AGL Upstream Investments Pty Ltd

Tiedman Irrigation Program - Water Compliance Report for the Period 1 January to 4 July 2014

Gloucester Gas Project

28 August 2014

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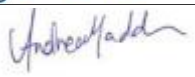
Approved by:	Andrea Madden	Date: 28/08/2014	Signature: 

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Glossary

Alluvium	Unconsolidated sediments (clays, sands, gravels and other materials) deposited by flowing water. Deposits can be made by streams on river beds, floodplains, and alluvial fans.
Alluvial aquifer	Permeable zones that store and produce groundwater from unconsolidated alluvial sediments. Shallow alluvial aquifers are generally unconfined aquifers.
Aquifer	Rock or sediment in a formation, group of formations, or part of a formation that is saturated and sufficiently permeable to transmit economic quantities of water.
Bore	A structure drilled below the surface to obtain water from an aquifer or series of aquifers.
Coal	A sedimentary rock derived from the compaction and consolidation of vegetation or swamp deposits to form a fossilised carbonaceous rock.
Coal seam	A layer of coal within a sedimentary rock sequence.
Coal seam gas (CSG)	Coal seam gas is a form of natural gas (predominantly methane) that is extracted from coal seams.
Concentration	The amount or mass of a substance present in a given volume or mass of sample, usually expressed as microgram per litre (water sample) or micrograms per kilogram (sediment sample).
Datalogger	A digital recording instrument that is inserted in monitoring and pumping bores to record pressure measurements and water level variations.
Electrical conductivity (EC)	A measure of a fluid's ability to conduct an electrical current and is an estimation of the total ions dissolved. It is often used as a measure of water salinity.
Groundwater	The water contained in interconnected pores or fractures located below the water table in the saturated zone.
Micro Siemens per centimetre (µS/cm)	A measure of water salinity commonly referred to as EC (see also Electrical Conductivity). Most commonly measured in the field with calibrated field meters.
Monitoring bore	A non-pumping bore, is generally of small diameter that is used to measure the water level/pressure head of an aquifer and/or water quality. Bores generally have a short well screen against a single aquifer through which water can enter.
pH	Potential of Hydrogen; the logarithm of the reciprocal of hydrogen-ion concentration in gram atoms per litre; provides a measure on a scale from 0 to 14 of the acidity or alkalinity of a solution (where 7 is neutral, greater than 7 is alkaline and less than 7 is acidic).
Recharge	The process which replenishes groundwater, usually by rainfall infiltrating from the ground surface to the water table and by river water reaching the

	water table or exposed aquifers. The addition of water to an aquifer.
Redox potential (ORP or Eh)	The redox potential is a measure (in volts) of the affinity of a substance for electrons – its electronegativity – compared with hydrogen (which is set at 0). Substances more strongly electronegative than (i.e. capable of oxidising) hydrogen have positive redox potentials. Substances less electronegative than (i.e. capable of reducing) hydrogen have negative redox potentials. Also known as oxidation-reduction potential and Eh.
Salinity	The concentration of dissolved salts in water, usually expressed in EC units or milligrams of total dissolved solids per litre (mg/L TDS).
Salinity classification	Fresh water quality – water with a salinity <800 µS/cm. Marginal water quality – water that is more saline than freshwater and generally waters between 800 and 1,600 µS/cm. Brackish quality – water that is more saline than freshwater and generally waters between 1,600 and 4,800 µS/cm. Slightly saline quality – water that is more saline than brackish water and generally waters with a salinity between 4,800 and 10,000 µS/cm. Moderately saline quality – water that is more saline than brackish water and generally waters between 10,000 and 20,000 µS/cm. Saline quality – water that is almost as saline as seawater and generally waters with a salinity greater than 20,000 µS/cm. Seawater quality – water that is generally around 55,000 µS/cm.
Screen	A type of bore lining or casing of special construction, with apertures designed to permit the flow of water into a bore while preventing the entry of aquifer or filter pack material.
Water quality	Term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.
Water quality data	Chemical, biological, and physical measurements or observations of the characteristics of surface and ground waters, atmospheric deposition, potable water, treated effluents, and waste water and of the immediate environment in which the water exists.
Well	Pertaining to a gas exploration well or gas production well.

Abbreviations

AGL	AGL Upstream Investments Pty Ltd
CDFM	Cumulative deviation from mean
CSG	Coal seam gas
DRE	Division of Resources and Energy
DoTI	NSW Department of Trade and Investment
EC	Electrical conductivity
GFDA	Gas Field Development Area
GGP	Gloucester Gas Project
NOW	NSW Office of Water
REF	Review of Environmental Factors
WMP	Water management plan

Units

ºC	degrees Celsius
ha	hectare
m	metres
mAHD	metres Australian Height Datum
mbgl	metres below ground level
mg/L	milligrams per litre
mm	millimetres
mm/day	millimetres per day
ML	megalitres
mV	millivolt
µS/cm	microsiemens per centimetre

Executive summary

AGL Upstream Infrastructure Investments Pty Ltd (AGL) is proposing to develop the Gloucester Gas Project (GGP) which will comprise several stages of development however, only one stage, the Stage 1 Gas Field Development Area (GFDA) is currently approved. A comprehensive groundwater investigation (Phase 2 Groundwater Investigations) was completed in early 2012 to confirm the hydrogeological conceptual model across the Stage 1 GFDA (Parsons Brinckerhoff 2012). Surface water and groundwater investigations are ongoing pending the commencement of the GGP.

