Nambucca Heads to Urunga – Pacific Highway Upgrade

NH2U Construction Groundwater Monitoring Report REV 1

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Document history and status

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Contents

1 Introduction

This document presents the Surface Water Monitoring undertaken for the construction staging of the NH2U section of the Warrell Creek to Urunga (WC2U) Pacific Highway Upgrade. This section of highway upgrades consists of 22 kilometres from Nambucca Heads to Urunga (NH2U), which runs from design chainage 61,265 m to 83,682 m.

The purpose of this document is to present the surface water monitoring results obtained as part of the construction stage of the NH2U Project.

1.1 Project Overview

The Warrell Creek to Urunga Pacific Highway Upgrade involves an upgrade of the existing highway to four lane divided highway from the existing Allgomera deviation, south of Warrell Creek, to Waterfall Way at Raleigh north of Urunga. The upgrade extends over approximately 42 kilometres.

The Warrell Creek to Urunga (WC2U) Project was identified as a critical infrastructure project by the NSW Government, designed to improve safety, traffic efficiency and increase capacity along the Pacific Highway. It forms part of the overall program for upgrading the Pacific Highway. Planning commenced on the WC2U project in 2003 and project approval was granted on 19 July 2011, under Part 3A of the Environmental Planning and Assessment Act 1979.

The 22 kilometre section of the highway upgrade from Nambucca Heads to Urunga has been agreed between the Australian and NSW Governments with major construction commencing in 2014. Therefore the Water Quality Monitoring Program for the Warrell Creek to Urunga Pacific Highway Upgrade has been divided into the two highway upgrade sections: Warrell Creek to Nambucca Heads (WC2NH) and Nambucca Heads to Urunga (NH2U).

As part of the Proposal's approval, preparation and implementation of a Water Quality Monitoring Program is required to address the Minister for Planning and Infrastructure's Condition of Approval (CoA) B17, and Sections 2.15.4, and Commitments W3, W6, W7 of the "Warrell Creek to Urunga Submissions and preferred project report" (hereafter referred to as the 'Submissions Report').

1.2 Regulatory Context

1.2.1 Condition of Approval B17 – Water Quality

Condition of Approval (CoA) B17 addresses the requirements of the establishment of a Water Monitoring Program for the duration of the project and three years following the completion of construction as well as reporting of monitoring results to the EPA, the Department of Planning and Environment and DPI. The Program shall be developed in consultation with OEH [now EPA] and DPI and shall include but not necessarily be limited to:

a) Identification of surface water and groundwater quality monitoring locations which are representative of the potential extent of impacts from the project;
b) identification of works and activities during construction and operation of the project, including emergencies and spill events, that have the potential to impact on surface water quality and risks to oyster farming in the Nambucca, Bellinger, and Kalang rivers;
c) Representative background monitoring of surface water and groundwater quality parameters for a minimum of six (6) months (considering seasonality) prior to the commencement of construction to establish baseline water conditions;

d) Development and presentation of indicators or standards against which any changes to surface water quality will be assessed, having regard to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 (ANZECC, 2000);
e) Contingency and ameliorative measures in the event that adverse impacts to surface water quality are identified;
f) a minimum monitoring period of three years following the completion of construction or until any disturbed waterways/ groundwater resources are certified by an independent expert as being rehabilitated to an acceptable condition. The monitoring shall also confirm the establishment of operational water control measures (such as sedimentation basins and vegetation swales); and
g) Reporting of the monitoring results to the Department of Planning and Environment, OEH and DPI.

1.2.2 Statement of Commitments

Commitment W3 of the Submissions Report requires monitoring of upstream and downstream of significant groundwater paths identified in the Groundwater Monitoring Program. Additionally, Commitment W7 requires baseline monitoring of groundwater levels and chemical levels at cutting sites near springs, creeks or endangered ecological communities prior to construction commenting.

1.3 NSW Groundwater Policy

There are a set of NSW Government policies in reference for the protection and sustainable use of groundwater resources in NSW. These are organised as part of the State Groundwater Policy Framework Document (1997). This document is broken into three sub-policies; Groundwater Protection, Groundwater Quality Management and Groundwater Dependent Ecosystems, with each setting broad objectives and principals to guide decisions. For further details on the policies, please refer to the Groundwater Quality Monitoring Program.

1.3.1 The NSW State Groundwater Policy Framework Document

The Goal for the management of groundwater in New South Wales is:
"…to manage the State's groundwater resources so that they can sustain environmental, social and economic uses for the people of NSW."

1.3.1.1 Policy Objectives

It is the policy of the NSW Government to encourage the ecologically sustainable management of the State's groundwater resources, so as to:

- Slow and halt, or reverse any degradation of groundwater resources;
- Ensure long term sustainability of the systems ecological support characteristics;
- Maintain the full range of beneficial uses of these resources;
- And, maximise economic benefit to the Region, State and Nation.

1.3.1.2 Policy Principles

The State Groundwater Policy objectives will be achieved through application of the following resource management principles:

- An ethos for the ecologically sustainable management of groundwater resources should be encouraged in all agencies, communities and individuals, who own, manage or use these resources, and its practical application facilitated.
- Non-sustainable resource uses should be phased out.

- Significant environmental and/or social values dependent on groundwater should be accorded special protection.
- Environmentally degrading processes and practices should be replaced with more efficient and ecologically sustainable alternatives.
- Where possible, environmentally degraded areas should be rehabilitated and their ecosystem support functions restored.
- Where appropriate, the management of surface and groundwater resources should be integrated.
- Groundwater management should be adaptive, to account for both increasing understanding of resource dynamics and changing community attitudes and needs.
- Groundwater management should be integrated with the wider environmental and resource management framework, and also with other policies dealing with human activities and land use, such as urban development, agriculture, industry, mining, energy, transport and tourism (Department of Land and Water Conservation 1997).

As mentioned, the State Groundwater Policy encompasses three component policies. Clearly, and necessarily, these policies overlap and interrelate in many regards. They include the:

- Quality Protection Policy;
- Quantity Management Policy;
- And, the Dependent Ecosystems Policy.

In association with the Framework Document these policy documents make up the State Groundwater Policy.

The Framework document sets out the overall direction of groundwater management in NSW and provides broad objectives and principles to guide management (as above). The component policies build on this approach and provide more detail and guidance on how to manage and protect groundwater quality, groundwater quantity and groundwater dependent ecosystems respectively (Department of Land and Water Conservation 1998).

1.3.2 The NSW Groundwater Quality Protection Policy

The Groundwater Quality Protection Policy is specifically designed to protect our valuable groundwater resources against pollution. Adoption of this Policy means that the sustainability of groundwater resources and their ecosystem support functions will be given explicit consideration in resource management decision making.

1.3.2.1 Policy Objectives

For groundwater quality protection, it is the policy of the NSW Government to encourage the ecologically sustainable management of the State's groundwater resources so as to:

- Slow and halt, or reverse any degradation in groundwater resources;
- Direct potentially polluting activities to the most appropriate local geological setting so as to minimise the risk to groundwater;
- Establish a methodology for reviewing new developments (industrial/mining/urban and rural) with respect to their potential impact on water resources that will provide protection to the resource commensurate with both the threat that the development poses and the value of the resource;
- And, establish triggers for the use of more advanced groundwater protection tools such as groundwater vulnerability maps, or groundwater protection zones (Department of Land and Water Conservation 1998).

1.3.2.2 Policy Principles

The Groundwater Quality Protection Policy adopts the principles outlined in the NSW State Groundwater Policy Framework Document. In relation to Groundwater Quality Protection, the following principles specifically apply:

- All groundwater systems should be managed such that their most sensitive identified beneficial use (or environmental value) is maintained;
- Town water supplies should be afforded special protection against contamination;
- Groundwater pollution should be prevented so that future remediation is not required;
- For new developments, the scale and scope of work required to demonstrate adequate groundwater protection shall be commensurate with the risk the development poses to a groundwater system and the value of the groundwater resource;
- A groundwater pumper shall bear the responsibility for environmental damage or degradation caused by using groundwater that are incompatible with soil, vegetation or receiving waters;
- Groundwater dependent ecosystems will be afforded protection;
- Groundwater quality protection should be integrated with the management of groundwater quantity;
- The cumulative impacts of developments on groundwater quality should be recognised by all those who manage, use, or impact on the resource;
- And, where possible and practical, environmentally degraded areas should be rehabilitated and their ecosystem support functions restored (Department of Land and Water Conservation 1998).

1.3.3 The NSW Groundwater Quantity Management Policy

The NSW State Groundwater Quantity Management Policy (unpublished) was aimed at managing extraction of groundwater within sustainable yields to ensure continuing availability of groundwater into the future and ensure the viability of groundwater dependant ecosystems.

The quantity policy has been in draft form for approximately seven years and is not publicly available. The draft policy has essentially been superseded by the ongoing implementation of water sharing plans which detail quantity management for specific groundwater aquifers. The only current water sharing plan relevant to the highway upgrade is for the Bellinger River Area Unregulated and Alluvial Water Sources (2008). Review of the water sharing plan indicates no significant restrictions or implications for the highway upgrade.

1.3.4 The NSW Groundwater Dependent Ecosystems Policy

The State Groundwater Dependant Ecosystems Policy is specifically designed to protect our valuable ecosystems which rely on groundwater for survival so that, wherever possible, the ecological processes and biodiversity of these dependent ecosystems area maintained or restored, for the benefit of the present and future generations.

This Policy provides guidance on how to protect and manage these valuable natural systems in a practical sense. The range of tools that can be used to manage these ecosystems should be adapted to suit local conditions. The following principles apply to the management of groundwater-dependent ecosystems in NSW:

1. The scientific, ecological, aesthetic and economic values of groundwater-dependent ecosystems, and how threats to them may be avoided, should be identified and action taken to ensure that the most vulnerable and the most valuable ecosystems are protected.

2. Groundwater extraction should be managed within sustainable yield of aquifer systems, so that the ecological processes and biodiversity of their dependent ecosystems area maintained and/or restored. Management may involve establishment of threshold levels that are critical for ecosystem health, and controls on extraction in the proximity of groundwater dependent ecosystems.
3. Priority should be given to ensuring that sufficient groundwater of suitable quality is available at the time when it is need:
a) For protecting ecosystems which are known to be, or are most likely to be, groundwater dependent;
b) And, for the groundwater dependent ecosystems which are under an immediate or high degree of threat from groundwater-related activities.
4. Where scientific knowledge is lacking, the Precautionary Principle should be applied to protect groundwater dependent ecosystems. The development of adaptive management systems and research to improve understanding of these ecosystems is essential to their management.
5. Planning, approval and management of development and land use activities should aim to minimise adverse impacts on groundwater dependent ecosystems by:
a) Maintaining, where possible, natural patterns of groundwater flow and not disruption groundwater levels that are critical for ecosystems;
b) Not polluting or causing adverse changes in groundwater quality;
c) And, rehabilitating degraded groundwater systems where practical (Department of Land and Water Conservation 2002).

2 Background

This section will provide information regarding the implementation of the Groundwater Quality Monitoring Program. Background information presented will consist of the locations of monitoring, hydro-geological profile of the Project and risks identified for the construction stage of the Project.

2.1 Pre-construction Groundwater Monitoring

Geolink was engaged by RMS for the NH2U Project to undertaken the pre-construction groundwater monitoring and formulate the Groundwater Quality Monitoring Program. The following information is taken from the environmental assessment stage of the Project and incorporated in the Groundwater Quality Monitoring Program.

2.2 Topography and Geology

The Project area is characterised by two terrain types of alluvial flood plains and foothills of the costal ranges.

2.2.1 Alluvial Floodplains:

The alluvial floodplains comprise flat to gentle sloping coastal plains, river terraces and estuarine mud flats. The geology and soil consists of quaternary alluvial and estuarine soils up to 15m to 35m thick. Soils potentially found in these areas include sands, silts, clays, organic clays and the possibility of gravels and acid sulfate soils.

From investigations in the Environmental Assessment stage of the Project found the soils on the floodplains and surrounding the waterways are fine-grained alluvial soils such as silty clays and sandy clays. Archaeological investigations also uncovered quartz gravel in some areas which would have a greater permeability. Compaction from local livestock along the Project area would reduce water permeability;

2.2.2 Foothills of the Coastal Ranges

The foothills of coastal ranges comprise of gentle to moderate undulating hills, with wide river valleys and creeks. Geologically, the Nambucca beds are defined by phyllites with slate, schists, some granite intrusions and local granodriorite dykes. The soils consist of residual clay of high plasticity to 5m in depth and alluvial/colluvial sandy clay sediments in the small creeks.

Phyllite is a fine-grained rock formed from low grade metamorphism of claystones. Boreholes, up to 26 m in depth, encountered moderately to highly weathered phyllite. There is a gradual transition from weathered rock to residual clay soil. Rock below alluvial flats exhibited less weathered rock than those located in the ridgelines.

Boreholes encountered extensive quartz veining in the phyllite. The phyllite predominantly displays signs of increased weathering in the vicinity of the quartz veining, which is likely due to groundwater flow through the veining (SKM, 2010a:424).

2.2.3 Groundwater Dependent Ecosystems

Groundwater dependent ecosystems (GDEs) in the area of the highway upgrade that have the potential to be affected by changing groundwater levels consist of terrestrial vegetation and wetlands located in the low-lying floodplain areas intersected by the proposed highway upgrade, including:

- Swamp oak floodplain forest;
- Swamp sclerophyll forest;

- Subtropical coastal floodplain forest;
- Lowland rainforest; and
- Freshwater wetlands.

2.2.4 Risks to Groundwater during Construction

There are three cuttings along the NH2U upgrade considered to have a high risk ('Type A' cuttings) and 19 cuttings considered to have a moderate risk ('Type B' cuttings) of impacting surrounding ecosystems and groundwater sensitive areas.

Groundwater barriers can form from construction and operation of embankments on soft soil that compresses and forms a less permeable layer of soil. There would be a greater impact on areas with naturally high water tables and saturated soils such as freshwater wetlands and swamps. The Flora and Fauna Working Paper (SKM, 2010b) identified one higher quality area of this community adjacent to the eastern side of the existing highway near Deep Creek (chainage 64600).

However, in general, the Working Paper concluded that provision of minimum design standard drainage structures adjacent to wetlands and saturated soils is expected to mitigate the potential impacts from altered ground-water recharge rates and that a detectable change in groundwater levels is not expected (SKM, 2010b:169).

2.2.5 Section of Monitoring Locations

Cuttings classified as high-risk in the EA have a significant depth of excavation (> 10 m depth); a large length and area; and/or there are known EECs, creeks, bores or structures in the immediate vicinity of the cutting (within approx. 250 m). In addition to the high-risk cuttings, three moderate-risk cuttings that had existing boreholes with standpipes were also monitored to confirm they are moderate-risk as opposed to high-risk.

These moderate-risk cuttings were selected on the basis of either being in close vicinity to a SEPP 14 wetland, having a significant depth of cut or being in close vicinity to an EEC. Locations of moderate and high risk cuts to be monitored during construction are presented in Figures 2.2.5.1 to 2.2.5.4. Locations monitored are listed in Section 3.1.

