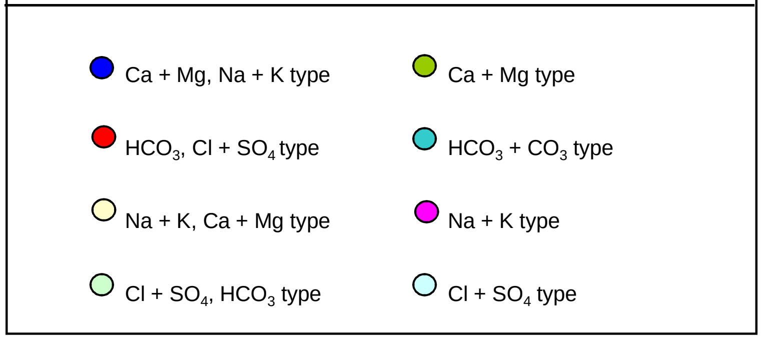
Client: Adani Mining



WATER TYPE CATEGORISATION



WATER TYPE SUB-FIELDS



CLIENTS | PEOPLE | PERFORMANCE

Piper Diagram - Individual Sampled Locations

Chart 2 of 3

Date: 01/07/13

G:\41\24415\60 Mellaluka and Doongmabulla\Water Quality Data\Piper plot\[Mellaluka_GW_SW_piperplot.xls]PIPER

Project: Carmichael Coal Project

Project No: 41-24415-60

Description: Mellaluka Springs and Groundwater Report

Client: Adani Mining

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	J Woodworth	N Webb	DRAFT	J Keane	DRAFT	30/07/2013
0	J Woodworth	S. Hein	On file	J. Keane	On file	31/07/2013
1	M Goodall	J Keane		J Keane		24/10/2013

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