As part of its current exploration program, AGL proposed irrigating a maximum of 70 ML of produced water over a maximum area of 40 ha over a two to three year period (the original approval was only for two years from 5 July 2012 to 4 July 2014. This approval has recently been extended to 30 April 2015.). Irrigation includes water from exploration programs (from 2013) which is stored in the Tiedman and Stratford dams, as well as any rainfall which falls in the dams. This water is blended with fresh water from sources including the Avon River to optimise the quality of the irrigated water.

A surface water and groundwater monitoring program commenced in October 2011 and was established in accordance with the approved Water Management Plan (AGL 2012). The monitoring aims to ensure that the quality of the water used for irrigation is appropriate and that the application of irrigated water does not result in impacts on the local surface water or groundwater resources. Water level and water quality data are evaluated for each monitoring period.

This compliance report (the third in a series of three 6-monthly reports during this initial approval period) is an approval requirement of the NSW Department of Trade and Investment (DoTI). The following reports have been prepared:

- baseline monitoring report (Parsons Brinckerhoff 2013a)
- first compliance report covering the initial irrigation period to 30 June 2013 (Parsons Brinckerhoff 2013b)
- second compliance report covering the period 1 July to 31 December 2013 (Parsons Brinckerhoff 2014)
- this third and final compliance report, under the initial approval, covering the period 1 January to 4 July 2014.

Monitoring during the 6 month period to 4 July 2014 showed there was no change in stream levels, alluvial or shallow fractured rock groundwater levels that can be attributed to the irrigation program activities. Surface water and groundwater levels remained comparable to the results from the previous compliance report.

The blended water used for irrigation, which is stored in the Tiedman south dam (TSD), complied with the ANZECC (2000) irrigation guidelines with the exception of pH (all events), iron (all events) and total phosphorus (all events) which were slightly above the guidelines. Irrigation water pH was just over the irrigation guideline for the February and May 2014 events, variable iron concentrations are normal for groundwater, and the phosphorus guideline level is intended to minimise bio-clogging of irrigation equipment. On these grounds, the blended water in the TSD is considered suitable for irrigation.

A small number of surface water samples slightly exceeded the ANZECC (2000) guidelines for the protection of freshwater aquatic ecosystems during the monitoring period. However such exceedances were noted during the baseline monitoring period and most analytes remain within the ranges observed during the baseline period. It is concluded that there has been no detectable change in natural surface water or groundwater quality as a result of the irrigation program activities.

1. Introduction

1.1 Gloucester Gas Project

AGL is proposing to build the GGP which comprises several stages of development facilitating the extraction of coal seam gas (CSG) from the Gloucester Basin. Concept plan and project approval (Part 3A Approval) for the Stage 1 GFDA was granted on 22 February 2011 under Part 3A of the *Environmental Planning and Assessment Act (1979) (EP&A Act)*. In addition the project received approval under the *Environment Protection and Biodiversity Conservation Act (1999) (EPBC Act)* (EPBC Approval) on 11 February 2013.

The GGP will involve depressurising of deep groundwater and the extraction of gas from multiple coal seams within the Gloucester coal measures. Target coal seam depths will vary from site to site but are expected to range between 200 and 1,000 m below ground level (mbgl). The current GGP includes the construction, operation and decommissioning of not more than 110 coal seam gas wells and associated infrastructure, including gas and water gathering lines within the Stage 1 GFDA. A comprehensive groundwater investigation (Phase 2 Groundwater Investigations) was completed in early 2012 to confirm the hydrogeological conceptual model across the Stage 1 GFDA (Parsons Brinckerhoff 2012). Surface water and groundwater investigations are ongoing pending the commencement of the GGP.

The dewatering of deep coal seams will result in produced water. Irrigation has been identified as the preferred water management and reuse method for produced water at Gloucester, and consequently an irrigation program (using water from exploration programs) is underway to evaluate the sustainability of irrigating salt tolerant crops on improved soils on AGL's Tiedman property at Stratford.

Part V approval under the *EP&A Act* for the irrigation program was issued in July 2012 (DRE 2012) for a period of two years.

1.2 Irrigation program

AGL proposed irrigating a maximum of 70 ML of produced water over a maximum area of 40 ha over a two to three year period (the original approval was only for two years from 5 July 2012 to 4 July 2014 but this has recently been extended to 30 April 2015). Irrigation includes water from exploration programs which is stored in the Tiedman and Stratford dams, as well as any rainfall which falls in the dams and any additional water produced from the 2013, 2014 and 2015 exploration activities. This water is blended with fresh water from sources including the Avon River to optimise the quality of the irrigated water.

The 40 ha irrigation area is divided into two areas, being Stage 1A and 1B (Figure 1.1):

- Stage 1A is the intensive irrigation area serviced by a lateral move irrigator in the north-west portion of the Tiedman property. The lateral move irrigator irrigates a maximum area of 18.2 ha, including 16 x 0.75 ha plots (12 ha) incorporating four different soil improvements. A small additional (adjacent) area for enhancements to the program was proposed for the Stage 1A area; however this is unlikely to proceed at this time.
- Stage 1B comprises the existing irrigation area of about 8.6 ha (of which about 4 ha is currently under irrigation) plus an expansion area to the west and south (if required). It is highly unlikely that this additional area of 21 ha will be required.

The irrigation water is a blended water mix with an electrical conductivity (EC) of around 1,500 µS/cm (although 2,000 µS/cm is the upper limit for the blended water in the Review of Environmental Factors (REF) (Parsons Brinckerhoff 2011)). The target water salinity is expected to be mostly in the range 1,400 to

1,600 µS/cm. The blended water comprises an approximate ratio of three parts fresh water and one part produced water. Freshwater is sourced from local farm dams and the Avon River. The irrigation program allows salt tolerant crops to be grown, with continuous cropping over summer and winter.