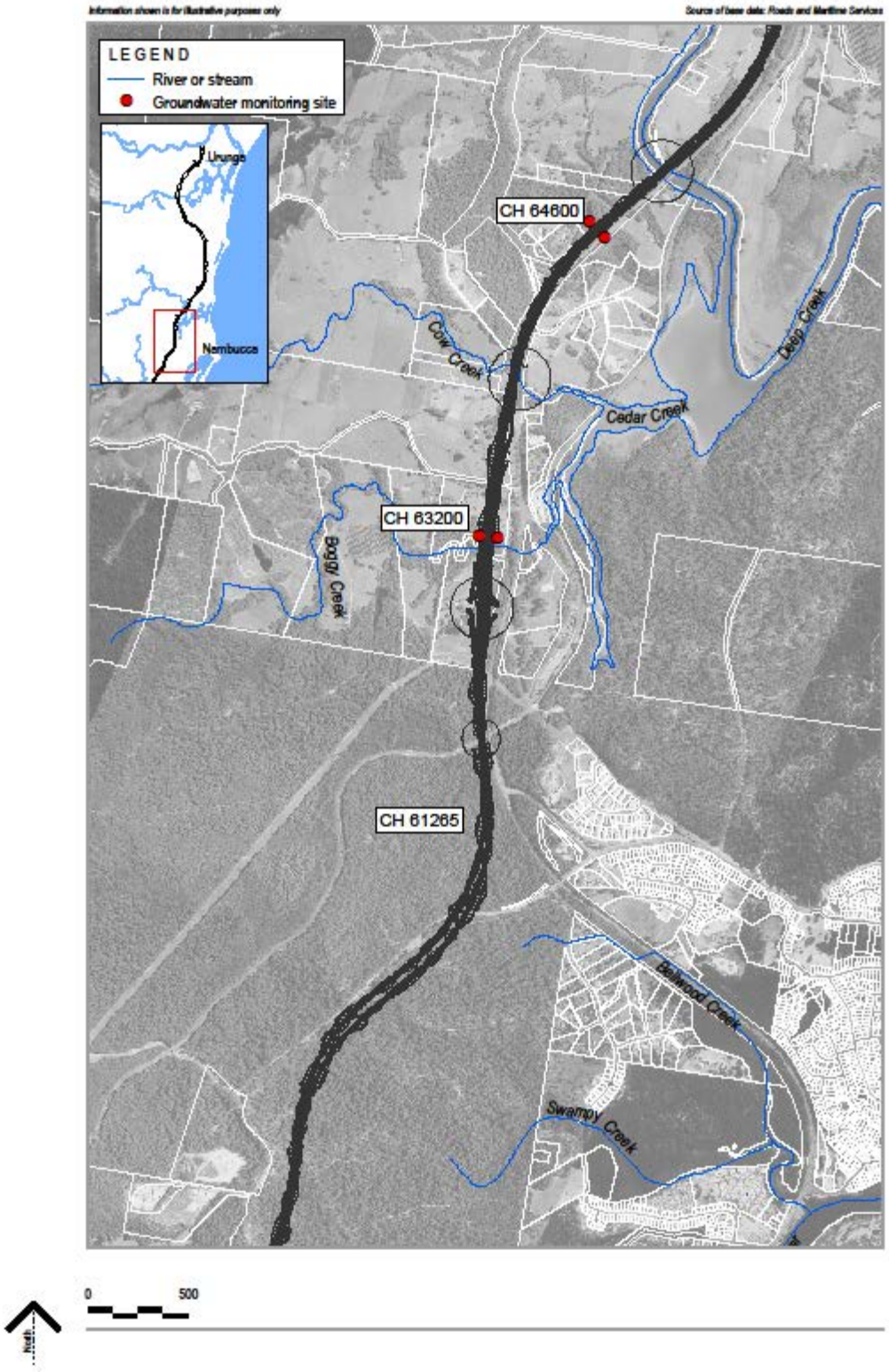

Figure 2.2.5.1 – Groundwater Monitoring Locations – Chainage 61265 to 64400

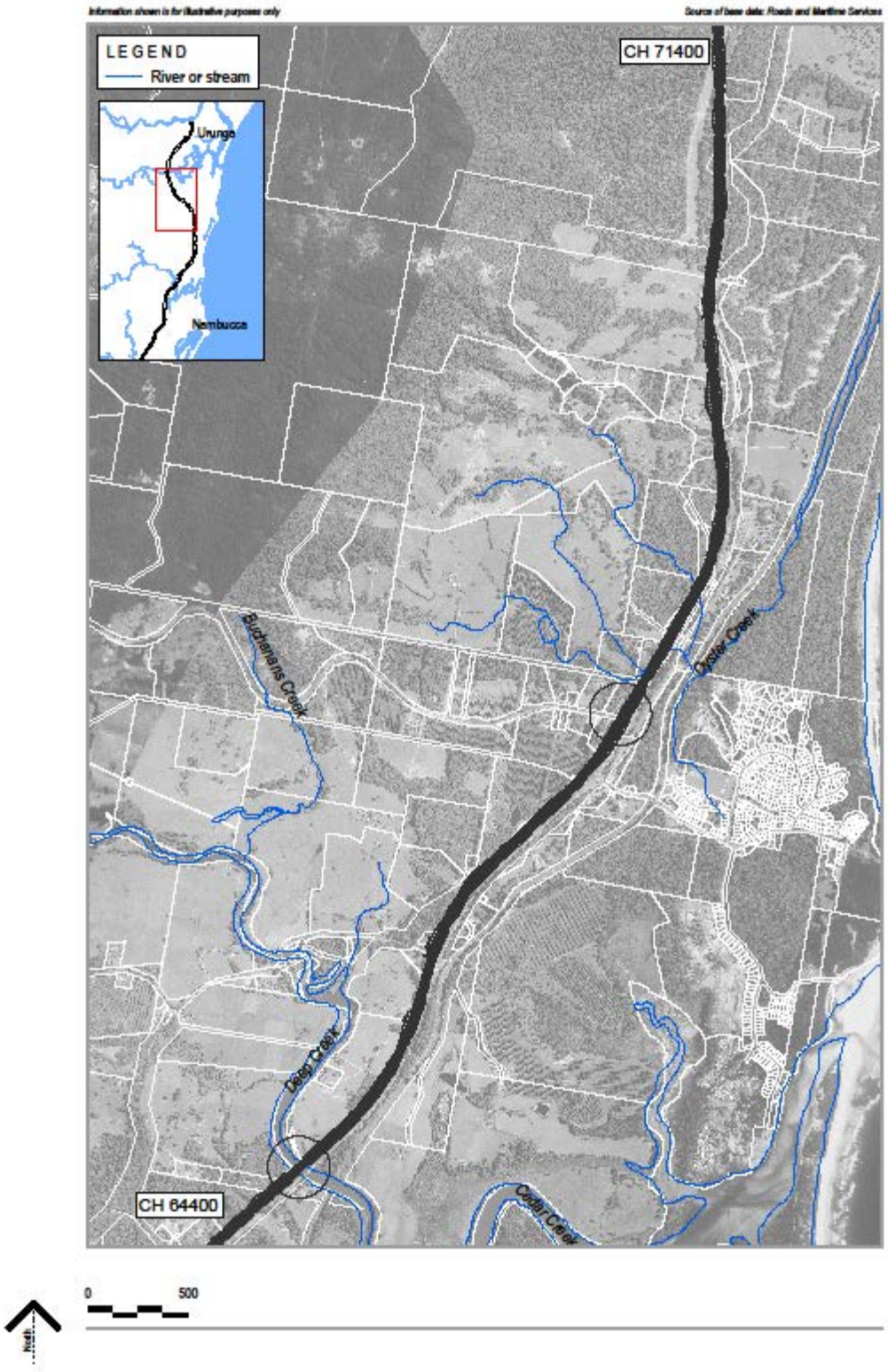

Figure 2.2.5.2 – Groundwater Monitoring Locations – Chainage 64400 to 71400

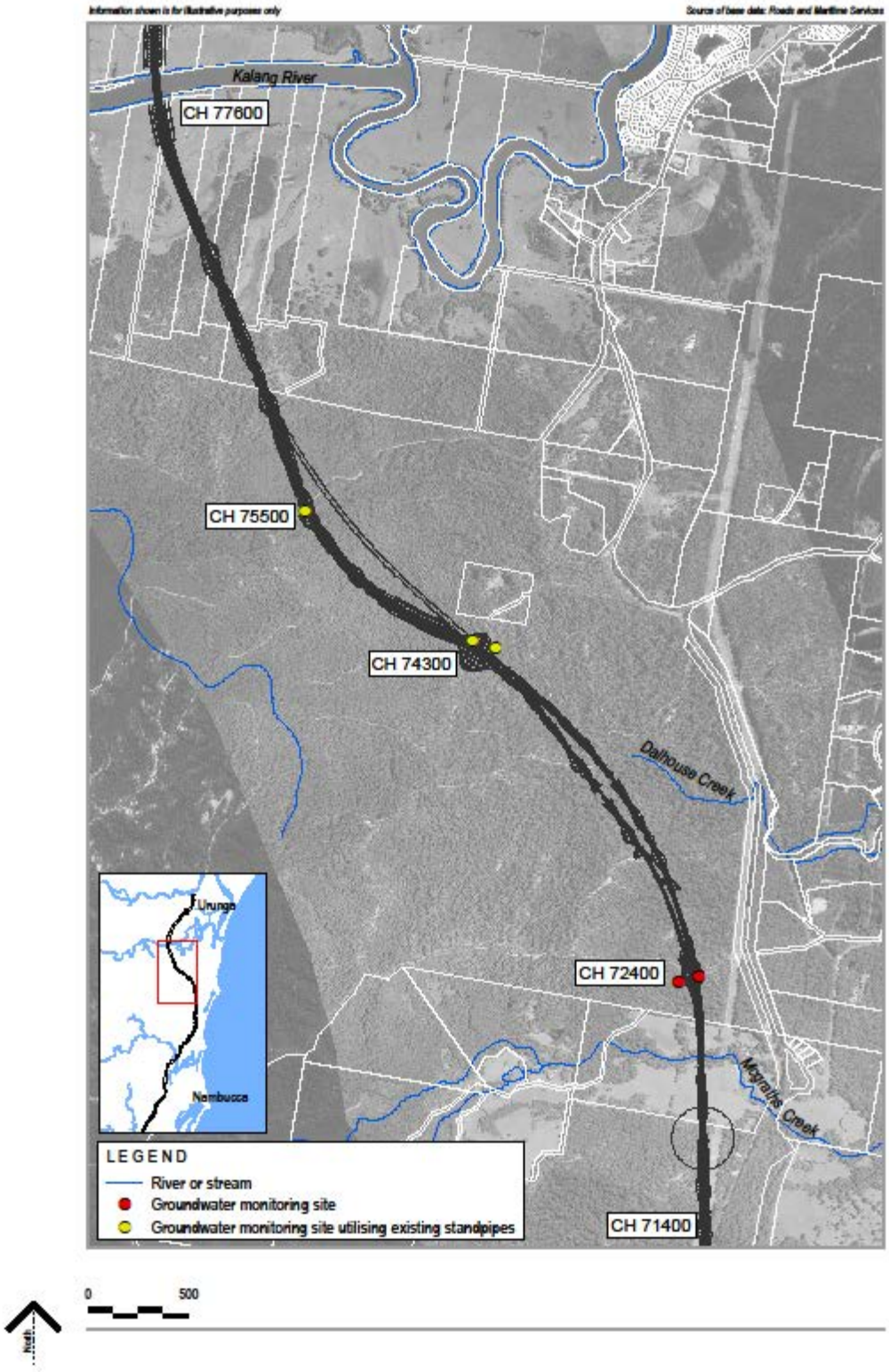

Figure 2.2.5.3 – Groundwater Monitoring Locations – Chainage 71400 to 77600

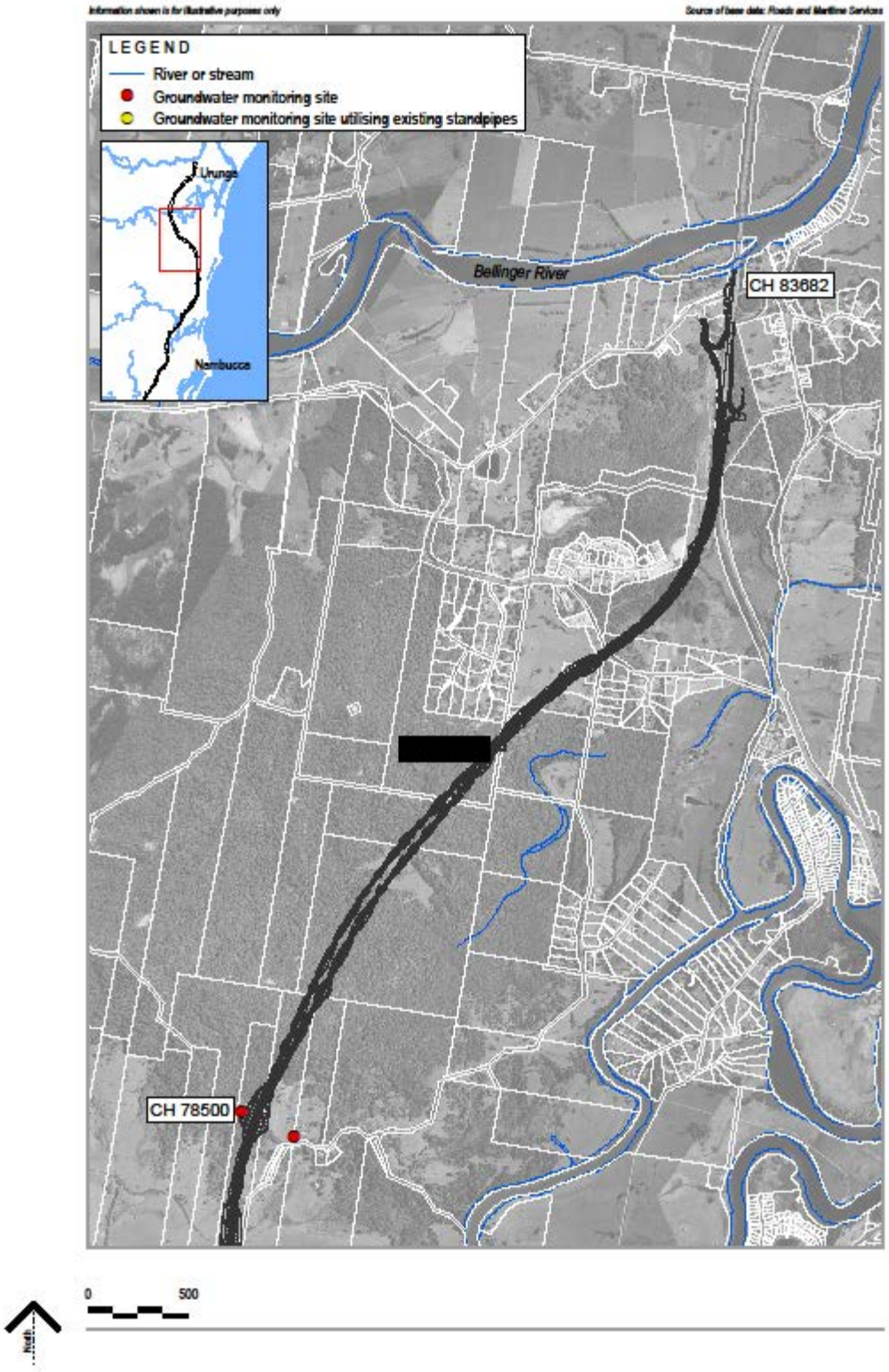

Figure 2.2.5.4 – Groundwater Monitoring Locations – Chainage 77600 to 83682

3 Monitoring Requirements

This section will identify the monitoring requirements for the construction stage of the Project, outlining the locations of sampling, frequency of sampling and the parameters for testing.

3.1 Locations of Monitoring

The monitoring locations consist of 12 locations at moderate and high risk cut areas identified during the Environmental Assessment stage of the Project. The following chainages are the locations in which groundwater monitoring has been undertaken in upstream and downstream locations (relative to the groundwater flow on each side of the cutting):

- Chainage 63,200 – (High risk cutting);
- Chainage 64,600 – (Adjacent to freshwater wetland EEC and SEPP14 wetland No. 357);
- Chainage 72,400 – (High risk cutting);
- Chainage 74,300 – (Moderate risk cutting);
- Chainage 75,500 – (Moderate risk cutting);
- And, Chainage 78,500 – (High risk cutting).

For the purpose of identification during Project monitoring, the upstream locations mentioned above will be identified with a 1 preceding the chainage and for downstream locations, a 2 will precede the chainage. Figures 2.2.5.1 to 2.2.5.4 present the locations of the cuts and subsequent monitoring locations.

3.2 Monitoring Parameters and Frequencies

From the preconstruction monitoring, the parameters for groundwater monitoring will be outlined in Table 3.2.1 and based off the RMS *Guideline for Construction Water Quality Monitoring*.

Table 3.2.1 – Monitoring Parameter Requirements

Indicators/ Parameters	Analytical Group	Analytes	Analysis Method
Groundwater Quality Indicators	Physical and chemical properties	pH, electrical conductivity (EC), temperature	Field measurement
Groundwater Quality Parameters	Physical properties	Total dissolved solids (TDS)	Laboratory analysis
	Hydrocarbons	Total petroleum hydrocarbons (TPH)	Laboratory analysis
	Heavy Metals	Aluminium (Al), Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Iron (Fe), Lead (Pb), Manganese (Mn), Mercury (Hg), Nickel (Ni), Selenium (Se), Silver (Ag), Zinc (Zn)	Laboratory analysis
	Nutrients	Total Nitrogen (TN), Nitrate (NO), Ammonia (NH), Total Phosphorus (TP), Phosphate (PO)	Laboratory analysis
	Major Anions	Chloride (Cl), sulfate (SO), Bicarbonate (HCO), Nitrate (NO)	Laboratory analysis

	Major Cations	Sodium (Na), potassium (K), calcium (Ca), magnesium (Mg)	Laboratory analysis

Along with the parameters listed in Table 3.2.1, the depth to groundwater will be recorded prior to water being extracted from the bores. This will be undertaken with the use of an automatic water recorder. For the duration of the construction stage of the Project, field parameters will be tested monthly. Laboratory parameters listed in Table 3.2.1 will be tested quarterly.

3.3 Groundwater Sampling and Observations

The bore purging method will be used for the extraction of groundwater. Protocols to include the following basic precautions for avoiding contamination during sample collection:

- Field measurements to be made on separate sub-samples of water;
- New or reused sample containers must be appropriately cleaned (use of containers supplied by the analytical laboratory is recommended);
- All field equipment is pre-cleaned to the same standard as the containers;
- Sample bottles suitable for each parameter to be used;
- Containers are uncapped or removed from their transport bags for minimum amounts of time;
- Containers that were filled with water as part of the preparation protocol are emptied well away from and downstream of the sampling location before being rinsed with sample and refilled;
- And, sampling staff should use plastic disposable gloves when handling sample containers at every stage during sampling (to avoid touching the sample, and the insides of caps or containers) ANZECC ARMCANZ (2000b:4-11,4-14).

3.3.1 Field Observations

At each visit, the following information is to be recorded on a field-record sheet (based on information in ANZECC ARMCANZ, 2000b):

- The exact locations of sampling sites;
- Weather conditions;
- The date and time when samples are taken (standard or daylight-saving time);
- Any other observations or information on the conditions at the time of sampling that may assist in interpretation of the data;
- And, if possible, photographic records are also highly desirable for future reference.

3.3.1 Sample Preservation

Water samples are susceptible to change as a result of physical, chemical or biological reactions which may take place between the time of sampling and the analysis. These changes are often sufficiently rapid to modify the sample considerably in the space of several hours.

All samples are to be stored in a refrigerated state immediately following sampling.
The preservation of samples to be analysed for heavy metals may require acidification in the field (which would necessitate the use of separate sample containers for the heavy metals sample) or acidification in the laboratory within 6 hours of sampling. Liaison with the analytical laboratory should be undertaken to confirm the most appropriate method of preservation of the heavy metals samples.

4 Results and Discussion

This section will explore the results collected during the course of the Project presenting the depth to water levels, and the minimum, maximum, standard deviation, mean and median values for pH, electrical conductivity and temperature.

4.1 Ch63200

For the duration of the construction stage of the Project, the bore 63200.1 has run dry before major construction activities were undertaken. This co-in sided with the establishment of a new bore. Given this, it is hard to gage the impact that construction has had on the cutting at chainage 63200. Despite this, the corresponding downstream bore of 63200.2 has remained relatively stable (with groundwater levels consistently between 10m to 15m) for the duration of construction with only a minor drop in the water levels.

The conductivity has remained relatively low and consistent for the course of the Project. Levels in pH have fluctuated between 4.5 to 8 in pH during construction. Nutrient levels were slightly elevated along with potassium levels for major cations and sulfate for major anions. Heavy metals remained relativity low or didn't register due to the minute concentration. Hydrocarbon levels remained low, bar one event to which the cause is unknown.

Figure 4.1.1 and Figure 4.1.2 presents the depth to groundwater collected for the bores 63200.1 and 63200.2 during the course of the construction stage of the Project. Raw data for both bores is presented in Appendix A.

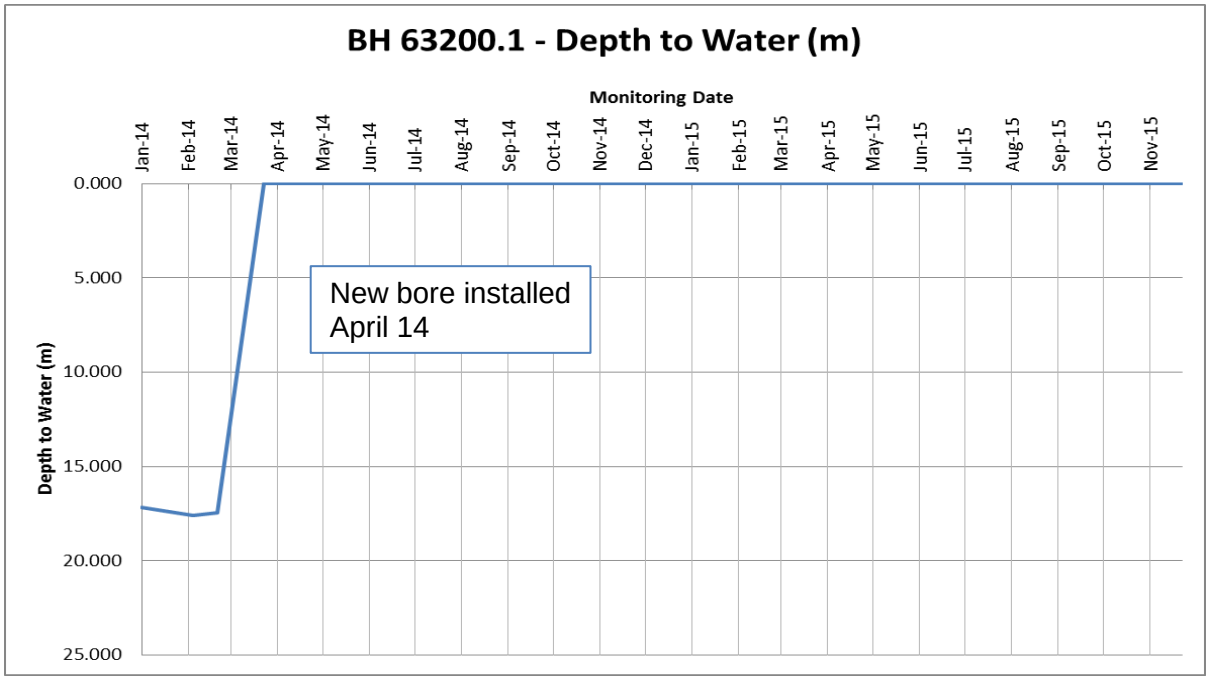

Figure 4.1.1 – Bore 63200.1 Groundwater Depths.

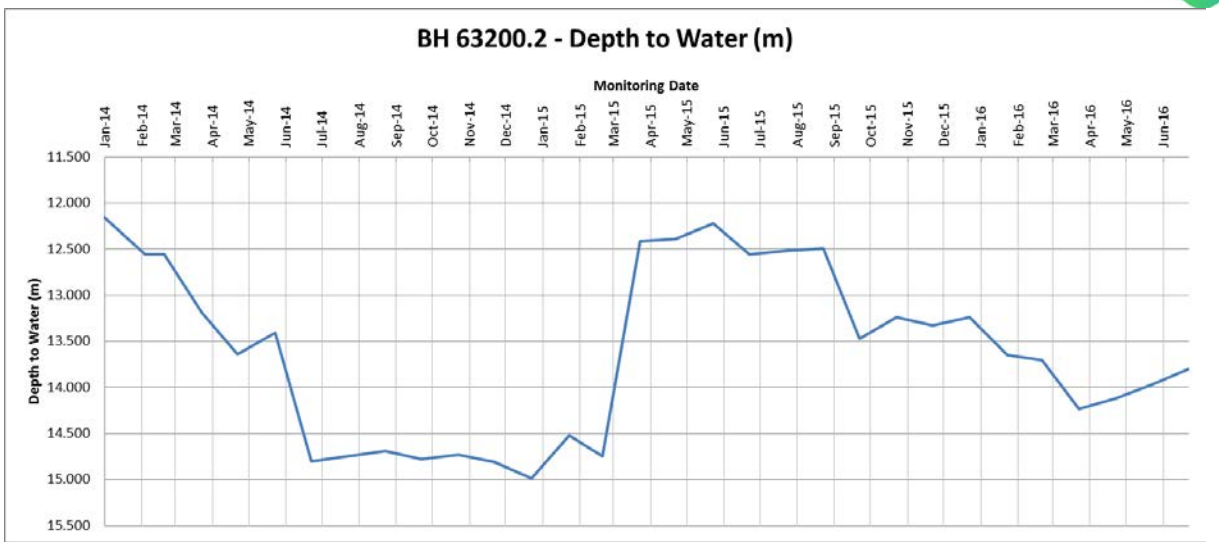

Figure 4.1.2 – Bore 63200.2 Groundwater Depths

4.2 Ch64600

For the course of the Project, both the bores, 64600.1 and 64600.2, have remained relatively stable in the depth to groundwater with Figures 4.2.1 and 4.2.2 presenting depths to ground water.