The main irrigation program began on 29 April 2013 for the Stage 1A area and on 1 May 2013 for the Stage 1B area (using blended water). Lower salinity produced water was also irrigated across the Stage 1B area from 16 October to 8 December 2012, to create some space in the Tiedman south dam (TSD) for blending the remaining produced water with fresh water sources.

Regional groundwater level monitoring commenced in January 2011 and surface water level monitoring commenced in March 2011. A baseline groundwater and surface water monitoring program was conducted between October 2011 and September 2012 to define pre-irrigation conditions (Parsons Brinckerhoff 2013a). This compliance report is an approval requirement of the NSW Department of Trade and Investment (DoTI) and is the third in a series of three 6 monthly reports during the irrigation program period. The first compliance report covered the initial irrigation period to 30 June 2013 (Parsons Brinckerhoff 2013b). The second compliance report covered the period 1 July to 31 December 2013 (Parsons Brinckerhoff 2014). This third and final compliance report under the initial approval to 4 July 2014 covers the period 1 January to 4 July 2014.

For the period from 1 January to 4 July 2014, 25.54 ML of blended irrigartion water was applied to the 12 ha area within the Stage 1A area and 7.48 ML of blended irrigation water was applied to 4 ha of the Stage 1B area. During the same period, 303.2 mm of rainfall was recorded by AGL (2014), which equates to 48.51 ML of rainfall across the two irrigation areas.

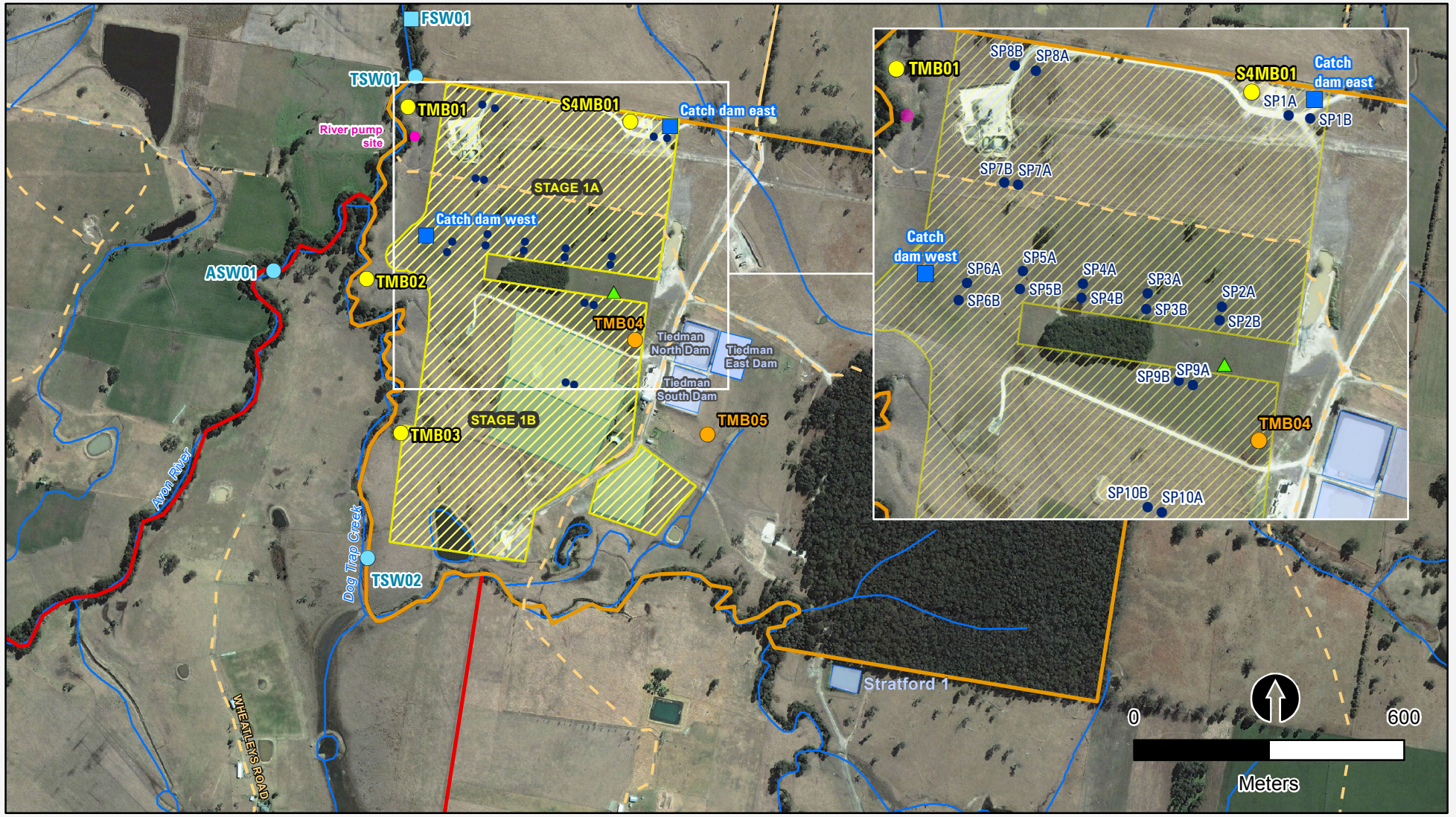
For the entire irrigation program to date, 45 ML of produced water has been irrigated and only 7 ML of produced water remains in Tiedman north dam (TND). There is no blended water remaining in TSD and there is minimal water (just enough to settle the liner) in the Tiedman east dam (TED).

1.3 Objectives

The objectives of the irrigation program and the associated water monitoring program are to ensure that the quality of the water used for irrigation is appropriate and that the application of blended water does not result in impacts to the local surface water or groundwater resources. This monitoring program mostly focuses on the Stage 1A irrigation area, as it is the intensive irrigation trial area for which performance data is required on salt accumulation and water application rates.

The water monitoring program and compliance reporting must be in accordance with the approved water management plan (AGL 2012). Details of the approved water management plan are provided in Section 2.3.

Approval for the irrigation program was given by DoTI–Division of Resources and Energy (DRE) on 5 July 2012 for a period of 2 years. This has recently been extended for a period of 10 months to 30 April 2015.



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- Groundwater monitoring bore
- Stream gauge
- Surface water monitoring location
- Seepage monitoring bore
- Perched shallow piezometer
- River pump site
- AGL weather station
- Catch dam
- Produced water dam
- Stage 1 irrigation area
- Atkins Property
- Tiedman Property
- Roads
- Tracks

Figure 1.1 Irrigation monitoring network

2. Monitoring network and methodology

2.1 Monitoring network and purpose

The water monitoring network for the irrigation program is summarised in Table 2.1 and shown on Figure 1.1.

Table 2.1 Summary of the water monitoring network

Category	Sub- category	Monitoring ID	Monitoring purpose	Monitoring commencement
Irrigation dams	Blended irrigation water	Tiedman south dam (TSD)	Monitor water quality of blended irrigation water	October 2011
	Produced water	Tiedman north dam (TND) Tiedman east dam (TED)	Monitor water quality of produced water	October 2011 May 2013
Groundwater	Shallow alluvial groundwater	TMB01 TMB02 TMB03	Monitor groundwater levels and quality in shallow alluvium adjacent to Dog Trap Creek and the Avon River for any potential impact from the project	February 2011
	Shallow rock groundwater	S4MB01	Monitor water levels and quality in fractured bedrock for any potential impact from the project	January 2011
	Perched groundwater (seepage monitoring bores)	TMB04 TMB05	Detect any potential leakage from the dams to form perched groundwater in the weathered rock profile adjacent to the dams	April 2011
	Perched water (soil piezometers)	SP1A/B to SP10A/B	Monitor perched water quality in and near the irrigation area for any potential impact from the project	November 2013
Surface water	Surface water	ASW01 TSW01 TSW02 FSW01	Monitor water levels and quality of the Avon River and Dog Trap Creek for any potential impact from the project	March 2011 March 2011 April 2012 February 2012
Catch dams	Irrigation plot runoff	Catch dam east (CDE) Catch dam west (CDW)	Monitor water quality of any irrigation plot runoff	May 2013

The groundwater and surface water monitoring locations for the Stage 1A and 1B irrigation program areas monitor and protect the possible receptors of blended irrigated water (even though the water quality is marginal freshwater and at worse brackish). Primary monitoring sites include:

- the storage dams and catch dams
- surface water sources of the Avon River and Dog Trap Creek
- the alluvium, adjacent and down gradient of the irrigation areas
- the shallow bedrock below the irrigation areas.

The storage dams (TND, TSD, and TED) are of a 'turkey's nest' style construction, are located on high ground (beyond the floodplain), and are designed to prevent ingress from surface runoff. The TND and TSD are single lined dams while the TED is a double lined dam. The TSD is the primary blended water irrigation dam and is monitored to determine if the blended water complies with the ANZECC (2000) irrigation water quality guidelines.

The two catch dams (CDE and CDW) monitor the water quality of any irrigation plot runoff.

The two seepage monitoring bores (TMB04 and TMB05) monitor soil/perched water in the weathered rock profile adjacent to the Tiedman north and south dams above the regional water table. The purpose of these bores is to detect leakage from the dams. Details of these bores are provided at Table 2.2.

Table 2.2 Seepage monitoring bore details

Monitoring bore	Total depth (m)	Screened interval (mbgl)	Lithology
TMB04	15.0	8.0 – 14.0	Shallow rock (weathered sandstone and siltstone)
TMB05	10.0	6.0 – 9.0	

There are three stream gauges where surface water levels and quality are monitored, being TSW01, TSW02 and ASW01 (Table 2.3). The FSW01 sampling location on the Avon River downstream of the Tiedman property is monitored during high rainfall events only.

Table 2.3 Stream gauges

Gauge ID	Location
TSW01	Avon River downstream of the confluence with Dog Trap Creek and the irrigation areas, adjacent to monitoring bore TMB01.
TSW02	Dog Trap Creek, upstream of the irrigation areas.
ASW01	Avon River upstream of the irrigation areas and the confluence with Dog Trap Creek.
FSW01	Avon River downstream of the Tiedman property and the confluence with Dog Trap Creek and the irrigation areas.

Three groundwater monitoring bores are screened within shallow alluvium associated with the Avon River and Dog Trap Creek (TMB01, TMB02 and TMB03). One monitoring bore (S4MB01) is screened within fractured bedrock underlying the irrigation area. Details are presented in Table 2.4.