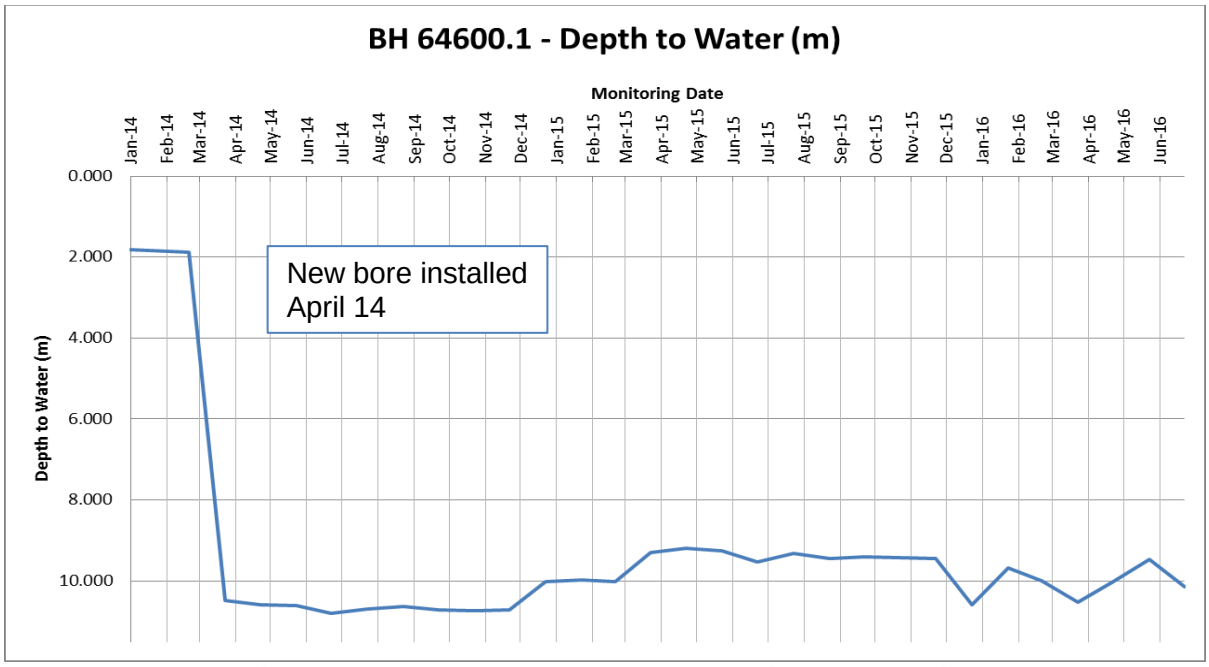

Figure 4.2.1 – Bore 64600.1 Groundwater Depths

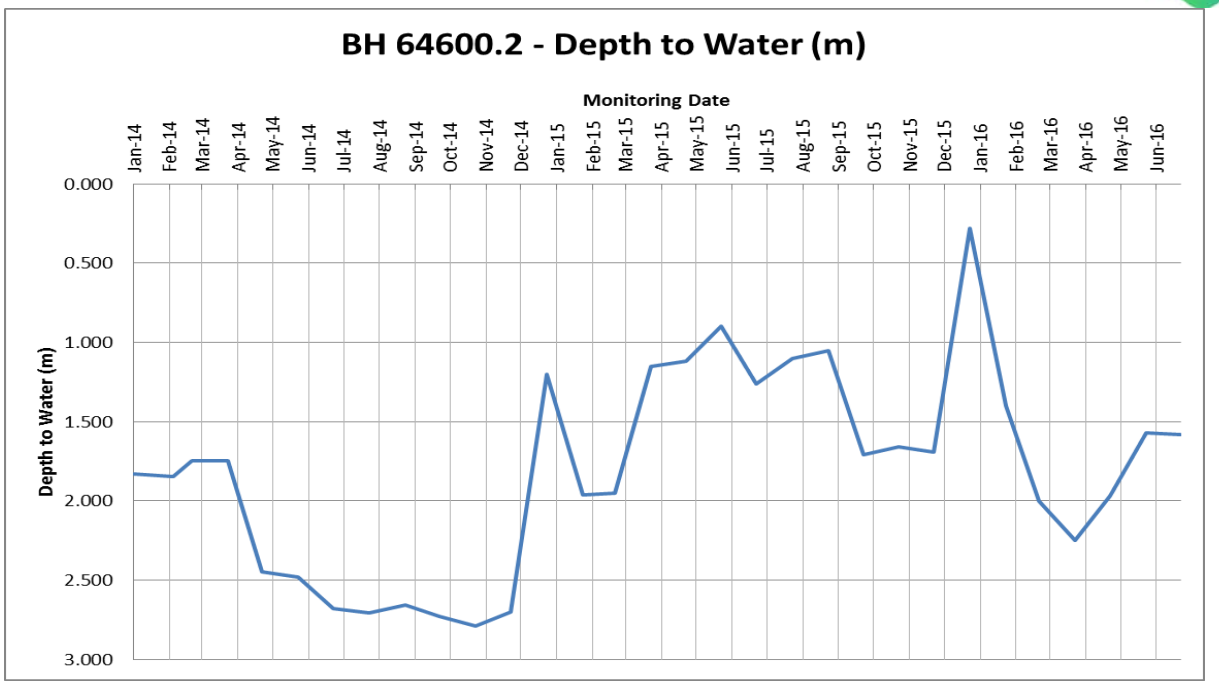

Figure 4.2.2 – Bore 64600.2 Groundwater Depths

Both bores experienced elevated levels in the electrical conductivity and nutrient levels. For bore 64600.1, the major anions and cations have had small increases over the 80th percentile values.

Small increases in some of the heavy metals were observed as well with aluminium with levels higher than the 80th percentile values. Levels of hydrocarbons have been observed at moderate levels through the course of the Project. As this bore is upstream of the groundwater gradient of the cutting and control, it can be noted that the Project has had no effect to this end.

Whereas, the bore 64600.2, no hydrocarbons were observed during the monitoring period during construction. pH levels decreased slightly below the 80th but increased later in the course of the Project. A few elevated levels for the major anions were observed along with the heavy metals. Raw data for bores 64600.1 and 64600.2 is presented in Appendix B.

4.3 Ch72400

For the observational bores for chainage 72400, the upstream bore 72400.1 has recorded as dry during the course of the Project whereas the downstream bore has declined in groundwater levels with the levels of groundwater declining through the course of the Project. Figures 4.3.1 and 4.3.2 presents the depths to ground water recorded during the construction stage of the Project.

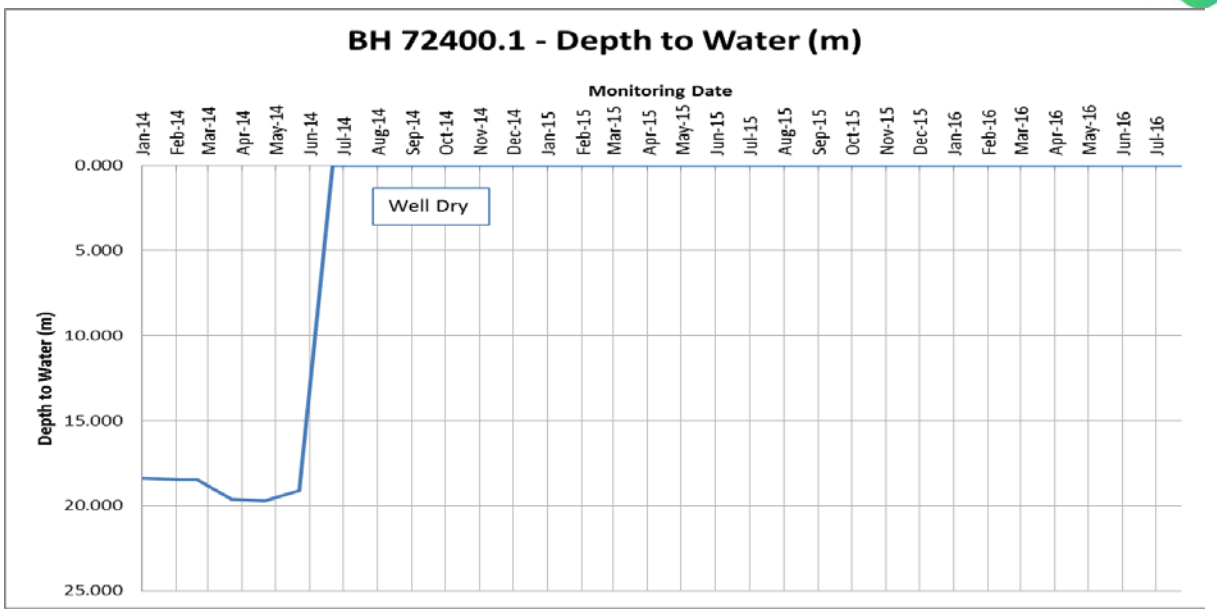

Figure 4.3.1 – Bore 72400.1 Groundwater Depths

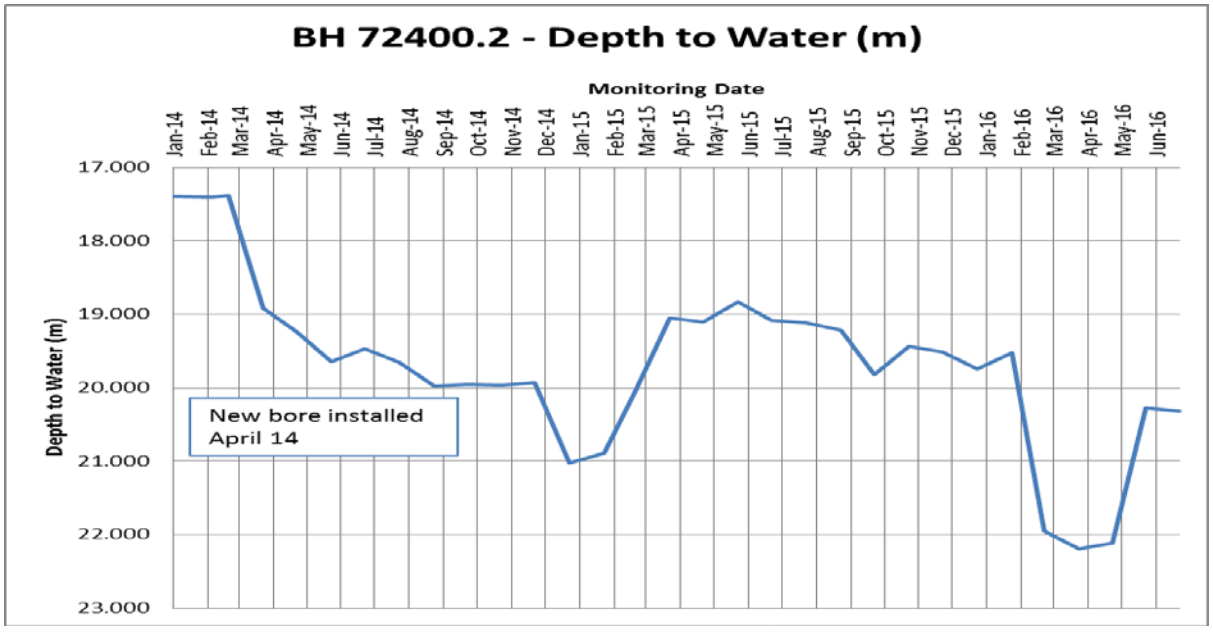

Figure 4.3.2 – Bore 72400.2 Groundwater Depths

During the few months that the bore 72400.1 recorded groundwater, the pH has been lower than the 80th percentile during this period. All other parameters have been compliant for this period.

Whereas for the bore 72400.2, some of the parameters tested were higher than the 80th percentile values. The electrical conductivity, major anions and cations showed higher results than the 80th percentile values in which the mean values were significantly higher than the 80th percentile values. No hydrocarbons were detected during the course of the Project. Raw data for bores 72400.1 and 72400.2 is presented in Appendix C.

4.4 Ch74300

For the majority of the Project, both the bores 74300.1 and 74300.2 have had declining groundwater levels. In the case of the upstream bore 74300.1, the bore has run dry. As this is on the upstream of the groundwater gradient, construction activities are not the cause of

this decline. Despite this, the decline in the downstream bore 74300.2 is quite significant whether this is due to the cutting is unknown as the upstream bore suggests an outside influence. Figures 4.4.1 and 4.4.2 present the groundwater levels for the bores 74300.1 and 74300.2.

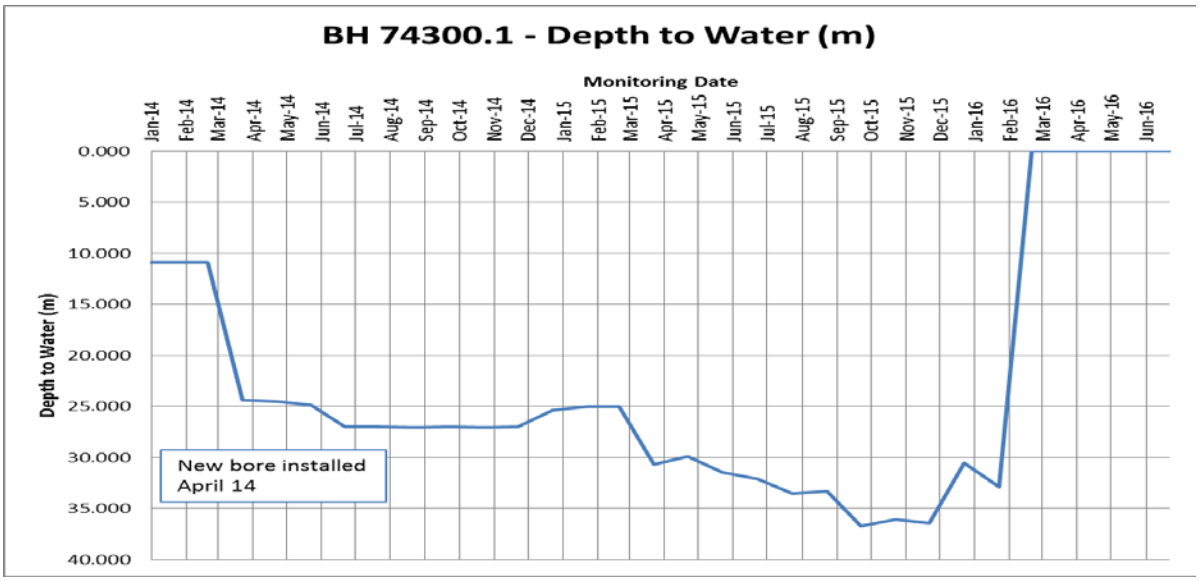

Figure 4.4.1 – Bore 74300.1 Groundwater Depths

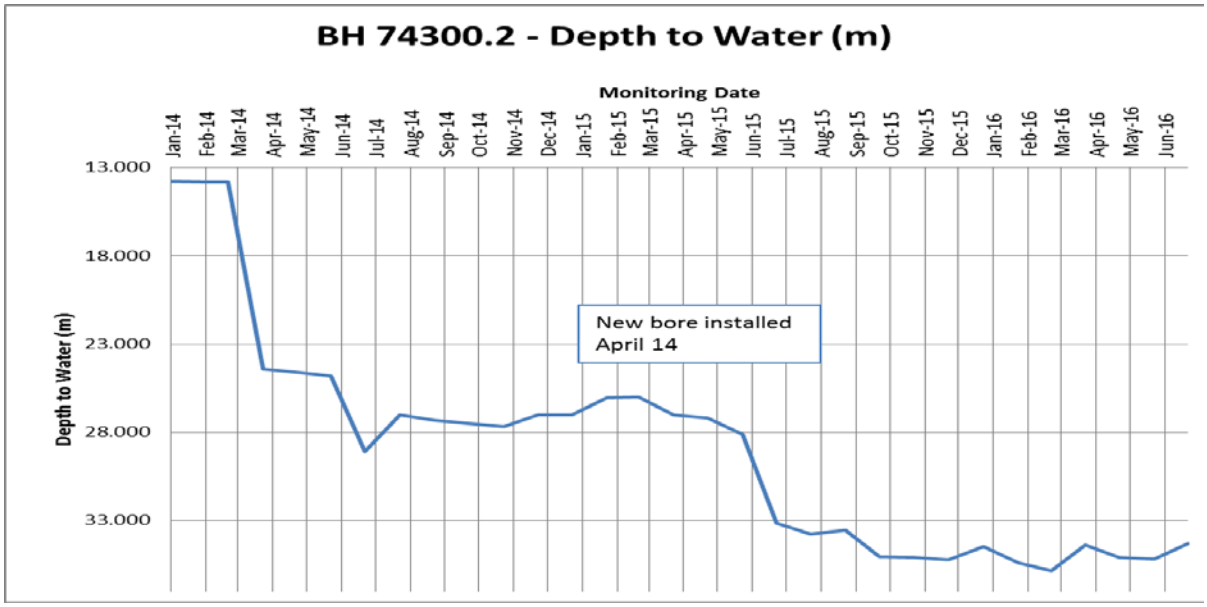

Figure 4.4.2 – Bore 74300.2 Groundwater Depths

Bore 74300.1 experienced elevated levels for the electrical conductivity, nutrients, major anions and cations, and hydrocarbons during the monitoring period. As this bore is upstream of the groundwater gradient, no construction activities were a result of these increased levels.

Whereas for the bore 74300.2, results showed there was less concentration of the parameters tested. Whilst there were elevated levels of pH, electrical conductivity, some nutrients and major anions and cations, the levels were not as significant as the upstream bore. Moderate levels of hydrocarbons were also recorded once in which the cause was

unknown upon investigation. Raw data for the bores 74300.1 and 74300.2 are presented in Appendix D.

4.5 Ch75500

The upstream bore 75500.1 has been stable in height for the majority of the Project whilst the downstream bore 75500.2, has been dry for the entirety of the construction stage of the Project, even after a new bore was installed in April of 2014. Given this, it is hard to conclude the affect the cutting has had on the groundwater for chainage 75500. Figure 4.5.1 presents the groundwater levels for the bore 75500.1. As no data is present for the bore 75500.2, no figure will be provided.

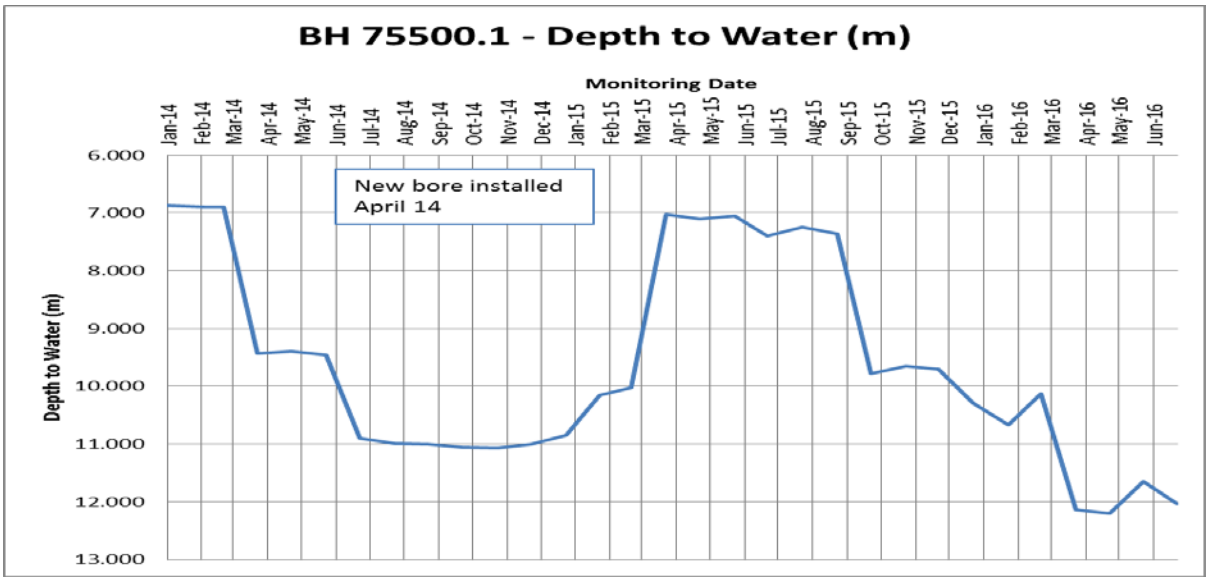

Figure 4.5.1 – Bore 75500.1 Groundwater Depths

Elevated levels in the nutrient, major anion and cations were observed slightly over the 80th percentiles for the bore 75500.1. Other elevated levels in pH were observed early in the monitoring period. Majority of parameters tested have been compliant through the course of the Project. As no data for bore 75500.2 could be collected due to the limited water supply, Appendix E will only comprise of raw data for bore 75500.1.

4.6 Ch78500

The upstream bore 78500.1 for the beginning of the construction stage of the Project recorded stable groundwater levels for the first six months until the bore ran dry. The cause of which is unknown. Whereas the downstream bore 78500.2 recorded relatively stable for the entirety of the Project. Figures 4.6.1 and 4.6.2 present the groundwater levels for the bores 78500.1 and 78500.2.

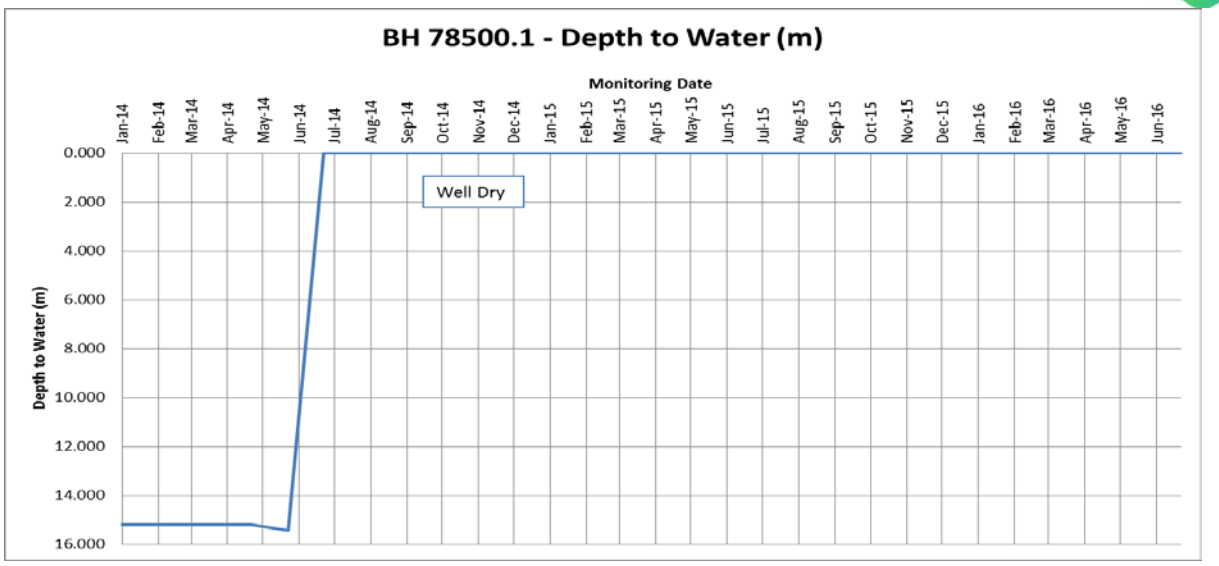

Figure 4.6.1 – Bore 78500.1 Groundwater Depths

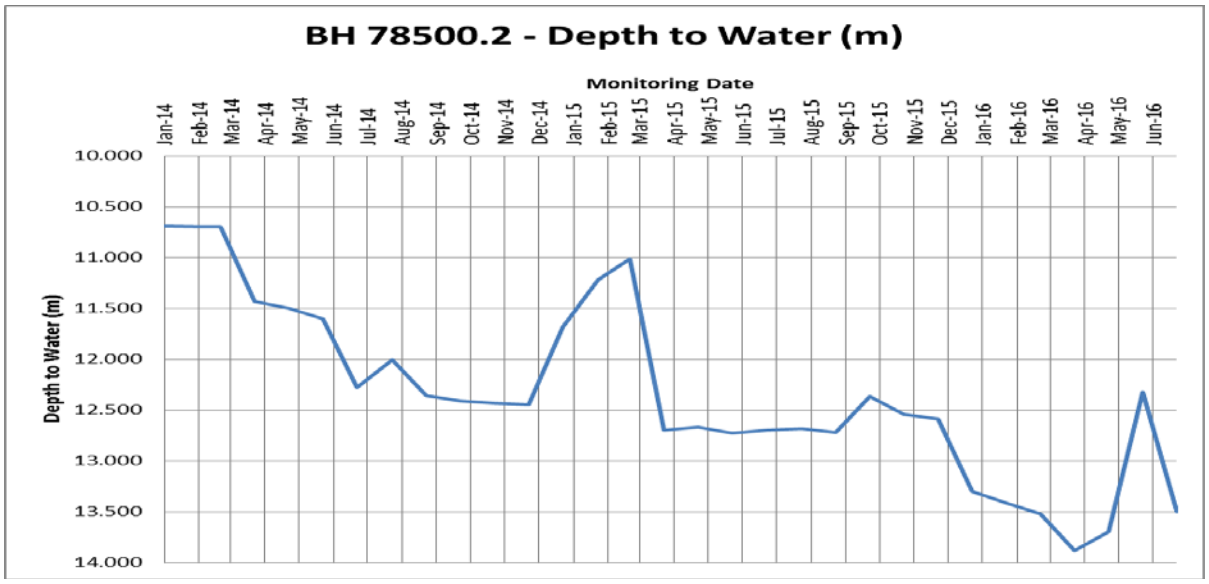

Figure 4.6.2 – Bore 78500.2 Groundwater Depths

The majority results from the parameters tested show compliance with the 80th percentile values with only a few slight elevated levels for the nutrients and major anions and cations. Appendix F presents the raw data for the bores 78500.1 and 78500.2.

4.7 Discussion of Results

From the results presented in Sections 4.1 to 4.6 and the raw data presented in Appendixes A to F, it is hard to define the impact that the construction has had on the groundwater resources. The limiting factor of the bores running dry (both upstream and downstream of the groundwater gradient) has had an effect on the comparison of results of the groundwater levels and parameter measurements.

Furthermore, it can be seen through the course of the Project that groundwater levels have declined in both upstream and downstream bores of the groundwater gradient. This can be attributed to the irregular weather conditions experienced during the construction stage of the Project.

As the dryer than normal conditions were experienced during this time, the recharge to the local groundwater resources would be limited causing the levels to drop. Given the geology of certain areas such as chainage 74300 where the granite, phyllites and slates were identified, the permeability for recharging the groundwater is limited significantly when compared to chainage 64600 comprising of sandy clays, silty clays and some gravel areas in which has a higher permeability.

For the tested parameters listed in Table 3.2.1, the majority of results were compliant through the course of the Project. Levels for nutrients were relatively stable for the duration of the Project with minor elevation recorded. The results for the major anions and cations fluctuated through the bores observed. For some, the concentration levels were significantly higher than the 80th percentiles. But relative to the concentrations recorded, the concentrations present are not enough to make an impact of the groundwater quality.

Along with the nutrients, the heavy metals were relatively stable with only a few minor elevations concentrations noted through monitoring. The majority of samples were too low to register significant figures in the laboratory analysis. This also applies for the BTEX and other hydrocarbons tested as the majority of results don't register a significant quantity. Despite this, the upstream bore 64600.1 registered moderate levels of hydrocarbons and chemicals. Since this is upstream of the groundwater gradient suggest contamination from an outside influence local to the area.

From this, it is hard to identify any discernible impacts on the groundwater resources from the cutting identified in 3.1. Chainage 64600 is the and to a lesser extent, chainage 74300; show that construction has influenced the groundwater resources. Groundwater levels in both chainage are consistent with each other, with the upstream general having the higher concentration and levels of the parameters tested.

Appendix A – Chainage 63200 Raw Data

Monitoring Bore 63200.1 - control site		Earthworks Activity during Monitoring	Date	Time	Compliance comments	Field Results: Depth to Water (m)	Temp (Celsius)	EC (us/cm)	pH	**Lab Results** Total Dissolved Solids (mg/L)	Bicarbonate (Alkalinity) (mg/L $CaCO_3$ **equivalent)**	Total Phosphorus (mg/L P)	Phosphate (mg/L P)	Total Nitrogen (mg/L N)	Nitrate (mg/L N)	Nitrite (mg/L N)	Ammonia (mg/L N)	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Chloride (mg/L)	Sulfate (mg/L SO_4^{2-})
	February	Construction	13/02/2014	8:00am	Minor parameter fluctuation	17.587	20.6	0.275	5.57														
	March	Construction	31/03/2014	7:20am	Minor parameter fluctuation	17.450	21.17	0.275	5.57	Insufficient sample available to undertake lab testing													
					new bore installed - control site																		
2014	April (new bore installed)	Construction	7/04/2014	7:30am	-	DRY	DRY	DRY	DRY														
	May	Construction	29/05/2014	12:30pm	-	DRY	DRY	DRY	DRY														
	June	Construction	25/06/2014	9:30am	-	DRY	DRY	DRY	DRY														
	July	Construction	31/07/2014	10:00am	-	DRY	DRY	DRY	DRY	Insufficient sample available to undertake lab testing													
	August	Construction	18/08/2014	9:40am	-	DRY	DRY	DRY	DRY														
	September	Construction	24/09/2014	10:11am	-	DRY	DRY	DRY	DRY														
	October	Construction	30/10/2014	8.30am	-	DRY	DRY	DRY	DRY	Insufficient sample available to undertake lab testing													
	November	Construction	20/11/2014	7.30am	-	DRY	DRY	DRY	DRY														
	December	Construction	16/12/2014	8.00am	-	DRY	DRY	DRY	DRY														
2015	January	Construction	15/01/2015	10.10am	-	DRY	DRY	DRY	DRY														
	February	Construction	24/02/2015	7.15am	-	DRY	DRY	DRY	DRY														
	March	Construction	23/03/2015	8.20am	-	DRY	DRY	DRY	DRY	Insufficient sample available to undertake lab testing													
	April	Construction	28/04/2015	7.15am	-	DRY	DRY	DRY	DRY														
	May	Construction	26/05/2015	8.00am	-	DRY	DRY	DRY	DRY														
	June	Construction	25/06/2015	7.30am	-	DRY	DRY	DRY	DRY														
	July	Construction	21/07/2015	7.00am	-	DRY	DRY	DRY	DRY	Insufficient sample available to undertake lab testing													
	August	Construction	13/08/2015	8.30am	-	DRY	DRY	DRY	DRY														
	September	Construction	19/09/2015	7.15am	-	DRY	DRY	DRY	DRY														
	October	Construction	30/10/2015	7.30am	-	DRY	DRY	DRY	DRY	Insufficient sample available to undertake lab testing													
	November	Construction	19/11/2015	7.00am	-	DRY	DRY	DRY	DRY														
	December	Construction	14/12/2015	1.00pm	-	DRY	DRY	DRY	DRY														
2016	January	Construction	28/01/2016	10.00am	-	DRY	DRY	DRY	DRY	Insufficient sample available to undertake lab testing													
	February	Construction	20/02/2016	2.00 pm	-	DRY	DRY	DRY	DRY														
	March	Construction	11/03/2016	8.00 am	-	DRY	DRY	DRY	DRY														
	April	Construction	28/04/2016	9.00 am	-	DRY	DRY	DRY	DRY	Insufficient sample available to undertake lab testing													
	May	Construction	31/05/2016	11.50 am	-	DRY	DRY	DRY	DRY														
	June	Construction	27/06/2016	7.30am	-	DRY	DRY	DRY	DRY														
	July	Construction	08/07/2016	2.30pm	-	DRY	DRY	DRY	DRY	Insufficient sample available to undertake lab testing													
	August	Construction	-	-	-	DRY	DRY	DRY	DRY														

Monitoring Bore 63200.1 - control site		Earthworks Activity during Monitoring	Date	Time	Silver (mg/L)	Aluminium (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Lead (mg/L)	Selenium (mg/L)	Zinc (mg/L)	Mercury (mg/L)	BTEX	Benzene (µg/L or ppb)	Toluene (µg/L or ppb)	Ethylbenzene (µg/L or ppb)	m+p-Xylene (µg/L or ppb)	o-Xylene (µg/L or ppb)	Naphthalene (µg/L or ppb)	Total Recoverable Hydrocarbons:	C6-C9 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb) LESS BTEX (F1)	C10-C14 Fraction (µg/L or ppb)	C15-C28 Fraction (µg/L or ppb)	C29-C36 Fraction (µg/L or ppb)	C10-C16 Fraction (µg/L or ppb)	Naphthalene Fraction (µg/L or ppb)	C10-C16 less C16-C34 Fraction (µg/L or ppb)	C16-C34 Fraction (µg/L or ppb)	C34-C40 Fraction (µg/L or ppb)
2014	February	Construction	13/02/2014	8:00am																															
	March	Construction	31/03/2014	7:20am																															
	April (new bore installed)	Construction	7/04/2014	7:30am																															
	May	Construction	29/05/2014	12:30pm																															
	June	Construction	25/06/2014	9:30am																															
	July	Construction	31/07/2014	10:00am																															
	August	Construction	18/08/2014	9:40am																															
	September	Construction	24/09/2014	10:11am																															
	October	Construction	30/10/2014	8.30am																															
	November	Construction	20/11/2014	7.30am																															
	December	Construction	16/12/2014	8.00am																															
2015	January	Construction	15/01/2015	10.10am																															
	February	Construction	24/02/2015	7.15am																															
	March	Construction	23/03/2015	8.20am																															
	April	Construction	28/04/2015	7.15am																															
	May	Construction	26/05/2015	8.00am																															
	June	Construction	25/06/2015	7.30am																															
	July	Construction	21/07/2015	7.00am																															
	August	Construction	13/08/2015	8.30am																															
	September	Construction	19/09/2015	7.15am																															
	October	Construction	30/10/2015	7.30am																															
	November	Construction	19/11/2015	7.00am																															
	December	Construction	14/12/2015	1.00pm																															
2016	January	Construction	28/01/2016	10.00am																															
	February	Construction	20/02/2016	2.00 pm																															
	March	Construction	11/03/2016	8.00 am																															
	April	Construction	28/04/2016	9.00 am																															
	May	Construction	31/05/2016	11.50 am																															
	June	Construction	27/06/2016	7.30am																															
	July	Construction	08/07/2016	2.30pm																															
	August	Construction	-	-																															

Monitoring Bore 63200.2 - impact site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Silver (mg/L)	Aluminium (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Lead (mg/L)	Selenium (mg/L)	Zinc (mg/L)	Mercury (mg/L)	BTEX	Benzene (µg/L or ppb)	Toluene (µg/L or ppb)	Ethylbenzene (µg/L or ppb)	m+p-Xylene (µg/L or ppb)	o-Xylene (µg/L or ppb)	Naphthalene (µg/L or ppb)	Total Recoverable Hydrocarbons:	C6-C9 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb) LESS BTEX (F1)	C10-C14 Fraction (µg/L or ppb)	C15-C28 Fraction (µg/L or ppb)	C29-C36 Fraction (µg/L or ppb)	C10-C16 Fraction (µg/L or ppb)	C10-C16 less Naphthalene Fraction (µg/L or ppb)	C16-C34 Fraction (µg/L or ppb)	C34-C40 Fraction (µg/L or ppb)
	January	Pre Construction	10/01/2013	7:55am	<0.001	0.203	<0.001	<0.001	<0.001	0.002	0.013	0.006	0.002	0.001	<0.002	0.012	<0.0005		<1	<1	<1	<1	<1	<1		<10	<10	<10	<50	<100		<50		<100	<100
	February	Construction	13/02/2014	8:45am																														
	March	Construction	31/03/2014	7:21am	<0.001	0.124	0.001	<0.001	<0.001	0.007	0.107	0.01	0.001	<0.001	<0.001	0.008	<0.0005		<1	<1	<1	<2	<1	<1		13	13	13	<50	<100	<100	<50		<100	<100
	April	Construction	7/04/2014	8:15am																														
	May	Construction	29/05/2014	9:30am																														
	June	Construction	25/06/2014	10:20am																														
	July	Construction	31/07/2014	11:00am	<0.001	0.059	0.001	<0.001	<0.001	0.001	0.115	0.022	0.001	<0.001	<0.002	0.005	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	August	Construction	18/08/2014	9:45am																														
	September	Construction	24/09/2014	12:00pm																														
	October	Construction	30/10/2014	10.25am																														
	November	Construction	20/11/2014	11.22am	<0.001	0.96	0.003	<0.001	<0.001	0.005	0.209	0.03	0.001	0.002	<0.002	0.011	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
2014	December	Construction	16/12/2014	9.00am																														
	January	Construction	15/01/2015	8.45am																														
	February	Construction	24/02/2015	11.00am																														
	March	Construction	23/03/2015	7.50am																														
	April	Construction	28/04/2015	8.00am	0.001	0.134	0.001	<0.001	<0.001	0.002	0.075	0.014	0.001	<0.001	<0.001	0.012	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	May	Construction	26/05/2015	8.52am																														
	June	Construction	25/06/2015	8.47am																														
	July	Construction	21/07/2015	7.30am	<0.001	0.062	0.001	<0.001	<0.001	0.002	0.078	0.013	0.002	0.001	<0.001	0.017	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	August	Construction	13/08/2015	8.55am																														
	September	Construction	19/09/2015	8.00am																														
	October	Construction	30/10/2015	8.20am	<0.001	0.028	0.002	<0.001	<0.001	0.001	0.048	0.024	0.001	<0.001	0.001	0.011	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	November	Construction	19/11/2015	7.30am																														
2015	December	Construction	14/12/2015	1.30pm																														
	January	Construction	28/01/2016	9.45am	<0.001	0.017	0.001	<0.001	<0.001	0.001	0.014	0.013	<0.001	<0.001	<0.001	0.009	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	February	Construction	19/02/2016	2.20 pm																														
	March	Construction	11/03/2016	8.45 am																														
2016	April	Construction	28/04/2016	10.00 am	<0.001	0.021	0.001	<0.001	<0.001	0.001	0.036	0.008	0.001	<0.001	<0.005	0.008	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	May	Construction	31/05/2016	12.20 pm																														
	June	Construction	27/06/2016	8.15 am																														
	July	Construction	8/07/2016	2.40 pm	<0.001	0.036	<0.001	<0.001	<0.001	<0.001	0.026	1.3	<0.001	<0.001	<0.005	0.008	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	August	Construction	-	-																														

Monitoring Bore 63200.2 - impact site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Compliance comments	Field Results: Depth to Water (m)	Temp (Celsius)	EC (us/cm)	pH	**Lab Results** Total Dissolved Solids (mg/L)	Bicarbonate (Alkalinity) (mg/L $CaCO_3$ **equivalent**)	Total Phosphorus (mg/L P)	Phosphate (mg/L P)	Total Nitrogen (mg/L N)	Nitrate (mg/L N)	Nitrite (mg/L N)	Ammonia (mg/L N)	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Chloride (mg/L)	Sulfate (mg/L SO_4^{2-})
	January	Pre Construction	10/01/2013	7:55am	-	12.160	20.9	0.17	5.23	100	4	0.01	0.01	0.097	0.015	0.002	0.009	14.8	0.3	0.29	2.47	39.1	2.58
	February	Construction	13/02/2014	8:45am	Minor parameter fluctuation	12.560	21	0.275	5.25														
	March	Construction	31/03/2014	7:21am	low level of hydrocarbon detection in March 14. Cause unknown. Minor parameter fluctuation	12.56	21.17	0.275	5.57	18		0.02	<0.005	0.25	0.04	0.002	0.024	15.7	0.6	2.1	1.5	33	8
	April	Construction	7/04/2014	8:15am	complies	13.19	21.34	0.118	5.46														
	May	Construction	29/05/2014	9:30am	complies	13.64	21.26	0.126	5.85														
	June	Construction	25/06/2014	10:20am	complies	13.41	20.36	0.128	5.99														
	July	Construction	31/07/2014	11:00am	Minor parameter fluctuation	14.8	18.52	0.129	5.35	2,677	0.00	0.09	<0.005	0.60	0.036	<0.001	0.035	16.5	1.1	1.8	2.1	35	3
	August	Construction	18/08/2014	9:45am	complies	14.75	18.66	0.126	5.43														
	September	Construction	24/09/2014	12:00pm	complies	14.69	19.5	0.128	5.61														
	October	Construction	30/10/2014	10.25am	complies	14.78	21.25	0.13	5.71														
	November	Construction	20/11/2014	11.22am	Minor parameter fluctuation	14.73	21.31	0.128	5.98	70		0.79	0.216	0.53	0.023	0.001	0.164	8.9	0.7	2.5	1.4	16	6
2014	December	Construction	16/12/2014	9.00am	complies	14.81	21.36	0.1	5.24														
	January	Construction	15/01/2015	8.45am	Minor parameter fluctuation	14.990	21.5	0.21	5.35														
	February	Construction	24/02/2015	11.00am	Minor parameter fluctuation	14.520	21.9	0.22	5.42														
	March	Construction	23/03/2015	7.50am	complies	14.75	22	0.136	5.66	Lab results taken but unable to be tested due to delivery time lapse. Resampled in April.													
	April	Construction	28/04/2015	8.00am	Minor parameter fluctuation	12.41	20.31	0.155	6.95	40	10	0.061	0.007	0.537	0.133	0.002	0.028	5.9	11	5.2	1.2	34	4
	May	Construction	26/05/2015	8.52am	complies	12.39	20.19	0.162	6.82														
	June	Construction	25/06/2015	8.47am	complies	12.22	17.69	0.148	6.98														
	July	Construction	21/07/2015	7.30am	Minor parameter fluctuation	12.56	18.58	0.116	7.67	60	12	0.03	0.012	0.30	0.137	0.009	0.016	13.8	1.1	3.9	1.9	19	36
	August	Construction	13/08/2015	8.55am	complies	12.52	18.12	0.113	7.51														
	September	Construction	19/09/2015	8.00am	complies	12.49	18.65	0.111	7.44														
	October	Construction	30/10/2015	8.20am	Minor parameter fluctuation	13.47	18.8	0.118	6.92	90	4	0.06	0.04	0.71	0.183	0.006	0.31	14.4	0.8	1.8	1.7	27	11
	November	Construction	19/11/2015	7.30am	complies	13.24	19.2	0.112	7.01														
2015	December	Construction	14/12/2015	1.30pm	Minor parameter fluctuation	13.33	20.19	0.114	6.92														
	January	Construction	28/01/2016	9.45am	Minor parameter fluctuation	13.24	21.36	0.106	5.67	20	10	0.07	<0.005	0.48	0.032	0.001	0.048	12.3	0.3	2.1	1.4	18	7
	February	Construction	19/02/2016	2.20 pm	Minor parameter fluctuation	13.65	23.35	0.103	6.07														
	March	Construction	11/03/2016	8.45 am	Minor parameter fluctuation	13.7	19.85	0.119	6.82														
2016	April	Construction	28/04/2016	10.00 am	Minor parameter fluctuation	14.23	19.49	0.098	6.01	20	6	0.083	0.01	0.322	0.032	<0.005	0.026	11.1	0.19	0.9	1.45	20.3	2.49
	May	Construction	31/05/2016	12.20 pm	Minor parameter fluctuation	14.12	19.62	0.096	6.04														
	June	Construction	27/06/2016	8.15 am	Minor parameter fluctuation	13.97	20.62	0.101	6.09														
	July	Construction	8/07/2016	2.40 pm	Minor parameter fluctuation	13.8	19.48	0.139	4.92	33	6	0.034	<0.005	0.063	0.051	<0.005	0.006	10.6	<0.5	1.3	0.008	20.2	<9
	August	Construction	-	-	-																		