Table 2.4 Groundwater monitoring bore details

Monitoring bore	Total depth (m)	Screened interval (mbgl)	Lithology	Formation
TMB01	12.0	7.0 – 10.0	Clay	Avon River alluvium
TMB02	15.5	9.0 – 12.0	Mixed gravels	Avon River alluvium
TMB03	12.5	5.0 – 11.0	Mixed gravels and sand	Avon River alluvium
S4MB01	66.0	58.0 – 64.0	Sandstone	Shallow rock: Leloma Formation

There are 10 paired piezometers (SP1A/B to SP10A/B; 0.3-1.2 m and 1.5 m deep) within and just outside the Stage 1A and 1B irrigation areas. Those piezometers with accumulated water were sampled in the routine February and May 2014 sampling events.

2.2 Monitoring program

Quarterly water monitoring is undertaken at most sites and is subject to 6-monthly compliance reporting. The water compliance reports are scheduled to align with soil compliance reports. The schedule of sampling events and reporting is provided in Table 2.5.

Table 2.5 Schedule of sampling/reporting events

Sampling event	Type	Sampling date	Compliance report
Baseline	Water Soil	October 2011 – September 2012 January 2013	January 2013 May 2013
Irrigation 1	Water Soil	May 2013 (for period to 30 June 2013) May 2013 (for period to 30 June 2013)	August 2013 August 2013
Irrigation 2	Water Soil	August 2013 and November 2013 (for period to 31 December 2013) November 2013 (for period to 31 December 2013)	January 2014 January 2014
Irrigation 3	Water Soil	February 2014 and May 2014 (for period to 4 July 2014) May 2014 (for period to 4 July 2014)	August 2014 (this report) August 2014

Water quality is the primary monitoring requirement at all sites, although water levels are also measured continuously at the dedicated stream gauges (ASW01, TSW02 and TSW01), the two seepage monitoring bores near the Tiedman dams (TMB04 and TMB05), and the dedicated shallow monitoring bores (TMB01, TMB02 and TMB03 (alluvial) and S4MB01 (fractured rock)).

Each of the three turkey nest dams (TSD, TND, and TED) is monitored for water quality each quarter and salinity of the blended irrigation water is tracked continuously via a salinity (EC) logger in TSD. This logger has been operational since late 2011. It was removed from TSD in December 2012 and not deployed for several months. On the completion of the new produced water dam, the logger was moved to TED on 12 March 2013 rather than being reinstalled in TSD due to operation and maintenance requirements at TSD and TND. Desludging activities were subsequently carried out on both TND and TSD in April-June 2013. These activities were completed in July 2013. The EC logger was relocated back into TSD in August 2013. EC loggers were installed at catch dam west (CDW) and catch dam east (CDE) on 7 May 2013 and data until 13 May 2014 have been included in this compliance report.

The water sample taken from TSD in February 2014 is the sample that Fodder King has used for the water and salt balances in a separate soils compliance report for this reporting period (Fodder King 2014).

Several of the ten paired piezometers were sampled during the February and May 2014 sampling events where perched water had accumulated. Water levels and further discussion are provided in the soils compliance report (Fodder King 2014).

The two catch dams (CDE and CDW) are monitored for water quality each quarter and the salinity of the water is tracked continuously via a salinity (EC) logger in each dam. FSW01 (Avon River – downstream), ASW01 (Avon River – upstream), CDW and CDE are monitored during high rainfall events. These locations were sampled during the high rainfall event in March 2014.

2.3 Approved water management plan

The approved water management plan (WMP) is titled '*Water Management Plan for the Tiedman Irrigation Program – Gloucester*' (AGL 2012). The WMP was based on the outline provided in the REF (Parsons Brinckerhoff 2011), the NSW Office of Water's (NOW) letter of 12 August 2011, baseline monitoring initiated by AGL, discussions with NOW in December 2011, and additional information provided in February 2012.

Table 2.6 summarises the groundwater and surface water monitoring scope as outlined in the WMP.

Table 2.6 Groundwater and surface water monitoring scope

Monitoring ID	Description	Water levels	Routine water quality and sampling frequency	Extra sampling event
TND	Tiedman north dam	Not required	Metals, nutrients, cations/anions – Quarterly Hydrocarbons – Annually	Physical parameters[a] – Monthly
TSD	Tiedman south dam	Not required	Salinity logger – Continuous Metals, nutrients, cations/anions – Quarterly Hydrocarbons – Annually	Physical parameters – Monthly
TED	Tiedman east dam	Not required	Metals, nutrients, cations/anions – Quarterly Hydrocarbons – Annually	Physical parameters – Monthly
CDE	Catch dam located north-east of Stage 1A irrigation area	Not required	Salinity logger – Continuous	Physical parameters, metals, nutrients, cations/anions – Subject to test results from CDW overflow event
CDW	Catch dam located south-west of Stage 1A irrigation area	Not required	Salinity logger – Continuous	Physical parameters, metals, nutrients, cations/anions – Sample and test first overflow event only then assess for future events
TMB04	Seepage monitoring bore, located west of Tiedman north dam	Yes continuous	Physical parameters then purge dry and assess inflows – Quarterly If inflow within 12-hours then physical parameters again, metals, nutrients, cations/anions	Physical inspection of surrounding area – Monthly