Appendix B – Chainage 64600 Raw Data

Monitoring Bore 64600.1 - control site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Compliance comments	Field Results: Depth to Water (m)	Temp (Celsius)	EC (us/cm)	pH	Lab Results Total Dissolved Solids (mg/L)	Bicarbonate (Alkalinity) (mg/L $CaCO_3$ equivalent)	Total Phosphorus (mg/L P)	Phosphate (mg/L P)	Total Nitrogen (mg/L N)	Nitrate (mg/L N)	Nitrite (mg/L N)	Ammonia (mg/L N)	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Chloride (mg/L)	Sulfate (mg/L SO_4^{2-})
	January	Pre construction	10/01/2014	8:36am	-	1.820	20.1	0.202	5.75	100	13	0.015	0.011	0.068	0.03	<0.001	0.005	34.1	0.53	1.53	4.53	58.5	2.58
	February	Construction	13/02/2014	9:55am	Minor parameter fluctuation	1.850	22	0.202	5.82														
	March	Construction	31/03/2014	8:00am	Minor parameter fluctuation	1.880	21.54	0.202	6.82	4028		0.05	0.005	0.55	0.085	0.001	0.278	230	11.5	67.5	10.6	396	35
					new bore installed																		
	April (new bore installed)	Construction	7/04/2014	8:45am	Minor parameter fluctuation	10.480	21.68	1.64	7.35														
	May	Construction	29/05/2014	1:43pm	Minor parameter fluctuation	10.58	20.54	1.62	6.45														
	June	Construction	25/06/2014	10:25am	Minor parameter fluctuation	10.62	20.05	1.65	6.24														
	July	Construction	31/07/2014	11:15am	Minor parameter fluctuation. High level aluminium & hydrocarbon detection. Cause unknown	10.8	18.6	1.59	8.27	19796		0.09	0.005	0.81	0.205	0.001	0.355	249	7.3	128	8.1	447	21
	August	Construction	18/08/2014	9:50am	Minor parameter fluctuation	10.69	18.9	1.59	8.16														
	September	Construction	24/09/2014	11:20am	Minor parameter fluctuation	10.63	18.6	1.65	7.91														
	October	Construction	30/10/2014	10.15am	Minor parameter fluctuation	10.71	19.5	1.67	7.88														
	November	Construction	20/11/2014	9.25am	Minor parameter fluctuation. High level aluminium in Nov 14 (unknown cause)	10.73	21.1	1.25	7.76	70		0.08	0.012	0.37	0.05	0.002	0.313	284	5.3	5.3	107	7.3	516
2014	December	Construction	16/12/2014	8.35am	Minor parameter fluctuation	10.72	19.9	1.8	8.65														
	January	Construction	15/01/2015	12.00pm	Minor parameter fluctuation	10.020	20.09	1.91	8.36														
	February	Construction	24/02/2015	10.15am	Minor parameter fluctuation	9.980	21.3	1.76	8.01														
	March	Construction	23/03/2015	11.50am	Minor parameter fluctuation	10.010	21.8	1.59	7.95	ted due to delivery time lapse. Resampled in April.													

2015	April	Construction	28/04/2015	10.00am	Elevated BTEX and TRH results currently being investigated. This is a control site not impacted by construction works. Possible contamination from bore installation. Minor parameter fluctuation on several other parameters	9.300	20.27	1.09	6.40	673	45	0.05	0.01	0.27	0.05	0.003	0.04	175	2.60	43.00	6.40	304.00	8.00
	May	Construction	26/05/2015	9.38am	EC minor fluctuation but within acceptable level.	9.20	20.1	0.99	6.36														
	June	Construction	25/06/2015	10.15am	EC minor fluctuation. Previous elevated BTEX and TRH results still being investigated	9.25	19.8	1.01	6.56														
	July	Construction	21/07/2015	10.48am	Slightly Elevated BTEX and TRH results but reduced from previous results. Minor parameter fluctuation on several other parameters	9.53	18.33	0.731	6.88	380	25	0.13	0.007	0.25	0.025	0.001	0.022	108	0.90	13.9	6.8	194	33
	August	Construction	13/08/2015	9.45am	EC minor fluctuation but within acceptable level.	9.32	18.21	0.699	6.71														
	September	Construction	17/09/2015	8.45am	EC minor fluctuation but within acceptable level.	9.45	18.51	0.712	6.85														
	October	Construction	30/10/2015	9.00am	pH slightly lower than P20 value of 5.35. EC slightly higher than P80 value but within acceptable level. Minor parameter fluctuation on several other parameters. Note this is a control site.	9.4	19.15	0.789	5.05	420	5	0.07	0.03	0.20	0.04	<0.001	0.026	134	0.70	4.9	9.1	231	14
	November	Construction	19/11/2015	8.25am	EC minor fluctuation but within acceptable level.	9.42	19.25	0.656	6.12														
	December	Construction	14/12/2015	2.15pm	complies	9.44	19.89	0.645	6.36														

2016	January	Construction	28/01/2016	10.30am	Minor parameter fluccation for pH, though greater than the P20 value of 5.35	10.6	20.83	1.28	5.8	729	<1	0.04	0.009	0.25	0.077	<0.001	0.008	232	0.6	6.6	17.9	401	10
	February	Construction	19/02/2016	2.00 pm	Complies	9.67	25.36	2.09	5.78														
	March	Construction	11/03/2016	8.20 am	Complies	9.99	19.97	1.09	6.94														
	April	Construction	28/04/2016	1.30 pm	Minor parameter fluccations	10.52	22.15	1.26	5.79	690	10	0.027	0.012	0.17	0.06	<0.005	0.022	212	0.66	3.5	15.9	375	5.58
	May	Construction	31/05/2016	1.50 pm	Complies	10.02	21.69	1.12	5.89														
	June	Construction	27/06/2016	9.30 am	Complies	9.46	20.52	1.3	5.97														
	July	Construction	8/07/2016	2.00 pm	Minor parameter fluctuations	10.14	20.26	1.43	4.58	780	6	0.022	<0.005	<0.01	<0.005	<0.005	<0.005	243	0.6	3	0.021	426	<9
	August	Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Monitoring Bore 64600.1 - control site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Silver (mg/L)	Aluminium (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Lead (mg/L)	Selenium (mg/L)	Zinc (mg/L)	Mercury (mg/L)	BTEX	Benzene (ug/L or ppb)	Toluene (ug/L or ppb)	Ethylbenzene (ug/L or ppb)	m+p-Xylene (ug/L or ppb)	o-Xylene (ug/L or ppb)	Naphthalene (ug/L or ppb)	Total Recoverable Hydrocarbons:	C6-C9 Fraction (ug/L or ppb)	C6-C10 Fraction (ug/L or ppb)	C6-C10 Fraction (ug/L or ppb) LESS BTEX (F1)	C10-C14 Fraction (ug/L or ppb)	C15-C28 Fraction (ug/L or ppb)	C29-C36 Fraction (ug/L or ppb)	C10-C16 Fraction (ug/L or ppb)	C10-C16 less Naphthalene Fraction (ug/L or	C16-C34 Fraction (ug/L or ppb)	C34-C40 Fraction (ug/L or ppb)
	January	Pre construction	10/01/2014	8:36am	<0.001	0.019	<0.001	<0.001	<0.001	0.001	0.006	0.013	0.003	<0.001	<0.002	0.012	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50			
	February	Construction	13/02/2014	9:55am																															
	March	Construction	31/03/2014	8:00am	<0.001	0.02	0.003	<0.001	0.001	0.001	0.079	0.125	0.002	<0.001	0.002	0.001	<0.0005		<10	<10	<10	<20	<10	<10	`	<100	<100	<10	<50	<100	<100	<50		<100	<100
	April (new bore installed)	Construction	7/04/2014	8:45am																															
	May	Construction	29/05/2014	1:43pm																															
	June	Construction	25/06/2014	10:25am																															
	July	Construction	31/07/2014	11:15am	<0.001	2.373	0.01	<0.001	0.005	0.002	0.005	<0.001	<0.001	<0.001	<0.002	<0.001	<0.0005		<10	150	<10	<20	<10	<10		260	260	..	<50	<100	<100	<50		<100	<100
	August	Construction	18/08/2014	9:50am																															
	September	Construction	24/09/2014	11:20am																															
	October	Construction	30/10/2014	10.15am																															
	November	Construction	20/11/2014	9.25am	0.001	7.139	0.01	<0.0001	0.022	0.015	0.968	0.043	0.004	0.005	<0.002	0.041	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	130	<100	<100	120		120	<100
2014	December	Construction	16/12/2014	8.35am																															
	January	Construction	15/01/2015	12.00pm																															
	February	Construction	24/02/2015	10.15am																															
	March	Construction	23/03/2015	11.50am																															
	April	Construction	28/04/2015	10.00am	<0.001	0.035	0.001	<0.001	<0.001	0.001	0.01	0.02	0.001	<0.001	<0.001	0.004	<0.0005		<1	1400	1	<2	<1	<1		2200	2200	<50	<100	<100	<100	<50	<50	<100	<100
	May	Construction	26/05/2015	9.38am																															
	June	Construction	25/06/2015	10.15am																															
2015	July	Construction	21/07/2015	10.48am	<0.001	0.095	<0.001	<0.001	<0.001	0.001	0.074	0.059	0.003	<0.001	0.001	0.02	<0.0005		<1	<1	76	<2	<1	<1		120	130	50	<50	<100	<100	<50		<100	<100

	August	Construction	13/08/2015	9.45am																																	
	September	Construction	17/09/2015	8.45am																																	
	October	Construction	30/10/2015	9.00am	<0.001	1.957	<0.001	<0.001	<0.001	0.002	0.024	0.043	0.002	0.002	<0.001	0.025	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	November	Construction	19/11/2015	8.25am																																	
	December	Construction	14/12/2015	2.15pm																																	
2016	January	Construction	28/01/2016	10.30am	<0.001	5.025	0.001	<0.001	0.001	0.004	0.046	0.016	0.003	0.004	0.001	0.03	<0.0006		<1	49	<1	<2	<1	<1		80	80	31	<50	<100	<100	<50		<100	<100
	February	Construction	19/02/2016	2.00 pm																																	
	March	Construction	11/03/2016	8.20 am																																	
	April	Construction	28/04/2016	1.30 pm	<0.001	5.071	0.001	<0.001	0.001	0.003	0.109	0.026	0.004	0.004	<0.005	0.036	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	May	Construction	31/05/2016	1.50 pm																																	
	June	Construction	27/06/2016	9.30 am																																	
	July	Construction	8/07/2016	2.00 pm	<0.001	4.7	0.004	<0.001	<0.001	0.003	8.4	18.7	0.002	0.003	<0.005	0.031	<0.0005		<1	42	<1	<2	<1	<1		72	80	38	<50	<100	<100	<50	<50	<100	<100
	August	Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Monitoring Bore 64600.2 - impact site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Compliance comments	Field Results: Depth to Water (m)	Temp (Celsius)	EC (us/cm)	pH	**Lab Results** Total Dissolved Solids (mg/L)	Bicarbonate (Alkalinity) (mg/L $CaCO_3$ **equivalent)**	Total Phosphorus (mg/L P)	Phosphate (mg/L P)	Total Nitrogen (mg/L N)	Nitrate (mg/L N)	Nitrite (mg/L N)	Ammonia (mg/L N)	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Chloride (mg/L)	Sulfate (mg/L SO_4^{2-})
	January	Pre construction	10/01/2014	9:15am	-	1.830	21	0.243	5.66	200	38	0.011	0.006	0.039	<0.005	0.003	<0.005	37.9	0.87	5.13	7.48	61.1	4.14
	February	Construction	13/02/2014	10:37am	Minor parameter fluctuation	1.847	21	0.242	5.78														
	March	Construction	31/03/2014	10:00am	Minor parameter fluctuation	1.747	20	0.242	5.78	21	36	0.03	0.005	0.09	0.026	<0.001	0.014	33.9	0.8	3.9	6.4	59	8
	April	Construction	07/04/2014	9:20am	Minor parameter fluctuation	1.747	20.07	1.99	5.86														
	May	Construction	29/05/2014	9:15am	complies	2.450	22.39	0.267	7.93														
	June	Construction	25/06/2014	10:30am	complies	2.48	21	0.255	7.4														
	July	Construction	31/07/2014	11:30am	Minor parameter fluctuation	2.68	17.95	0.35	6.5	24		0.02	0.01	0.08	0.023	0.002	0.025	37.5	0.8	4.2	6.8	68	5
	August	Construction	18/08/2014	9:55am	Minor parameter fluctuation	2.71	18.6	0.35	6.66														
	September	Construction	24/09/2014	10:15am	Minor parameter fluctuation	2.66	19.2	0.371	6.52														
	October	Construction	30/10/2014	11.05am	Minor parameter fluctuation	2.73	21.2	0.365	6.36														
	November	Construction	20/11/2014	12.30pm	*Sample contaminated during collection - retest completed by lab showed all clear (refer to LEN006 SW -D9464)	2.79	21.4	0.354	6.55	155		0.07	0.009	0.12	0.048	0.001	0.048	37.1	0.8	4.2	6.7	64	6
2014	December	Construction	16/12/2014	1.00pm	Minor parameter fluctuation	2.7	21.8	0.29	5.82														
	January	Construction	28/02/2015	12.05pm	complies	Retest BTEX and TRH following contamination of sampling equipment																	
	January	Construction	15/01/2015	12.15pm	Minor parameter fluctuation	1.200	20.09	1.91	8.36														
	February	Construction	24/02/2015	9.30am	Minor parameter fluctuation	1.960	22.2	0.39	6.03														
	March	Construction	23/03/2015	11.00am	Minor parameter fluctuation	1.950	21.5	0.45	5.78	Lab results taken but unable to be tested due to delivery time lapse. Resampled in April.													
	April	Construction	24/04/2015	11.15am	Minor parameter fluctuation	1.150	21.7	0.285	6.73	147	40	0.046	0.008	0.301	0.147	0.001	0.004	37.2	0.9	6.1	7.3	60	5
	May	Construction	26/05/2015	10.05am	complies	1.120	20.9	0.271	6.81														
2015	June	Construction	25/06/2015	8.00am	Minor parameter fluctuation	0.9	16.83	0.509	7.6														
	July	Construction	21/0/7/2015	10.48am	Minor parameter fluctuations	1.26	18.59	0.352	7.99	180	60	0.03	0.026	0.13	0.025	0.001	0.038	42.7	3.7	7.6	7.9	60	30
	August	Construction	13/08/2015	10.15am	Complies	1.1	18.5	0.264	7.85														
	September	Construction	17/09/2015	9.25am	Complies	1.05	18.46	0.262	7.75														
	October	Construction	30/10/2015	10.00am	Minor parameter fluctuations	1.71	18.27	0.256	6.56	160	42	0.04	0.028	0.09	0.02	0.001	0.035	36.5	1	5.7	7.3	54	11
	November	Construction	19/11/2015	8.45am	Complies	1.66	19.21	0.261	6.77														

	December	Construction	14/12/2015	3.00pm	Complies	1.69	19.89	0.266	6.81														
2016	January	Construction	28/01/2016	9.00am	Complies	0.28	23.51	0.301	6.32	167	50	0.03	0.009	0.19	0.016	0.002	0.031	36.6	0.7	5	6.9	54	6
	February	Construction	19/02/2016	1.45 pm	Complies	1.4	25.95	0.269	6.06														
	March	Construction	11/03/2016	3.10 pm	Minor parameter Fluctuations	2	25.91	0.372	7.23														
	April	Construction	28/04/2016	4.00 pm	Minor parameter Fluctuations	2.25	23.81	0.3	6.28	233.3	38	0.027	0.019	0.2	0.072	<0.005	0.041	35	1.02	4.82	6.64	55.2	2.43
	May	Construction	31/05/2016	3.55 pm	Minor parameter Fluctuations	1.97	22.92	0.361	6.41														
	June	Construction	27/06/2016	10.15 am	Complies	1.57	19.08	0.281	7.07														
	July	Construction	8/07/2016	1.30 pm	Minor parameter fluctuations	1.58	21.03	0.309	6.8	153	36	0.021	0.005	0.09	0.064	<0.005	0.009	35.1	0.7	4.4	0.016	49.8	<9
	August	Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	September	Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Monitoring Bore 64600.2 - impact site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Silver (mg/L)	Aluminium (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Lead (mg/L)	Selenium (mg/L)	Zinc (mg/L)	Mercury (mg/L)	BTEX	Benzene (µg/L or ppb)	Toluene (µg/L or ppb)	Ethylbenzene (µg/L or ppb)	m+p-Xylene (µg/L or ppb)	o-Xylene (µg/L or ppb)	Naphthalene (µg/L or ppb)	Total Recoverable Hydrocarbons:	C6-C9 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb) LESS BTEX (F1)	C10-C14 Fraction (µg/L or ppb)	C15-C28 Fraction (µg/L or ppb)	C29-C36 Fraction (µg/L or ppb)	C10-C16 Fraction (µg/L or ppb)	C10-C16 less Naphthalene Fraction (µg/L or ppb)	C16-C34 Fraction (µg/L or ppb)	C34-C40 Fraction (µg/L or ppb)
	January	Pre construction	10/01/2014	9:15am	<0.001	0.008	0.001	<0.001	<0.001	0.001	0.035	0.02	<0.001	<0.001	<0.002	0.004	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	February	Construction	13/02/2014	10:37am																															
	March	Construction	31/03/2014	10:00am	<0.001	0.004	<0.001	<0.001	<0.001	0.001	0.005	0.019	0.001	<0.001	<0.001	0.019	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	April	Construction	07/04/2014	9:20am																															
	May	Construction	29/05/2014	9:15am																															
	June	Construction	25/06/2014	10:30am																															
	July	Construction	31/07/2014	11:30am	<0.001	0.002	<0.001	<0.001	<0.001	0.001	0.013	0.018	0.002	<0.001	<0.002	0.009	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	August	Construction	18/08/2014	9:55am																															
	September	Construction	24/09/2014	10:15am																															
	October	Construction	30/10/2014	11.05am																															
	November	Construction	20/11/2014	12.30pm	<0.001	0.029	0.006	<0.001	<0.001	0.003	1.432	0.019	0.004	0.001	<0.002	0.012	<0.005		<1	2900*	1	<2	<1	<1		4600*	4600*	1700*	<50	<100	<100	<50		<100	<100
2014	December	Construction	16/12/2014	1.00pm																															
	January	Construction	28/02/2015	12.05pm															<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	January	Construction	15/01/2015	12.15pm																															
	February	Construction	24/02/2015	9.30am																															
	March	Construction	23/03/2015	11.00am																															
	April	Construction	24/04/2015	11.15am	<0.001	0.012	0.001	<0.001	<0.001	0.001	0.001	0.02	0.002	<0.001	<0.001	0.036	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	May	Construction	26/05/2015	10.05am																															
2015	June	Construction	25/06/2015	8.00am																															
	July	Construction	21/0/7/2015	10.48am	<0.001	0.023	0.001	<0.001	<0.001	0.001	0.018	0.021	0.002	<0.001	<0.001	0.013	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	August	Construction	13/08/2015	10.15am																															
	September	Construction	17/09/2015	9.25am																															
	October	Construction	30/10/2015	10.00am	<0.001	0.008	0.001	<0.001	<0.001	0.001	0.005	0.03	0.001	<0.001	<0.001	0.008	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	November	Construction	19/11/2015	8.45am																															
	December	Construction	14/12/2015	3.00pm																															
	January	Construction	28/01/2016	9.00am	<0.001	0.005	<0.001	<0.001	<0.001	0.001	0.001	0.018	0.002	<0.001	<0.001	0.008	<0.0007		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	February	Construction	19/02/2016	1.45 pm																															
	March	Construction	11/03/2016	3.10 pm																															
	April	Construction	28/04/2016	4.00 pm	<0.001	0.002	<0.001	<0.001	<0.001	0.001	0.003	0.018	0.002	<0.001	<0.005	0.018	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
2016	May	Construction	31/05/2016	3.55 pm																															
	June	Construction	27/06/2016	10.15 am																															
	July	Construction	8/07/2016	1.30 pm	<0.001	<0.005	<0.001	<0.001	<0.001	<0.001	0.005	6.4	0.001	<0.001	<0.005	0.009	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	August	Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	September	Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix C – Chainage 72400 Raw Data

Monitoring Bore 72400.1 - control site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Compliance comments	Field Results: Depth to Water (m)	Temp (Celsius)	EC (us/cm)	pH	Lab Results Total Dissolved Solids (mg/L)	Bicarbonate (Alkalinity) (mg/L $CaCO_3$ **equivalent**)	Total Phosphorus (mg/L P)	Phosphate (mg/L P)	Total Nitrogen (mg/L N)	Nitrate (mg/L N)	Nitrite (mg/L N)	Ammonia (mg/L N)	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Chloride (mg/L)	Sulfate (mg/L SO_4^{2-})
2014	January	Pre construction	10/01/2014	10.02am	-	18.400	21.3	0.912	5.45	300	25	0.06	0.027	0.28	0.117	0.011	0.040	185.0	1.1	6.8	7.8	228	101
	February	Construction	13/02/2014	11:06am	Minor parameter fluctuation	18.450	20.22	0.915	5.44														
	March	Construction	31/03/2014	9:12am	Minor parameter fluctuation	18.450	20.36	0.915	5.44	2320	57	1.34	0.007	0.36	0.098	<0.001	0.044	191	2	8	8.9	286	140
	April	Construction	7/04/2014	9:52am	complies	19.62	23.37	1.08	5.85														
	May	Construction	29/05/2014	9:30am	Minor parameter fluctuation	19.71	20.68	1.23	4.87														
	June	Construction	26/05/2014	10:18am	Minor parameter fluctuation	19.11	19.68	1.33	5.02														
	July	Construction	31/07/2014	9:45am	-	DRY	DRY	DRY	DRY	Insufficient sample available for lab tests													
	August	Construction	18/08/2014	10:28am	-	DRY	DRY	DRY	DRY														
	September	Construction	24/09/2014	11:22am	-	DRY	DRY	DRY	DRY														
	October	Construction	30/10/2014	9.21am	-	DRY	DRY	DRY	DRY														
	November	Construction	20/11/2014	8.35am	-	DRY	DRY	DRY	DRY	Insufficient sample available for lab tests													
	December	Construction	16/12/2014	1.30pm	-	DRY	DRY	DRY	DRY														
2015	January	Construction	15/01/2015	8.55am	-	DRY	DRY	DRY	DRY														
	February	Construction	24/02/2015	9.50am	-	DRY	DRY	DRY	DRY														
	March	Construction	23/03/2015	10.35am	-	DRY	DRY	DRY	DRY	Insufficient sample available for lab tests													
	April	Construction	27/04/2015	2.30pm	-	DRY	DRY	DRY	DRY														
	May	Construction	26/05/2015	10.50am	-	DRY	DRY	DRY	DRY														
	June	Construction	25/06/2015	11.00am	-	DRY	DRY	DRY	DRY														
	July	Construction	21/07/2015	11.10am	-	DRY	DRY	DRY	DRY	Insufficient sample available for lab tests													
	August	Construction	13/08/2015	10.55am	-	DRY	DRY	DRY	DRY														
	September	Construction	17/09/2015	10.30am	-	DRY	DRY	DRY	DRY														
	October	Construction	30/10/2015	8.00am	-	DRY	DRY	DRY	DRY	Insufficient sample available for lab tests													
	November	Construction	19/11/2015	9.15am	-	DRY	DRY	DRY	DRY														
	December	Construction	14/11/2015	3.30pm	-	DRY	DRY	DRY	DRY														
2016	January	Construction	28/01/2016	8.00am	-	DRY	DRY	DRY	DRY	Insufficient sample available for lab tests													
	February	Construction	20/02/2016	1.30 pm	-	DRY	DRY	DRY	DRY														
	March	Construction	11/03/2016	12.00 pm	-	DRY	DRY	DRY	DRY														
	April	Construction	28/04/2016	2.00 pm	-	DRY	DRY	DRY	DRY	Insufficient sample available for lab tests													
	May	Construction	31/05/2016	4.00 pm	-	DRY	DRY	DRY	DRY														
	June	Construction	27/06/2016	10.50 am	-	DRY	DRY	DRY	DRY														
	July	Construction	8/07/2016	5.00 pm	-	DRY	DRY	DRY	DRY	Insufficient sample available for lab tests													
	August	Construction	-	-	-																		

Monitoring Bore 72400.1 - control site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Silver (mg/L)	Aluminium (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Lead (mg/L)	Selenium (mg/L)	Zinc (mg/L)	Mercury (mg/L)	BTEX	Benzene (µg/L or ppb)	Toluene (µg/L or ppb)	Ethylbenzene (µg/L or ppb)	m+p-Xylene (µg/L or ppb)	o-Xylene (µg/L or ppb)	Naphthalene (µg/L or ppb)	Total Recoverable Hydrocarbons:	C6-C9 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb) LESS BTEX (F1)	C10-C14 Fraction (µg/L or ppb)	C15-C28 Fraction (µg/L or ppb)	C29-C36 Fraction (µg/L or ppb)	C10-C16 Fraction (µg/L or ppb)	C10-C16 less Naphthalene Fraction (µg/L or ppb)	C16-C34 Fraction (µg/L or ppb)	C34-C40 Fraction (µg/L or ppb)
2014	January	Pre construction	10/01/2014	10.02am	<0.001	0.078	0.001	<0.001	0.001	0.003	0.023	0.254	0.016	<0.001	<0.002	0.058	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	
	February	Construction	13/02/2014	11:06am																															
	March	Construction	31/03/2014	9:12am	<0.001	0.032	<0.001	<0.001	<0.001	0.001	0.018	0.388	0.017	<0.001	0.001	0.039	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	April	Construction	7/04/2014	9:52am																															
	May	Construction	29/05/2014	9:30am																															
	June	Construction	26/05/2014	10:18am																															
	July	Construction	31/07/2014	9.45am																															
	August	Construction	18/08/2014	10:28am																															
	September	Construction	24/09/2014	11:22am																															
	October	Construction	30/10/2014	9.21am																															
	November	Construction	20/11/2014	8.35am																															
	December	Construction	16/12/2014	1.30pm																															
2015	January	Construction	15/01/2015	8.55am																															
	February	Construction	24/02/2015	9.50am																															
	March	Construction	23/03/2015	10.35am																															
	April	Construction	27/04/2015	2.30pm																															
	May	Construction	26/05/2015	10.50am																															
	June	Construction	25/06/2015	11.00am																															
	July	Construction	21/07/2015	11.10am																															
	August	Construction	13/08/2015	10.55am																															
	September	Construction	17/09/2015	10.30am																															
	October	Construction	30/10/2015	8.00am																															
	November	Construction	19/11/2015	9.15am																															
	December	Construction	14/11/2015	3.30pm																															
2016	January	Construction	28/01/2016	8.00am																															
	February	Construction	20/02/2016	1.30 pm																															
	March	Construction	11/03/2016	12.00 pm																															
	April	Construction	28/04/2016	2.00 pm																															
	May	Construction	31/05/2016	4.00 pm																															
	June	Construction	27/06/2016	10.50 am																															
	July	Construction	8/07/2016	5.00 pm																															
	August	Construction	-	-																															

Monitoring Bore 72400.2 impact site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Compliance comments	Field Results: Depth to Water (m)	Temp (Celsius)	EC (us/cm)	pH	Lab Results Total Dissolved Solids (mg/L)	Bicarbonate (Alkalinity) (mg/L $CaCO_3$ equivalent)	Total Phosphorus (mg/L P)	Phosphate (mg/L P)	Total Nitrogen (mg/L N)	Nitrate (mg/L N)	Nitrite (mg/L N)	Ammonia (mg/L N)	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Chloride (mg/L)	Sulfate (mg/L SO_4^{2-})
2014	January	Pre construction	10/01/2014	11:10am	-	17.390	20	0.278	6	250.00	7.00	0.07	0.01	0.01	0.01	<0.001	0.01	54.70	0.55	0.65	1.82	70.70	21.03
	February	Construction	13/02/2014	12:10am	complies	17.410	21	0.275	6.2														
	March	Construction	31/03/2014	11:12am	Minor parameter fluctuation and well maintenance 31/03/2014	17.380	21.72	0.975	11.02	95		0.03	0.017	0.8	<0.005	0.531	0.099	54.3	17.6	95.2	2.4	106	105
					new bore installed																		
	April (new bore installed)	Construction	7/04/2014	10:15am	Minor parameter fluctuation	18.92	25.1	1.1	10.51														
	May	Construction	29/05/2014	2:30pm	Minor parameter fluctuation. EC within acceptable range	19.24	22.15	0.598	8.36														
	June	Construction	25/06/2014	12:22pm	Minor parameter fluctuation. EC within acceptable range	19.65	20.15	0.51	8.23														
	July	Construction	31/07/2014	11:15pm	Minor parameter fluctuation	19.47	21.78	0.652	7.73	88	164	0.06	0.049	0.72	0.476	0.006	0.023	74.4	6.5	49.8	9.5	102	32
	August	Construction	18/08/2014	12:50pm	Minor parameter fluctuation. EC within acceptable range	19.66	21	0.652	7.52														
	September	Construction	24/09/2014	12:35pm	Minor parameter fluctuation. EC within acceptable range	19.98	21.05	0.662	7.52														
	October	Construction	30/10/2014	10.32am	Minor parameter fluctuation. EC within acceptable range	19.95	21.3	0.647	7.01														
	November	Construction	20/11/2014	8.30am	Minor parameter fluctuation	19.97	21.6	0.644	7.26	650		0.43	0.205	0.33	0.117	0.003	0.074	184	3.2	25.5	18.6	194	59
	December	Construction	16/12/2014	11.35am	Minor parameter fluctuation. EC within acceptable range	19.93	21.6	1.03	6.47														
	January	Construction	15/01/2015	10.15am	Minor parameter fluctuation. EC within acceptable range	21.030	22.3	1.56	6.35														
	February	Construction	24/02/2015	10.55am	Minor parameter fluctuation. EC within acceptable range	20.890	22.1	1.56	6.21														

	March	Construction	23/03/2015	2.30pm	Minor parameter fluctuation. EC within acceptable range	20.050	21.8	1.46	6.45	Lab results taken but unable to be tested due to delivery time lapse. Resampled in April.													
	April	Construction	28/04/2015	10.30am	Minor parameter fluctuation.	19.05	20.24	0.968	6.53	587	150	0.22	0.064	0.397	0.116	0.005	0.075	147	5	33.8	17	184	46
	May	Construction	26/05/2015	11.2	Minor parameter fluctuation. EC within acceptable range	19.1	20.22	0.971	6.61														
	June	Construction	25/06/2015	9.23am	Minor parameter fluctuation. EC within acceptable range	18.83	18.69	1.03	6.77														
2015	July	Construction	21/07/2015	11.15am	Minor parameter fluctuation. EC within acceptable range	19.08	18.91	1.21	6.99	667	140	0.32	0.227	0.16	0.026	0	0.041	208	3.7	27.1	23.1	309	84
	August	Construction	13/08/2015	11.45am	Minor parameter fluctuation. EC within acceptable range	19.12	18.35	1.15	7.06														
	September	Construction	17/09/2015	11.15am	Minor parameter fluctuation. EC within acceptable range	19.21	18.88	1.18	7.25														
	October	Construction	30/10/2015	9.30am	Minor parameter fluctuation. EC within acceptable range	19.82	19.89	1.23	6.16	660	140	0.29	0.13	0.13	0.02	0.001	0.008	221.6	3.3	21.9	20.9	270	55
	November	Construction	19/11/2015	10.00am	Minor parameter fluctuation. EC within acceptable range	19.44	19.22	1.21	6.64														
	December	Construction	14/12/2015	4.10pm	Minor parameter fluctuation. EC within acceptable range	19.51	19.95	1.25	6.56														
	January	Construction	28/01/2016	8.30am	Minor parameter fluctuation. EC within acceptable range	19.74	20.65	1.86	7.34	105	50	0.03	0.009	0.19	0.016	0.002	0.031	36.6	0.7	5	6.9	54	6
	February	Construction	19/02/2016	5.10 pm	Minor parameter fluctuation. EC within acceptable range	19.52	22.51	1.26	6.25														
2016	March	Construction	11/03/2016	10.30am	Minor parameter fluctuation. EC within acceptable range	21.95	20.82	1.27	6.82														

April	Construction	2/05/2016	1.00 pm	Minor parameter fluctuation	22.19	22.19	1.29	6.16	791.7	105	0.365	0.173	0.141	0.021	<0.005	0.006	184	2.18	13.8	17.8	236	38.4
May	Construction	31/05/2016	4.30 pm	Minor parameter fluctuation	22.12	21.61	1.79	7.22														
June	Construction	27/05/2016	11.10 am	Minor parameter fluctuation	20.27	19.79	1.38	6.94														
July	Construction	8/07/2016	4.30 pm	Minor parameter fluctuation	20.32	19.75	1.01	6.04	587	108	0.223	0.115	0.053	0.013	<0.005	<0.005	178	1.8	14.2	0.37	213	42.6
August	Construction	-	-	-																		

Monitoring Bore 72400.2 impact site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Silver (mg/L)	Aluminium (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Lead (mg/L)	Selenium (mg/L)	Zinc (mg/L)	Mercury (mg/L)	BTEX	Benzene (µg/L or ppb)	Toluene (µg/L or ppb)	Ethylbenzene (µg/L or ppb)	m+p-Xylene (µg/L or ppb)	o-Xylene (µg/L or ppb)	Naphthalene (µg/L or ppb)	Total Recoverable Hydrocarbons:	C6-C9 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb) LESS BTEX (F1)	C10-C14 Fraction (µg/L or ppb)	C15-C28 Fraction (µg/L or ppb)	C29-C36 Fraction (µg/L or ppb)	C10-C16 Fraction (µg/L or ppb)	C10-C16 less Naphthalene Fraction (µg/L or ppb)	C16-C34 Fraction (µg/L or ppb)	C34-C40 Fraction (µg/L or ppb)
2014	January	Pre construction	10/01/2014	11:10am	<0.001	0.751	0.003	<0.001	0.001	0.004	1.615	0.184	0.005	0.001	<0.002	0.031	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	February	Construction	13/02/2014	12:10am	<0.001	0.103	0.002	<0.001	<0.001	0.003	0.406	0.178	0.005	<0.001	<0.002	0.029	<0.0005																			
	March	Construction	31/03/2014	11:12am	<0.001	0.124	0.001	<0.001	0.019	0.002	0.004	0.001	0.001	<0.001	0.001	0.001	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	April (new bore installed)	Construction	7/04/2014	10:15am																															
	May	Construction	29/05/2014	2:30pm																															
	June	Construction	25/06/2014	12:22pm																															
	July	Construction	31/07/2014	11:15pm	<0.001	0.042	0.002	<0.001	0.001	0.005	0.228	0.007	0.01	<0.001	<0.002	0.005	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	August	Construction	18/08/2014	12:50pm																															
	September	Construction	24/09/2014	12:35pm																															
	October	Construction	30/10/2014	10.32am																															
	November	Construction	20/11/2014	8.30am	<0.001	1.651	0.006	<0.001	0.006	0.016	1.728	0.448	0.058	0.004	<0.002	0.109	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	December	Construction	16/12/2014	11.35am																															
2015	January	Construction	15/01/2015	10.15am																															
	February	Construction	24/02/2015	10.55am																															
	March	Construction	23/03/2015	2.30pm																															
	April	Construction	28/04/2015	10.30am	<0.001	0.012	0.004	<0.001	0.001	0.001	0.429	0.488	0.032	<0.001	<0.001	0.047	<0.0005		<1	<1	<1	<2	<1	1		<10	<10	<10	<50	<100	<100	<100		<100	<100
	May	Construction	26/05/2015	11.2																															
	June	Construction	25/06/2015	9.23am																															
	July	Construction	21/07/2015	11.15am	<0.001	0.019	0.005	<0.001	0.001	0.001	0.825	0.703	0.047	0.001	0.001	0.046	<0.0005		<1	<1	<1	<2	<1	1		<10	<10	<10	<50	<100	<100	<100		<100	<100
	August	Construction	13/08/2015	11.45am																															
	September	Construction	17/09/2015	11.15am																															

	October	Construction	30/10/2015	9.30am	<0.001	0.006	0.002	<0.001	0.001	0.001	0.009	0.523	0.05	0.001	<0.001	0.047	<0.0005		<1	<1	<1	<2	<1	1		<10	<10	<10	<50	<100	<100	<100		<100	<100
	November	Construction	19/11/2015	10.00am																															
	December	Construction	14/12/2015	4.10pm																															
2016	January	Construction	28/01/2016	8.30am	<0.001	0.005	<0.001	<0.001	<0.001	0.001	0.001	0.018	0.002	<0.001	<0.001	0.008	<0.0007		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	February	Construction	19/02/2016	5.10 pm																															
	March	Construction	11/03/2016	10.30am																															
	April	Construction	2/05/2016	1.00 pm	<0.001	0.008	0.002	<0.001	<0.001	0.001	0.004	0.436	0.046	<0.001	<0.005	0.041	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	May	Construction	31/05/2016	4.30 pm																															
	June	Construction	27/05/2016	11.10 am																															
	July	Construction	8/07/2016	4.30 pm	<0.001	0.011	0.002	<0.001	<0.001	0.002	0.006	16.4	0.042	<0.001	<0.005	0.042	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	August	Construction	-	-																															

Appendix D – Chainage 74300 Raw Data

Monitoring Bore 74300.1 - control site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Compliance comments	Field Results: Depth to Water (m)	Temp (Celsius)	EC (us/cm)	pH	**Lab Results** Total Dissolved Solids (mg/L)	Bicarbonate (Alkalinity) (mg/L $CaCO_3$ **equivalent)**	Total Phosphorus (mg/L P)	Phosphate (mg/L P)	Total Nitrogen (mg/L N)	Nitrate (mg/L N)	Nitrite (mg/L N)	Ammonia (mg/L N)	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Chloride (mg/L)	Sulfate (mg/L SO_4^{2-})
	January	Pre construction	10/01/2014	11:48am	-	10.900	21	1.11	6.72	700	313	0.03	0.008	0.35	0.084	0.018	0.133	103.0	1.8	129.0	16.2	187	16
	February	Construction	13/02/2014	12:52pm	complies	10.900	21	1.11	6.69														
	March	Construction	31/03/2014	11:45am	low level of hydrocarbon detection in March 14. Cause unknown. Well maintenance 31/03/2014	10.9	20.91	4.931	11.7	99		0.05	0.011	3.16	0.024	0.004	2.219	204	144	345	0.3	84	212
					new bore installed																		
	April (new bore installed)	Construction	7/04/2014	10:46am	Minor parameter fluctuation	24.400	23.39	5.47	12														
	May	Construction	29/05/2014	3:00pm	Minor parameter fluctuation	24.50	22.6	3.8	8.9														
	June	Construction	25/06/2014	2:12pm	Minor parameter fluctuation. EC within acceptable range	24.9	20.36	3.1	7.99														
	July	Construction	31/07/2014	1:55pm	low level of hydrocarbon detection in July 14. Cause unknown	27.02	19.25	4.27	8.34	12	517	0.02	0.006	2.72	0.006	0.021	2.404	246	102	207	0	40	110
	August	Construction	18/08/2014	12:22pm	Minor parameter fluctuation. EC within acceptable range	26.99	20.36	4.27	8.24														
	September	Construction	24/09/2014	1:28pm	Minor parameter fluctuation. EC within acceptable range	27.06	20.7	3.02	8.19														
	October	Construction	30/10/2014	3.00pm	Minor parameter fluctuation. EC within acceptable range	27.02	21.3	2.66	7.89														
	November	Construction	20/11/2014	11.36am	*Sample contaminated during collection - retest completed by lab showed all clear (refer to 15/0674 LEND LEASE)	27.09	22	2.36	7.74	1075		0.06	<0.005	3.33	0.008	0.001	2.934	238	82.2	131	0.1	29	105
2014	December	Construction	16/12/2014	3.10pm	Minor parameter fluctuation	26.99	21	3.25	8.96	ling equipment, refer to 15/0674 - LEND LEASE. Lab results all clear													

2015	January	Construction	15/01/2015	12.35pm	Minor parameter fluctuation. EC within acceptable range	25.360	21.5	2.96	8.32														
	February	Construction	24/02/2015	1.30pm	Minor parameter fluctuation. EC within acceptable range	25.010	21	2.96	8.16														
	March	Construction	23/03/2015	10.00am	Minor parameter fluctuation. EC within acceptable range	25.03	21.6	2.78	8.03	ed due to delivery time lapse. Resampled in April.													
	April	Construction	28/04/2015	12.00pm	Minor parameter fluctuation. Slightly Elevated BTEX and TRH results. No construction impacts noted.	30.700	19.03	4.71	8.25	1200	1100	0.031	0.002	3.75	0.013	0.002	2.847	282	70.5	201	0.00	90	76
	May	Construction	26/05/2015	12.22pm	Minor parameter fluctuation. EC within acceptable range	29.90	19.9	4.21	8.8														
	June	Construction	25/06/2015	11.14am	Minor parameter fluctuation. EC within acceptable range	31.5	20.33	4.22	8.4														
	July	Construction	21/07/2015	11.30am	Minor parameter fluctuation. Slightly Elevated BTEX and TRH results. No construction impacts noted.	32.1	19.19	4.05	8.02	380	190	0.28	0.06	1.61	0.173	0.173	0.042	68.8	4.7	57.2	5.8	78	71
	August	Construction	13/08/2015	12.20pm	Minor parameter fluctuation. EC within acceptable range	33.5	19.02	3.76	7.89														
	September	Construction	17/09/2015	12.55pm	Minor parameter fluctuation. EC within acceptable range	33.32	18.96	3.35	7.64														
	October	Construction	30/10/2015	12.30pm	pH above P80 value of 6.9 and slightly above EPL limit of 8.5. EC also slightly above P80 value of 1.2 but within acceptable range. Minor parameter fluctuation on lab parameters.	36.7	22.7	2.95	8.56	860	<1	0.04	0.03	4.4	0.012	0.006	4.103	264	58.2	62.9	0.1	44	60