Monitoring ID	Description	Water levels	Routine water quality and sampling frequency	Extra sampling event
TMB05	Seepage monitoring bore, located south of the Tiedman dams	Yes continuous	Physical parameters then purge dry and assess inflows – Quarterly If inflow within 12-hours then physical parameters again, metals, nutrients, cations/anions	Physical inspection of surrounding area – Monthly
ASW01	Avon River (upgradient), located on the Atkins property	Yes continuous	Salinity logger – Continuous Nominal physical parameters, metals, nutrients, cations/anions – Quarterly Hydrocarbons – Annually	None planned
TSW02	Dog Trap Creek	Yes continuous	Salinity logger – Continuous Physical parameters, metals, nutrients, cations/anions – Quarterly Hydrocarbons – Annually	None planned
TSW01	Avon River, located downgradient of the Tiedman boundary	Yes continuous	Salinity logger – Continuous Nominal physical parameters, metals, nutrients, cations/anions – Quarterly Hydrocarbons – Annually	None planned
FSW01	Avon River, located downgradient, on the Farley property	Not required	Physical parameters, metals, nutrients, cations/anions – Quarterly Hydrocarbons – Annually	Physical parameters, metals, nutrients, cations/anions – Sample and test first overflow event only then assess for future events
TMB01	Avon River alluvium, located downgradient, on the site boundary	Yes continuous	Nominal physical parameters, metals, cations/anions – Quarterly Hydrocarbons and nutrients – Annually	None planned
TMB02	Avon River/Dog Trap Creek alluvium (mid site)	Yes continuous	Nominal physical parameters, metals, cations/anions – Quarterly Hydrocarbons and nutrients – Annually	None planned
TMB03	Dog Trap Creek alluvium (southern site)	Yes continuous	Nominal physical parameters, metals, cations/anions – Quarterly Hydrocarbons and nutrients – Annually	None planned
S4MB01	Northern site boundary (shallow rock)	Yes continuous	Nominal physical parameters, metals, cations/anions – Quarterly Hydrocarbons and nutrients – Annually	None planned

Note:
(a) Physical parameters defined in Table 2.7.

The WMP states that the water intended for irrigation will meet the ANZECC (2000) water quality criteria for irrigation purposes. There are no other commitments in the WMP or the project approval as to compliance with other guidelines or thresholds. The assessment criteria proposed in these water compliance reports (see Section 2.5.2) is mostly for comparative purposes only.

2.4 Water level monitoring

2.4.1 Groundwater level monitoring

Groundwater levels are electronically and manually measured in all monitoring bores. Pressure transducers with dataloggers suspended in the monitoring bore water column are programmed to record a groundwater level measurement every 6 hours. Manual measurements using an electronic dip meter are recorded every monitoring round and used to calibrate the logger data.

A barometric datalogger installed above the water table at S5MB01, located approximately 1 km to the east of the irrigation area, records changes in atmospheric pressure. Data from this logger are used to correct for the effects of changing barometric pressure on groundwater levels in the monitoring bores.

2.4.2 Surface water level monitoring

Surface water monitoring locations include gauge boards and dataloggers to continuously monitor water levels and salinity. Loggers installed at the stream gauges are set to take a reading every 15 minutes. All measurements are verified and calibrated by manual gauge readings and salinity (EC) measurements.

2.5 Water quality monitoring

Routine water quality sampling was completed at all of the sites listed in Table 2.6.

2.5.1 Automated monitoring

Salinity (EC) loggers are installed at three surface water locations (ASW01, TSW02 and TSW01), the blended water irrigation dam (TSD) (October 2011 – March 2013 and from August 2013 onwards), TED (March – August 2013) and in the two catch dams (CDW and CDE).

EC measurements are recorded electronically, and manually verified during quarterly sampling events. Salinity dataloggers record EC measurements every 15 minutes at the surface water sites, and every 6 hours at the Tiedman and catch dam sites.

2.5.2 Sampling methodology

Four sampling methods were used to obtain surface water and groundwater samples:

- Submersible 12V pump at groundwater monitoring bores screened within relatively permeable geological materials, TMB01, TMB02 and TMB03. A minimum of three well volumes was purged prior to sampling.
- Submersible 12V pump at the seepage monitoring bores TMB04 and TMB05 which are screened within material of very low permeability. The physical parameters (as defined in Table 2.7) of the purged groundwater were initially tested, then the bores were purged dry and if any inflow was observed within 12 hours then physical parameters were tested again and a sample taken for analysis.
- Disposable bailer at the shallow perched soil water piezometers (with piezometers purged dry and if any inflow was observed within 12 hours then physical parameters were tested again and a sample taken for analysis).

- In-situ snap sampler for groundwater monitoring bore S4MB01, screened within material of relatively low permeability.
- Grab sample using a telescopic sampler for surface water and dam water samples.

EC and pH were monitored during purging to ensure that they had stabilised prior to sample collection. Samples were sent to a NATA accredited laboratory for analysis, under the appropriate chain-of-custody protocols for chemical analysis. An intermediate water quality monitoring suite was adopted for the February 2014 event and a comprehensive suite (involving hydrocarbons and dissolved gases) was adopted for the May 2014 sampling event (details are provided in Table 2.7).

Table 2.7 Analytical suite

Category			Parameters	
Physical parameters (field)	Intermediate suite	Comprehensive suite	EC	Redox potential
			Temperature	pH
			Dissolved oxygen	Total dissolved solids (TDS)
Physical parameters (lab)			EC	pH
			Total suspended solids	TDS
Major ions			Calcium Magnesium Sodium Potassium	Chloride Bicarbonate Sulphate Fluoride Dissolved silica
Metals and minor/trace elements			Aluminium Arsenic Barium Beryllium Boron Bromine Cadmium Chromium Cobalt Copper Iron	Manganese Molybdenum Mercury Nickel Lead Selenium Strontium Uranium Vanadium Zinc
Nutrients			Total nitrogen Ammonia[a] Phosphorus (total and reactive)[a]	Nitrate Nitrite Total organic carbon (TOC)[a]
Dissolved gases			Methane	
Hydrocarbons			Phenol compounds Polycyclic aromatic hydrocarbons (PAH)	Total petroleum hydrocarbons (TPH) Benzene, toluene, ethyl benzene and xylenes (BTEX)

Note:
(a) Not analysed at the groundwater monitoring locations.