	November	Construction	19/11/2015	10.45am	Minor parameter fluctuation. EC within acceptable range	36.1	21.25	2.87	8.01														
	December	Construction	14/12/2015	4.55pm	Minor parameter fluctuation. EC within acceptable range	36.4	21.22	2.78	8.1														
2016	January	Construction	28/01/2016	5.00pm	Minor parameter fluctuation for EC. Unknown reason for high pH recorded.	30.52	21.39	2.68	12.04	867	<1	0.08	0.017	4.56	0.162	0.035	2.748	268	51	44.4	0.1	48	73
	February	Construction	19/02/2016	12.25 pm	Minor parameter fluctuation for EC. Unknown reason for high pH recorded.	32.9	22.04	2.71	12.09														
	March	Construction	11/03/2016	9.20 pm	-	DRY	DRY	DRY	DRY														
	April	Construction	28/04/2016	11.30am	-	DRY	DRY	DRY	DRY	Insufficient sample available for lab tests													
	May	Construction	31/05/2016	8.20 am	-	DRY	DRY	DRY	DRY														
	June	Construction	27/06/2016	11.50 am	-	DRY	DRY	DRY	DRY														
	July	Construction	8/07/2016	8.00 am	-	DRY	DRY	DRY	DRY	Insufficient sample available for lab tests													
	August	Construction	-	-	-	-	-	-	-														

Monitoring Bore 74300.1 control site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Silver (mg/L)	Aluminium (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Lead (mg/L)	Selenium (mg/L)	Zinc (mg/L)	Mercury (mg/L)	BTEX	Benzene (µg/L or ppb)	Toluene (µg/L or ppb)	Ethylbenzene (µg/L or ppb)	m+p-Xylene (µg/L or ppb)	o-Xylene (µg/L or ppb)	Naphthalene (µg/L or ppb)	Total Recoverable Hydrocarbons:	C6-C9 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb) LESS BTEX (F1)	C10-C14 Fraction (µg/L or ppb)	C15-C28 Fraction (µg/L or ppb)	C29-C36 Fraction (µg/L or ppb)	C10-C16 Fraction (µg/L or ppb)	C10-C16 less Naphthalene Fraction (µg/L or ppb)	C16-C34 Fraction (µg/L or ppb)	C34-C40 Fraction (µg/L or ppb)
	January	Pre construction	10/01/2014	11:48am	<0.001	0.007	0.005	<0.001	<0.001	<0.001	0.015	1.903	0.001	<0.001	<0.002	0.019	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	February	Construction	13/02/2014	12:52pm																															
	March	Construction	31/03/2014	11:45am	<0.001	0.197	0.002	<0.001	0.012	0.012	0.068	0.001	0.007	0.001	0.002	0.017	<0.0005		<1	<1	<1	<2	1	1		11	17	16	120	<100	<100	140	<50	<100	<100
	April (new bore installed)	Construction	7/04/2014	10:46am																															
	May	Construction	29/05/2014	3:00pm																															
	June	Construction	25/06/2014	2:12pm																															
	July	Construction	31/07/2014	1:55pm	<0.001	0.445	0.002	<0.001	0.001	0.005	0.032	<0.001	0.008	0.001	0.001	0.007	<0.0005		<1	<1	<1	<2	<1	1		<10	17	17	76	<100	<100	85	84	<100	<100
	August	Construction	18/08/2014	12:22pm																															
	September	Construction	24/09/2014	1:28pm																															
	October	Construction	30/10/2014	3.00pm																															
	November	Construction	20/11/2014	11.36am	<0.001	0.859	0.002	<0.001	0.001	0.004	0.178	0.006	0.009	0.003	<0.002	0.071	<0.0005		<1	<1	<1	<2	<1	1		<10	<10	<10	62*	<100	<100	69*		<100	<100
2014	December	Construction	16/12/2014	3.10pm															<1	<1	<1	<2	<1	1		<25	<25	<25	<25	<100	<100	<25		<100	<100
	January	Construction	15/01/2015	12.35pm																															
	February	Construction	24/02/2015	1.30pm																															
	March	Construction	23/03/2015	10.00am																															
	April	Construction	28/04/2015	12.00pm	<0.001	0.628	0.002	<0.001	<0.001	0.002	0.03	<0.001	0.012	0.001	<0.005	0.002	<0.0005		<1	<1	<1	<2	<1	1		<10	11	11	56	<100	<100	58		<100	<100
	May	Construction	26/05/2015	12.22pm																															
	June	Construction	25/06/2015	11.14am																															

2015	July	Construction	21/07/2015	11.30am	<0.001	0.15	0.001	<0.001	<0.001	0.008	0.361	0.114	0.001	0.014	<0.001	0.182	<0.0005		<1	<1	<1	<2	<1	1		10	10	10	55	<100	<100	64		<100	<100
	August	Construction	13/08/2015	12.20pm																															
	September	Construction	17/09/2015	12.55pm																															
	October	Construction	30/10/2015	12.30pm	<0.001	1.397	0.008	<0.001	<0.001	0.002	0.031	<0.001	0.014	<0.001	<0.001	0.002	<0.0005		<1	<1	<1	<2	<1	1		10	10	10	50	<100	<100	50		<100	<100
	November	Construction	19/11/2015	10.45am																															
	December	Construction	14/12/2015	4.55pm																															
2016	January	Construction	28/01/2016	5.00pm	<0.001	2.072	0.002	<0.001	<0.001	0.004	0.101	<0.001	0.013	0.001	0.001	0.007	<0.0009		<1	<1	<1	<2	<1	<1		<10	<10	<10	110	260	<100	180		190	<100
	February	Construction	19/02/2016	12.25 pm																															
	March	Construction	11/03/2016	9.20 pm																															
	April	Construction	28/04/2016	11.30am																															
	May	Construction	31/05/2016	8.20 am																															
	June	Construction	27/06/2016	11.50 am																															
	July	Construction	8/07/2016	8.00 am																															
	August	Construction	-	-																															

Monitoring Bore 74300.2 - impact site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Compliance comments	Field Results: Depth to Water (m)	Temp (Celsius)	EC (us/cm)	pH	**Lab Results** Total Dissolved Solids (mg/L)	Bicarbonate (Alkalinity) (mg/L $CaCO_3$ **equivalent)**	Total Phosphorus (mg/L P)	Phosphate (mg/L P)	Total Nitrogen (mg/L N)	Nitrate (mg/L N)	Nitrite (mg/L N)	Ammonia (mg/L N)	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Chloride (mg/L)	Sulfate (mg/L SO_4^{2-})
	January	Pre construction	10/01/2014	12:25pm	-	13.790	22.5	1.32	6.25	850	108	0.07	0.013	0.11	0.035	0.008	0.023	252.0	2.4	19.8	28.1	272	200
	February	Construction	13/02/2014	1:29pm	complies	13.820	20.06	1.41	6.33														
	March	Construction	31/03/2014	12:55	Minor parameter fluctuation	13.820	20.33	1.41	11.35	134		0.08	<0.005	0.74	0.007	<0.001	0.432	88.8	56.6	75.6	1.4	129	89
					new bore installed																		
	April ((new bore installed))	Construction	7/04/2014	11:18am	Minor parameter fluctuation	24.40	23.39	5.47	12														
	May	Construction	29/05/2014	1215pm	Minor parameter fluctuation	24.6	23	2.61	8.8														
	June	Construction	25/06/2014	1:10pm	Minor parameter fluctuation. EC within acceptable range	24.8	20.15	2.11	7.36														
	July	Construction	31/07/2014	11:18am	Minor parameter fluctuation. Also low level of hydrocarbon detection in July 14. Cause unknown.	29.07	19.67	1.54	8.47	133	250	0.07	0.019	1.84	0.02	0.011	1.565	212	44.8	95.2	3	310	195
	August	Construction	18/08/2014	1:33pm	complies	27.03	21.3	1.54	8.1														
	September	Construction	24/09/2014	2:02pm	complies	27.31	21.4	1.43	8.01														
	October	Construction	30/10/2014	11.45am	complies	27.49	21.56	1.32	7.87														
	November	Construction	20/11/2014	8.00am	Minor parameter fluctuation. *Sample contaminated during collection - retest completed by lab showed all clear (refer to 15/0674 LEND LEASE)	27.65	21.03	1.39	7.88	945		0.12	0.045	1.64	0.029	0.001	1.521	220	33.7	84.8	5.9	243	203
2014	December	Construction	16/12/2014	7.25am	complies	27.01	21.9	1.44	7.63	Retest of BTEX and TRH following contamination of sampling equipment. Lab results all clear, refer to 15/0674 - LEND LEASE													
	January	Construction	15/01/2015	8.35am	complies	27.000	21.4	1.35	7.36														
	February	Construction	24/02/2015	11.15am	complies	26.050	21.6	1.35	7														
	March	Construction	23/03/2015	4.50pm	complies	26.000	21	1.51	7.22	Lab results taken but unable to be tested due to delivery time lapse. Resampled in April.													
	April	Construction	27/04/2015	9.15am	Minor parameter fluctuation	27.00	20.63	0.217	6.7	133	50	0.086	0.005	0.546	0.08	0.005	0.046	17	3.2	18.5	2.3	27	10
	May	Construction	26/05/2015	1.10pm	complies	27.2	19.5	0.215	6.8														
	June	Construction	25/06/2015	11.25am	complies	28.1	20.01	0.282	6.76														
2015	July	Construction	21/07/2015	3.00pm	Minor parameter fluctuations	33.16	18.5	0.627	7.47	1147	0	0.06	0.01	3.74	0.022	0.025	2.651	297	67.1	128	0	62	172
	August	Construction	13/08/2015	1.15pm	Complies	33.75	18.12	0.561	7.25														
	September	Construction	17/09/2015	2.30pm	Complies	33.55	18.78	0.552	7.48														
	October	Construction	30/10/2015	3.00pm	Minor parameter fluctuations	35.04	21.71	1.19	7.46	690	140	0.009	0.33	0.26	0.045	0.004	0.1	167.8	6.4	72.6	13.1	161	83

	November	Construction	19/11/2015	12.10pm	Complies	35.1	21.55	1.12	7.41													
	December	Construction	14/12/2015	5.25pm	Complies	35.21	21.41	1.1	7.36													
2016	January	Construction	28/01/2016	2.45pm	Minor parameter fluctuations	34.45	22.99	1.26	7.05	1,140	295	0.04	0.016	0.39	0.024	0.003	0.246	206	5.2	148	44.6	216	372
	February	Construction	22/02/2016	8.10 am	Minor parameter fluctuations	35.38	20.4	2.29	6.77													
	March	Construction	11/03/2016	1.00pm	Minor parameter fluctuations	35.83	23.56	2.2	6.73													
	April	Construction	28/04/2016	10.30 am	Minor parameter fluctuations	34.4	20.24	1.93	7.27	1483.3	370	0.022	0.015	0.497	0.078	<0.005	0.37	219	5.09	134	37.8	285	162.6
	May	Construction	31/05/2016	7.45 am	Minor parameter fluctuations	35.1	22.49	2.19	7.02													
	June	Construction	27/06/2016	1.10 pm	complies	35.17	20.34	1.73	7.34													
	July	Construction	8/07/2016	8.45 am	Minor parameter fluctuations	34.28	18.7	1.84	7.36	800	350	0.02	0.006	0.498	0.443	<0.005	<0.005	186	4.8	100	0.32	213	51.3
	August	Construction	-	-	-																	

Monitoring Bore 74300.2 - impact site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Silver (mg/L)	Aluminium (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Lead (mg/L)	Selenium (mg/L)	Zinc (mg/L)	Mercury (mg/L)	BTEX	Benzene (µg/L or ppb)	Toluene (µg/L or ppb)	Ethylbenzene (µg/L or ppb)	m+p-Xylene (µg/L or ppb)	o-Xylene (µg/L or ppb)	Naphthalene (µg/L or ppb)	Total Recoverable Hydrocarbons	C6-C9 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb) LESS BTEX (F1)	C10-C14 Fraction (µg/L or ppb)	C15-C28 Fraction (µg/L or ppb)	C29-C36 Fraction (µg/L or ppb)	C10-C16 Fraction (µg/L or ppb)	C10-C16 less Naphthalene Fraction (µg/L or ppb)	C16-C34 Fraction (µg/L or ppb)	C34-C40 Fraction (µg/L or ppb)
	January	Pre construction	10/01/2014	12:25pm	<0.001	0.052	0.003	<0.001	<0.001	0.002	0.027	0.345	0.010	<0.001	<0.002	0.050	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	February	Construction	13/02/2014	1:29pm																															
	March	Construction	31/03/2014	12:55	<0.001	0.457	0.001	<0.001	0.001	0.004	0.007	0.001	0.001	<0.001	0.002	0.003	<0.0005		<1	<1	<1	<2	<1	3		<10	<10	<10	<50	<100	<100	52	<50	<100	<100
	April ((new bore installed))	Construction	7/04/2014	11:18am																															
	May	Construction	29/05/2014	1215pm																															
	June	Construction	25/06/2014	1:10pm																															
	July	Construction	31/07/2014	11:18am	<0.001	0.008	0.001	<0.001	<0.001	0.001	0.004	0.018	0.002	<0.001	<0.002	0.007	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	230	<100	68	68	210	<100
	August	Construction	18/08/2014	1:33pm																															
	September	Construction	24/09/2014	2:02pm																															
	October	Construction	30/10/2014	11.45am																															
	November	Construction	20/11/2014	8.00am	<0.001	0.163	0.001	<0.001	0.001	0.002	0.5	0.132	0.002	0.002	<0.002	0.035	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	53*	160*	<100	79*		190*	<100
2014	December	Construction	16/12/2014	7.25am															<1	<1	<1	<2	<1	1		<25	<25	<25	<25	<100	<100	<25		<100	<100
	January	Construction	15/01/2015	8.35am																															
	February	Construction	24/02/2015	11.15am																															
	March	Construction	23/03/2015	4.50pm																															
	April	Construction	27/04/2015	9.15am	<0.001	0.845	0.002	<0.001	0.002	0.01	0.572	0.043	0.003	0.004	0.001	0.109	<0.0005		<1	<1	<1	<2	<1	1		<25	<25	<25	<25	<100	<100	<25		<100	<100
	May	Construction	26/05/2015	1.10pm																															
	June	Construction	25/06/2015	11.25am																															
2015	July	Construction	21/07/2015	3.00pm	<0.001	0.815	0.003	<0.001	<0.001	0.003	0.013	<0.001	0.014	0.001	0.004	0.004	<0.0005		<1	<1	<1	<2	<1	1		<10	<10	<10	<50	100	<100	50		100	<100
	August	Construction	13/08/2015	1.15pm																															
	September	Construction	17/09/2015	2.30pm																															
	October	Construction	30/10/2015	3.00pm	<0.001	0.016	<0.001	<0.001	<0.001	0.002	0.078	0.318	0.005	<0.001	<0.001	0.021	<0.0005		<1	<1	<1	<2	<1	1		<10	<10	<10	<50	100	<100	50		100	<100
	November	Construction	19/11/2015	12.10pm																															
	December	Construction	14/12/2015	5.25pm																															
	January	Construction	28/01/2016	2.45pm	<0.001	0.005	<0.001	<0.001	<0.001	<0.001	0.019	2.188	0.148	<0.001	<0.001	0.423	<0.0010		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	February	Construction	22/02/2016	8.10 am																															
	March	Construction	11/03/2016	1.00pm																															
2016	April	Construction	28/04/2016	10.30 am	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.004	1.472	0.019	<0.001	<0.005	0.023	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	May	Construction	31/05/2016	7.45 am																															
	June	Construction	27/06/2016	1.10 pm																															
	July	Construction	8/07/2016	8.45 am	<0.001	<0.005	<0.001	<0.001	<0.001	0.002	<0.005	20	0.014	<0.001	<0.005	0.31	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	August	Construction	-	-																															

Appendix E – Chainage 75500 Raw Data

Monitoring Bore 75500.1 - control site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Compliance comments	Field Results: Depth to Water (m)	Temp (Celsius)	EC (us/cm)	pH	Lab Results Total Dissolved Solids (mg/L)	Bicarbonate (Alkalinity) (mg/L $CaCO_3$ equivalent)	Total Phosphorus (mg/L P)	Phosphate (mg/L P)	Total Nitrogen (mg/L N)	Nitrate (mg/L N)	Nitrite (mg/L N)	Ammonia (mg/L N)	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Chloride (mg/L)	Sulfate (mg/L SO_4^{2-})
	January	Pre construction	10/01/2014	1:08pm	-	6.870	22	0.958	5.41	750	13	0.02	0.006	0.26	0.011	0.001	0.113	207.0	1.9	1.9	19.6	337	26
	February	Construction	13/02/2014	2:21pm	complies	6.900	20.3	0.96	5.41														
	March	Construction	31/03/2014	1:30pm	Minor parameter fluctuation. Also low level of hydrocarbon detection in March 14. Cause unknown	6.900	20.3	0.96	11.3	129		0.08	<0.001	0.76	0.007	0.002	0.42	85.4	52.9	74.9	1.2	122	82
					new bore installed																		
	April (new bore installed)	Construction	07/04/2014	12:00pm	Minor parameter fluctuation. pH anomaly	9.440	23.1	1.36	11.71														
	May	Construction	29/05/2014	3:40pm	Minor parameter fluctuation.	9.390	22.41	1.34	8.78														
	June	Construction	25/06/2014	2:55pm	Minor parameter fluctuation.	9.46	20.32	1.25	8.01														
	July	Construction	31/07/2014	3:14pm	Minor parameter fluctuation. pH anomaly. Also low level of hydrocarbon detection in July 14. Cause unknown	10.9	19.95	1.1	8.53	96	101	0.04	0.028	0.82	0.009	0.002	0.558	105	52.7	38.7	1	110	49
	August	Construction	18/08/2014	1:35pm	complies	10.99	20.05	1.1	7.9														
	September	Construction	24/09/2014	1:12pm	complies	11.01	20.3	1.32	7.8														
	October	Construction	30/10/2014	12.15pm	complies	11.06	21.3	1.22	7.65														
	November	Construction	20/11/2014	2.36pm	Minor parameter fluctuation.	11.07	20.9	1.15	7.78	440		0.07	0.024	0.9	<0.005	0.001	0.647	114	49.2	18.1	0.6	123	64
2014	December	Construction	16/12/2014	2.00pm	Minor parameter fluctuation.	11	21.03	0.9	8.85														
	January	Construction	15/01/2015	3.30pm	complies	10.850	22.36	0.98	8.32														
	February	Construction	24/02/2015	11.20am	complies	10.150	21.99	0.98	8.24														
	March	Construction	23/03/2015	10.10am	complies	10.020	21.5	0.95	8.01	ed due to delivery time lapse. Resampled in April													