Water quality samples were collected in the sample bottles provided by the laboratory, with the appropriate preservation when required. Table 2.8 details the sample bottles used. Samples undergoing dissolved metal analysis were filtered through 0.45 µm filters in the field prior to collection.

Table 2.8 Sample bottles

Category	Sample bottle
Major cations/anions	1 x 1 L plastic, unpreserved
Dissolved metals	1 x 60 mL plastic, preserved
Nutrients	1 x 125 mL plastic, preserved
TOC	1 x 40 mL amber glass, preserved
Hydrocarbons and methane[a]	2 x 40 mL amber glass, preserved

Note:
(a) For the comprehensive suite only.

2.5.3 Assessment criteria

The guidelines for fresh and marine water quality (ANZECC 2000) recommend developing site specific guideline values that are derived from local reference data. Section 7.4.4.1 of the ANZECC guidelines recommends a minimum of 2 years of continuous monthly data at the reference site to establish a valid threshold value taken at the 80th percentile. The guideline allows for the threshold value to be modified as new baseline data becomes available by applying a rolling 80th percentile value incorporating the latest 24 month monitoring period. Where data are insufficient to calculate a valid threshold value, the guideline recommends defaulting to the appropriate ANZECC (2000) guideline value.

Guideline values are intended as a management tool for assessing water quality and protecting environmental values. The guideline values do not represent strict pass/fail criteria, rather the guideline value "triggers" management response to protect the environment or water resource. The response typically involves further assessment to determine if the water quality change represents a significant threat to environmental values.

In this study there is currently insufficient data with which to develop site specific trigger values strictly as described in ANZECC (2000). Accordingly monitoring data are compared against appropriate default ANZECC (2000) guideline values for the protection of freshwater aquatic ecosystems, with reference to the natural ranges in water quality from observations during the baseline monitoring period. However all data will be reassessed in 2014/15 with a view to determining more appropriate site specific trigger values for ongoing surface water and groundwater monitoring programs. The ANZECC (2000) guidelines used and rationale for the selection are provided in Table 2.9.

Table 2.9 Rationale for selection of guidelines

Category	Monitoring ID	Criteria	Rationale
Irrigation dams	Tiedman south dam (TSD)	ANZECC (2000) guidelines for Primary Industries (irrigation).	The blended water within this dam is used for irrigation.
	Tiedman north dam (TND) Tiedman east dam (TED)	None apply; results have been compared to ANZECC (2000) guidelines for Primary Industries (irrigation).	The water in these dams is not directly used for irrigation.
Groundwater	TMB01 TMB02 TMB03	None strictly apply. Reference is made to ranges in values over the baseline monitoring period.	There is currently insufficient data with which to develop site specific trigger values strictly as described in ANZECC (2000).
	S4MB01		
	TMB04		

Category	Monitoring ID	Criteria	Rationale
	TMB05		
	SP1A/B to SP10A/B		
Surface water	ASW01 TSW01 TSW02 FSW01	ANZECC (2000) guidelines: for the protection of freshwater aquatic ecosystems (95% protection levels (trigger values)).	These guidelines apply to natural surface water systems, with the 95% protection level most appropriate for moderately disturbed systems (see paragraph following this table for further details).
Catch dams	Catch dam east (CDE) Catch dam west (CDW)	If overflow occurs, the ANZECC (2000) guidelines: for the protection of freshwater aquatic ecosystems (95% protection levels (trigger values)).	The catch dams capture the initial runoff, which is returned to the Tiedman water storage dams (i.e. no guidelines apply). After capturing the first flush, any further runoff is allowed to overflow the catch dams as overland flow to the Avon River, hence surface water guidelines apply.

The ANZECC (2000) guidelines for the protection of fresh water ecosystems (80% and 95% protection levels) and irrigation water are provided in Table 2.10. Protection level signifies the percentage of species expected to be protected. In most cases the 95% protection level trigger values apply to ecosystems that could be classified as slightly-moderately disturbed, such as rural streams receiving runoff from land disturbed to varying degrees by grazing or pastoralism. The 80% protection level relates to highly disturbed systems, such as rural streams receiving runoff from intensive horticulture and urban streams receiving road and stormwater runoff. Given these descriptions, the 95% protection level is deemed most appropriate for comparative purposes in this report for surface water and the catch dams.

The ANZECC (2000) long term trigger values have been used as the irrigation guidelines. The long term trigger value is the maximum concentration of contaminant in the irrigation water which can be tolerated assuming 100 years of irrigation. This was adopted as a conservative approach and considers irrigation as a continuing management option.

The range of results for groundwater from the pre-irrigation baseline sampling period (Parsons Brinckerhoff 2013a) is provided in Table 2.11. There is currently insufficient data with which to develop site specific trigger values strictly as described in ANZECC (2000). Water quality results are provided in Appendix A and are plotted against the appropriate criteria in Appendix B.