2015	April	Construction	27/04/2015	1.30pm	Minor parameter fluctuation.	7.030	19.81	0.733	7.99	407	120	0.116	0.042	0.485	<0.005	0.006	0.097	105	17.5	30.5	5.7	129	23
	May	Construction	26/05/2015	2.10pm	complies	7.100	19.9	0.719	8.05														
	June	Construction	25/06/2015	12.12pm	complies	7.05	19.4	0.681	7.81														
	July	Construction	21./07/2015	12.10pm	pH slightly elevated - minor parameter fluctuations	7.4	19.23	0.786	8.52	453	145	0.12	0.081	0.44	0.165	0.016	0.075	112	19.8	28.3	5.7	144	49
	August	Construction	13/08/2015	1.55pm	complies	7.25	18.42	0.698	8.34														
	September	Construction	17/09/2015	3.25pm	complies	7.36	18.71	0.664	8.46														
	October	Construction	30/10/2015	1.20pm	Minor parameter fluctuation.	9.78	21.59	0.844	8.21	520	160	0.12	0.049	0.47	0.129	0.013	0.139	132.2	15.8	41.1	7.6	154	29
	November	Construction	19/11/2015	1.40pm	complies	9.65	21.35	0.759	8.15														
	December	Construction	15/12/2015	9.00am	complies	9.7	21.24	0.699	8.05														
2016	January	Construction	28/01/2016	4.00pm	Minor parameter Fluctuation.	10.3	22.45	0.887	7.25	520	114	0.079	0.023	0.26	0.014	0.003	0.05	151	10	24.8	10.3	186	31.5
	February	Construction	20/02/2016	2.45 pm	Complies	10.67	23.37	1.05	6.21														
	March	Construction	11/03/2016	9.50 am	Complies	10.13	21.32	1.03	6.92														
	April	Construction	28/04/2016	2.30 pm	Minor parameter fluctuations	12.14	23.02	1.07	6.06	683.3	65	0.156	0.024	0.247	0.005	<0.005	0.149	185	2.32	6.66	14.7	254	36
	May	Construction	31/05/2016	9.00 am	Complies	12.2	21.37	1.07	6.19														
	June	Construction	27/06/2016	2.10 pm	Complies	11.65	20.87	1.23	6.72														
	July	Construction	8/07/2016	10.00 am	Minor parameter fluctuations	12.04	19.89	0.071	5.97	460	60	0.193	0.036	0.086	0.005	<0.005	0.017	145	1.3	4.3	0.15	180	28.8
	August	Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Monitoring Bore 75500.1 - control site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Silver (mg/L)	Aluminium (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Lead (mg/L)	Selenium (mg/L)	Zinc (mg/L)	Mercury (mg/L)	BTEX	Benzene (µg/L or ppb)	Toluene (µg/L or ppb)	Ethylbenzene (µg/L or ppb)	m+p-Xylene (µg/L or ppb)	o-Xylene (µg/L or ppb)	Naphthalene (µg/L or ppb)	Total Recoverable Hydrocarbons:	C6- C9 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb) LESS BTEX (F1)	C10-C14 Fraction (µg/L or ppb)	C15-C28 Fraction (µg/L or ppb)	C29- C36 Fraction (µg/L or ppb)	C10-C16 Fraction (µg/L or ppb)	C10-C16 less Naphthalene Fraction (µg/L or ppb)	C16-C34 Fraction (µg/L or ppb)	C34-C40 Fraction (µg/L or ppb)
	January	Pre construction	10/01/2014	1:08pm	<0.001	0.518	0.001	<0.001	0.001	0.047	0.096	0.094	0.016	0.005	<0.002	0.231	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50			
	February	Construction	13/02/2014	2:21pm																															
	March	Construction	31/03/2014	1:30pm	<0.001	0.531	0.001	<0.001	0.001	0.004	0.007	0.001	0.001	<0.001	0.002	0.003	<0.0005		<1	<1	<1	<2	<1	4		17	19	19	53	<100	<100	53		<100	<100
	April (new bore installed)	Construction	07/04/2014	12:00pm																															
	May	Construction	29/05/2014	3:40pm																															
	June	Construction	25/06/2014	2:55pm																															
	July	Construction	31/07/2014	3:14pm	<0.001	0.064	0.001	<0.001	0.001	0.002	0.004	<0.001	0.001	<0.001	<0.002	0.002	<0.0005		<1	<1	<1	<2	<1	2		<10	<10	<10	<50	<100	<100	<50		<100	<100
	August	Construction	18/08/2014	1:35pm																															
	September	Construction	24/09/2014	1:12pm																															
	October	Construction	30/10/2014	12.15pm																															
	November	Construction	20/11/2014	2.36pm	<0.001	0.238	0.001	0.001	<0.001	0.004	0.004	0.346	0.014	0.003	<0.002	0.053	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
2014	December	Construction	16/12/2014	2.00pm																															
	January	Construction	15/01/2015	3.30pm																															
	February	Construction	24/02/2015	11.20am																															
	March	Construction	23/03/2015	10.10am																															
	April	Construction	27/04/2015	1.30pm	<0.001	0.218	0.003	<0.001	0.004	0.003	0.985	0.069	5	0.001	<0.001	0.014	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	May	Construction	26/05/2015	2.10pm																															
	June	Construction	25/06/2015	12.12pm																															
2015	July	Construction	21./07/2015	12.10pm	<0.001	0.191	0.003	<0.001	0.001	0.003	0.791	0.038	0.004	0.001	0.002	0.007	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	August	Construction	13/08/2015	1.55pm																															
	September	Construction	17/09/2015	3.25pm																															
	October	Construction	30/10/2015	1.20pm	<0.001	0.108	0.003	<0.001	0.003	0.002	1.276	0.86	0.005	0.001	0.001	0.007	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	November	Construction	19/11/2015	1.40pm																															
	December	Construction	15/12/2015	9.00am																															
	January	Construction	28/01/2016	4.00pm	<0.001	0.069	0.001	<0.001	0.002	0.002	0.439	0.112	0.007	<0.001	<0.001	0.029	<0.0011		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	February	Construction	20/02/2016	2.45 pm																															
	March	Construction	11/03/2016	9.50 am																															
2016	April	Construction	28/04/2016	2.30 pm	<0.001	0.04	<0.001	<0.001	<0.001	0.001	0.022	0.178	0.009	<0.001	<0.005	0.041	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	May	Construction	31/05/2016	9.00 am																															
	June	Construction	27/06/2016	2.10 pm																															
	July	Construction	8/07/2016	10.00 am	<0.001	0.12	0.003	<0.001	<0.001	0.003	0.85	10.2	0.007	<0.001	<0.005	0.085	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	August	Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix F – Chainage 78500 Raw Data

Monitoring Bore 78500.1 - control site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Compliance comments	Field Results: Depth to Water (m)	Temp (Celsius)	EC (us/cm)	pH	Lab Results Total Dissolved Solids (mg/L)	Bicarbonate (Alkalinity) (mg/L $CaCO_3$ equivalent)	Total Phosphorus (mg/L P)	Phosphate (mg/L P)	Total Nitrogen (mg/L N)	Nitrate (mg/L N)	Nitrite (mg/L N)	Ammonia (mg/L N)	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Chloride (mg/L)	Sulfate (mg/L SO_4^{2-})
	January	Pre construction	10/01/2014	2:00pm	-	15.210	20.4	2.2	5.82	1,800	90	1.27	1.002	0.28	0.175	0.003	0.053	618.0	2.0	3.7	39.4	709	399
	February	Construction	13/02/2013	1:55pm	Minor parameter fluctuation. pH within acceptable range	15.200	21.6	2.22	5.8														
	March	Construction	31/03/2014	2:45pm	Minor parameter fluctuation. pH within acceptable range	15.200	21.4	2.22	5.8	1700		0.28	0.011	1.9	0.007	0.01	0.177	24.6	1.3	3.5	2	22	27
	April	Construction	07/04/2014	12:59pm	complies	15.200	20.35	0.18	6.49														
	May	Construction	29/05/2014	4:00pm	complies	15.210	20.21	0.62	6.76														
	June	Construction	25/06/2014	3:30pm	complies	15.45	19.12	0.7	6.32														
	July	Construction	31/07/2014	2:25pm	-	DRY	DRY	DRY	DRY	Insufficient sample for lab test													
	August	Construction	18/08/2014	4:10pm	-	DRY	DRY	DRY	DRY														
	September	Construction	24/09/2014	3:55pm	-	DRY	DRY	DRY	DRY														
	October	Construction	30/10/2014	2.10pm	-	DRY	DRY	DRY	DRY														
	November	Construction	20/11/2014	1.00pm	-	DRY	DRY	DRY	DRY	Insufficient sample for lab test													
2014	December	Construction	16/12/2014	2.30pm	-	DRY	DRY	DRY	DRY														
	January	Construction	15/01/2015	11.00am	-	DRY	DRY	DRY	DRY														
	February	Construction	24/02/2015	10.15am	-	DRY	DRY	DRY	DRY														
	March	Construction	23/03/2015	3.20pm	-	DRY	DRY	DRY	DRY	Insufficient sample for lab test													
	April	Construction	28/04/2015	4.30pm	-	DRY	DRY	DRY	DRY														
	May	Construction	26/05/2015	3.15pm	-	DRY	DRY	DRY	DRY														
	June	Construction			-	DRY	DRY	DRY	DRY														
	July	Construction			-	DRY	DRY	DRY	DRY														
	August	Construction			-	DRY	DRY	DRY	DRY														
	September	Construction			-	DRY	DRY	DRY	DRY														
2015	October	Construction			-	DRY	DRY	DRY	DRY														
	November	Construction			-	DRY	DRY	DRY	DRY														
	December	Construction			-	DRY	DRY	DRY	DRY														
	June	Construction	25/06/2015	3.00pm	-	DRY	DRY	DRY	DRY														
	July	Construction	21/04/2015	11.45am	-	DRY	DRY	DRY	DRY	Insufficient sample for lab test													
	August	Construction	16/08/2015	3.10pm	-	DRY	DRY	DRY	DRY														
	September	Construction	17/09/2015	4.25pm	-	DRY	DRY	DRY	DRY														
	October	Construction	30/10/2015	3.55pm	-	DRY	DRY	DRY	DRY	Insufficient sample for lab test													
	November	Construction	19/11/2015	3.30pm	-	DRY	DRY	DRY	DRY														
	December	Construction	20/11/2015	3.30pm	-	DRY	DRY	DRY	DRY														
	January	Construction	28/01/2016	4.45pm	-	DRY	DRY	DRY	DRY	Insufficient sample for lab test													
	February	Construction	20/02/2016	4.30 pm	-	DRY	DRY	DRY	DRY														
	March	Construction	11/03/2016	5.00 pm	-	DRY	DRY	DRY	DRY														
2016	April	Construction	28/04/2016	5.00 pm	-	DRY	DRY	DRY	DRY	Insufficient sample for lab test													
	May	Construction	31/05/2016	10.50 am	-	DRY	DRY	DRY	DRY														
	June	Construction	27/06/2016	3.30 pm	-	DRY	DRY	DRY	DRY														
	July	Construction	8/07/2016	11.00 am	-	DRY	DRY	DRY	DRY	Insufficient sample for lab test													
	August																						

Monitoring Bore 78500.1 - control site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Silver (mg/L)	Aluminium (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Lead (mg/L)	Selenium (mg/L)	Zinc (mg/L)	Mercury (mg/L)	BTEX	Benzene (ug/L or ppb)	Toluene (ug/L or ppb)	Ethylbenzene (ug/L or ppb)	m+p-Xylene (ug/L or ppb)	o-Xylene (ug/L or ppb)	Naphthalene (ug/L or ppb)	Total Recoverable Hydrocarbons:	C6-C9 Fraction (ug/L or ppb)	C9-C10 Fraction (ug/L or ppb)	C6-C10 Fraction minus BTEX (F1)	C10-C14 Fraction (ug/L or ppb)	C15-C28 Fraction (ug/L or ppb)	C28-C36 Fraction (ug/L or ppb)	C10-C16 Fraction (ug/L or ppb)	C10-C16 less Naphthalene Fraction (ug/L or ppb)	C16-C34 Fraction (ug/L or ppb)	C34-C40 Fraction (ug/L or ppb)
	January	Pre construction	10/01/2014	2:00pm	<0.001	0.067	0.009	0.001	<0.001	0.005	0.008	2.195	0.112	<0.001	0.005	0.140	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	February	Construction	13/02/2013	1:55pm																															
	March	Construction	31/03/2014	2:45pm	<0.001	1.456	0.001	<0.001	0.002	0.004	1.689	0.066	0.003	<0.001	0.002	0.08	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	April	Construction	07/04/2014	12:59pm																															
	May	Construction	29/05/2014	4:00pm																															
	June	Construction	25/06/2014	3:30pm																															
	July	Construction	31/07/2014	2:25pm																															
	August	Construction	18/08/2014	4:10pm																															
	September	Construction	24/09/2014	3:55pm																															
	October	Construction	30/10/2014	2.10pm																															
	November	Construction	20/11/2014	1.00pm																															
2014	December	Construction	16/12/2014	2.30pm																															
	January	Construction	15/01/2015	11.00am																															
	February	Construction	24/02/2015	10.15am																															
	March	Construction	23/03/2015	3.20pm																															
	April	Construction	28/04/2015	4.30pm																															
	May	Construction	26/05/2015	3.15pm																															
	June	Construction																																	
	July	Construction																																	
	August	Construction																																	
	September	Construction																																	
2015	October	Construction																																	
	November	Construction																																	
	December	Construction																																	
	June	Construction	25/06/2015	3.00pm																															
	July	Construction	21/04/2015	11.45am																															
	August	Construction	16/08/2015	3.10pm																															
	September	Construction	17/09/2015	4.25pm																															
	October	Construction	30/10/2015	3.55pm																															
	November	Construction	19/11/2015	3.30pm																															
	December	Construction	20/11/2015	3.30pm																															
	January	Construction	28/01/2016	4.45pm																															
	February	Construction	20/02/2016	4.30 pm																															
	March	Construction	11/03/2016	5.00 pm																															
2016	April	Construction	28/04/2016	5.00 pm																															
	May	Construction	31/05/2016	10.50 am																															
	June	Construction	27/06/2016	3.30 pm																															
	July	Construction	8/07/2016	11.00 am																															
	August																																		

Monitoring Bore 78500.2 - impact site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Compliance comments	Field Results: Depth to Water (m)	Temp (Celsius)	EC (us/cm)	pH	**Lab Results** Total Dissolved Solids (mg/L)	Bicarbonate (Alkalinity) (mg/L $CaCO_3$ **equivalent)**	Total Phosphorus (mg/L P)	Phosphate (mg/L P)	Total Nitrogen (mg/L N)	Nitrate (mg/L N)	Nitrite (mg/L N)	Ammonia (mg/L N)	Sodium (mg/L)	Potassium (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Chloride (mg/L)	Sulfate (mg/L SO_4^{2-})
2014	January	Pre construction	10/01/2014	3:10pm	-	10.690	20.7	1.11	6.46	650	70	0.86	0.748	0.21	0.060	0.006	0.017	239.0	0.7	5.2	13.8	261	112
	February	Construction	13/02/2014	3:44pm	complies	10.700	21.3	1.14	6.34														
	March	Construction	31/03/2014	3:15pm	Minor parameter fluctuation	10.700	21.77	1.14	6.01	25	80	1.23	0.585	0.08	<0.005	0.002	0.008	229	0.9	8.9	14.1	301	125
	April	Construction	07/04/2014	1:30pm	complies	11.430	22.37	1.23	6.36														
	May	Construction	29/05/2014	4:45pm	complies	11.500	22.26	1.24	6.41														
	June	Construction	25/06/2014	4:30am	complies	11.6	20.05	1.1	6.62														
	July	Construction	31/07/2014	3:55pm	Minor parameter fluctuation	12.28	16.28	1.31	7.25	45	74	2.62	0.65	0.07	0.01	<0.001	0.02	234	1	9.4	12.4	290	91
	August	Construction	18/08/2014	4:22pm	complies	12.01	16.22	1.31	7.36														
	September	Construction	24/09/2014	3:14pm	complies	12.36	18.2	1.37	7.1														
	October	Construction	30/10/2014	4.30pm	complies	12.41	20.1	1.29	7.32														
	November	Construction	20/11/2014	2.35pm	Minor parameter fluctuation	12.43	21	1.21	7.56	745	69	0.73	0.473	0.04	0.015	<0.001	0.027	235	0.8	7.2	12.5	269	101
	December	Construction	16/12/2014	11.55am	complies	12.45	20.23	1.19	6.13														
2015	January	Construction	15/01/2015	9.45am	complies	11.680	21.4	1.21	6.59														
	February	Construction	24/02/2015	9.55am	Minor parameter fluctuation, within P20	11.220	22.3	1.21	5.96														
	March	Construction	23/03/2015	10.15am	complies	11.010	21.6	1.22	6.09	Lab results taken but unable to be tested due to delivery time lapse. Resampled in April.													
	April	Construction	28/04/2015	2.00pm	Minor parameter fluctuation	12.700	20.06	1.24	6.79	684	80	1.244	0.691	0.835	0.128	0.005	0.184	218	1.7	6.7	12.6	253	101
	May	Construction	26/05/2015	5.00pm	complies	12.670	20.1	1.21	6.82														
	June	Construction	25/06/2015	3.40pm	complies	12.73	20.02	1.24	6.91														
	July	Construction	21/07/2015	11.45am	Minor parameter fluctuation	12.7	19.83	1.22	7.23	703	135	1.01	0.571	0.32	0.128	0.007	0.037	224	1.5	6.7	13.5	281	147
	August	Construction	13/08/2015	3.55pm	complies	12.68	19.02	1.21	7.33														
	September	Construction	17/09/2015	4.45pm	complies	12.72	19.1	1.2	7.25														
	October	Construction	30/10/2015	2.15pm	complies	12.37	22.43	1.24	7.29	705	85	0.6	0.471	0.17	0.139	0.002	0.007	235.1	0.8	5.1	13.7	252	108
	November	Construction	19/11/2015	2.45pm	complies	12.54	21.86	1.2	7.35														
	December	Construction	15/12/2015	12.35pm	complies	12.59	21.35	1.19	7.25														
2016	January	Construction	29/01/2016	8.00am	Minor Fluctuation in TDS	13.3	21.34	1.25	6.71	720	74	0.704	0.501	0.141	<0.005	0.002	0.05	240	0.56	4.59	14.5	266	113.4
	February	Construction	19/02/2016	4.30 pm	Complies	13.42	25.74	0.63	6.9														
	March	Construction	11/03/2016	3.30 am	Complies	13.52	24.53	1.26	6.95														
	April	Construction	28/04/2016	3.00 pm	Complies	13.88	21.46	1.3	6.17	804.2	90	1.03	0.545	0.141	0.024	<0.005	0.014	235	0.79	3.96	14.2	255	105.3
	May	Construction	31/05/2016	9.45 am	Complies	13.7	21.94	1.21	6.89														
	June	Construction	27/06/2016	4.15 pm	Complies	12.32	19.05	1.3	7.12														
	July	Construction	8/07/2016	11.15 am	Complies	13.5	20.04	1.34	6.45	687	74	0.803	0.456	0.042	0.02	<0.005	0.019	230	0.5	3.5	0.47	247	
	August	Construction	-	-	-																		

Monitoring Bore 78500.2 impact site		Earthworks Activity during Monitoring	Monitoring Event Date	Time	Silver (mg/L)	Aluminium (mg/L)	Arsenic (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Iron (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Lead (mg/L)	Selenium (mg/L)	Zinc (mg/L)	Mercury (mg/L)	BTEX	Benzene (µg/L or ppb)	Toluene (µg/L or ppb)	Ethylbenzene (µg/L or ppb)	m+p-Xylene (µg/L or ppb)	o-Xylene (µg/L or ppb)	Naphthalene (µg/L or ppb)	Total Recoverable Hydrocarbons:	C6-C9 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb)	C6-C10 Fraction (µg/L or ppb) LESS BTEX (F1)	C10-C14 Fraction (µg/L or ppb)	C15-C28 Fraction (µg/L or ppb)	C29-C36 Fraction (µg/L or ppb)	C10-C16 Fraction (µg/L or ppb)	C10-C16 less Naphthalene Fraction (µg/L or ppb)	C16-C34 Fraction (µg/L or ppb)	C34-C40 Fraction (µg/L or ppb)
2014	January	Pre construction	10/01/2014	3:10pm	<0.001	0.012	0.004	<0.001	<0.001	0.002	0.017	0.483	0.018	<0.001	<0.002	0.052	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	February	Construction	13/02/2014	3:44pm																															
	March	Construction	31/03/2014	3:15pm	<0.001	0.024	0.004	<0.001	<0.001	0.001	0.016	0.466	0.017	<0.001	<0.001	0.02	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	April	Construction	07/04/2014	1:30pm																															
	May	Construction	29/05/2014	4:45pm																															
	June	Construction	25/06/2014	4:30am																															
	July	Construction	31/07/2014	3:55pm	<0.001	0.014	0.003	<0.001	<0.001	0.001	0.222	0.489	0.014	<0.001	<0.002	0.016	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	August	Construction	18/08/2014	4:22pm																															
	September	Construction	24/09/2014	3:14pm																															
	October	Construction	30/10/2014	4.30pm																															
	November	Construction	20/11/2014	2.35pm	<0.001	0.122	0.005	<0.001	<0.001	0.003	1.473	0.439	0.013	<0.001	<0.002	0.026	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	December	Construction	16/12/2014	11.55am																															
2015	January	Construction	15/01/2015	9.45am																															
	February	Construction	24/02/2015	9.55am																															
	March	Construction	23/03/2015	10.15am																															
	April	Construction	28/04/2015	2.00pm	<0.001	0.297	0.005	<0.001	0.001	0.005	1.678	0.565	0.017	0.003	<0.001	0.057	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	May	Construction	26/05/2015	5.00pm																															
	June	Construction	25/06/2015	3.40pm																															
	July	Construction	21/07/2015	11.45am	<0.001	0.034	0.004	<0.001	<0.001	0.002	0.058	0.413	0.017	0.001	0.001	0.045	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	August	Construction	13/08/2015	3.55pm																															
	September	Construction	17/09/2015	4.45pm																															
	October	Construction	30/10/2015	2.15pm	<0.001	0.027	0.003	<0.001	<0.001	0.001	0.013	0.439	0.016	0.001	<0.001	0.033	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	November	Construction	19/11/2015	2.45pm																															
	December	Construction	15/12/2015	12.35pm																															
2016	January	Construction	29/01/2016	8.00am	<0.001	0.008	0.004	<0.001	<0.001	<0.001	0.134	0.476	0.017	<0.001	<0.001	0.029	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	February	Construction	19/02/2016	4.30 pm																															
	March	Construction	11/03/2016	3.30 am																															
	April	Construction	28/04/2016	3.00 pm	<0.001	0.009	0.004	<0.001	<0.001	0.001	0.014	0.495	0.017	<0.001	<0.005	0.041	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50		<100	<100
	May	Construction	31/05/2016	9.45 am																															
	June	Construction	27/06/2016	4.15 pm																															
	July	Construction	8/07/2016	11.15 am	<0.001	0.01	0.004	<0.001	<0.001	<0.001	0.027	12.6	0.014	<0.001	<0.005	0.027	<0.0005		<1	<1	<1	<2	<1	<1		<10	<10	<10	<50	<100	<100	<50	<50	<100	<100
	August	Construction	-	-																															