Table 2.10 ANZECC (2000) guideline trigger values for aquatic ecosystems and irrigation water

Analyte[a]	Units	ANZECC - Aquatic ecosystems (freshwater) guideline value[b]		ANZECC – Irrigation guideline value[d]
		95% protection levels[h]	80% protection levels[h]	
pH (range)	pH units	6.5-8.0[c]		6.0-9.0
EC	µS/cm	125-2,200[c]		2,000[e]
Sodium	mg/L	-	-	460[f]
Chloride	mg/L	-	-	700[f,g]
Fluoride	mg/L	-	-	1
Total Phosphorus	mg/L	0.05[c]		0.05
Ammonia	mg/L	0.9	2.3	N/A
Aluminium	mg/L	0.055	0.150	5
Arsenic	mg/L	0.013[i]	0.140[i]	0.1
Boron	mg/L	0.37	1.30	0.5
Cadmium	mg/L	**0.0005**	**0.0022**	0.01
Chromium (VI)	mg/L	**0.0025**	**0.1**	0.1
Cobalt	mg/L	ID	ID	0.05
Copper	mg/L	**0.0035**	**0.0063**	0.2
Iron	mg/L	ID	ID	0.2
Lead	mg/L	**0.014**	**0.038**	2
Manganese	mg/L	1.9	3.6	0.2
Nickel	mg/L	**0.028**	**0.043**	0.2
Selenium (total)	mg/L	0.011	0.034	0.02
Uranium	mg/L	ID	ID	0.01
Zinc	mg/L	**0.02**	**0.078**	2

Notes:

(a) All metals are dissolved.

(b) ANZECC 2000 - Water Quality Guidelines: trigger values for the protection of freshwater aquatic ecosystems (for toxicants).

(c) ANZECC 2000 - Water Quality Guidelines: default trigger values for aquatic ecosystems, south-east Australia, low lying river ecosystems (for physical and chemical stressors).

(d) ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, long-term threshold values.

(e) Average root zone salinity threshold for Lucerne, Hunter River.

(f) Trigger value for the prevention of foliar injury due to chloride and sodium in irrigation water in moderately tolerant crops.

(g) Medium risk of increasing cadmium concentrations in crops due to chloride in irrigation waters.

(h) Protection level signifies the percentage of species expected to be protected. In most cases the 95% protection level trigger values apply to ecosystems that could be classified as slightly-moderately disturbed and the 80% protection level relates to highly disturbed systems.

(i) Arsenic species: As(V).

Bold values have been corrected for moderate water hardness (based on ANZECC 2000 Table 3.4.4).

ID = insufficient data to derive a reliable trigger value.

- = no guideline value.

Table 2.11 Groundwater pre-irrigation baseline water quality

Analyte[a]	Units	Groundwater pre-irrigation baseline[b]	
		min	max
pH	pH units	6.32	7.77
EC	µS/cm	3,199	13,848
Sodium	mg/L	484	1,350
Chloride	mg/L	841	2,940
Fluoride	mg/L	0.1	0.5
Total Phosphorus	mg/L	0.02	0.1
Ammonia	mg/L	<0.01	2.45
Aluminium	mg/L	<0.01	0.06
Arsenic	mg/L	0.001	0.009
Boron	mg/L	<0.05	0.27
Cadmium	mg/L	<0.0001	0.0002
Cobalt	mg/L	<0.001	0.005
Copper	mg/L	<0.001	0.006
Iron	mg/L	0.36	6.53
Lead	mg/L	all <0.001	
Manganese	mg/L	0.223	1.73
Nickel	mg/L	<0.001	0.006
Selenium	mg/L	all <0.01	
Uranium	mg/L	<0.001	0.017
Zinc	mg/L	0.01	0.146

Notes:
(a) All metals are dissolved.
(b) Groundwater pre-irrigation baseline data from Parsons Brinckerhoff (2013a).
(c) Baseline ranges exclude the seepage bores TMB04 and TMB05.

3. Tiedman dams and seepage monitoring

3.1 Water quality results

The water quality analytes for the Tiedman dams (TSD, TND and TED) and seepage monitoring bores (TMB04 and TMB05) are presented in Table 3.1 and Table 3.2 (the full suite is presented in Appendix A). The monthly water quality parameters collected by AGL are also tabulated and provided in Appendix A. The analytical results for TSD are compared to the ANZECC (2000) guidelines for Primary Industries (irrigation) as the blended water within this dam is used for irrigation. The produced water in TND, fresh water in TED and seepage monitoring water is not directly used for irrigation and therefore a comparison with the ANZECC (2000) irrigation guidelines is not relevant for compliance purposes.

Table 3.1 Tiedman dams and seepage monitoring bores results for February 2014

Analyte[a]	Units	ANZECC (2000) irrigation[b]	TSD	TND	TED	TMB04	TMB05
pH	pH units	6.00–9.00	**9.72**	9.82	9.97	5.75	5.61
EC	µS/cm	2,000[c]	1,535	5,595	2,004	7,133	7,387
Chloride	mg/L	700	207	711	262	1,970	2,250
Sodium	mg/L	460	262	1,060	413	1,200	1,160
Boron	mg/L	0.50	0.25	0.77	0.56	<0.05	<0.05
Iron	mg/L	0.20	**5.38**	0.54	0.60	6.86	14.50
Manganese	mg/L	0.20	0.049	0.098	0.046	9.57	19.10
Total phosphorus	mg/L	0.05	**1.61**	1.72	1.33	0.07	0.02
Ammonia	mg/L	N/A	0.05	<0.01	0.05	0.12	0.29

Notes:

(a) All metals are dissolved.

(b) ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, long-term threshold values (applied to TSD only).

(c) Average root zone salinity threshold for Lucerne, Hunter River.

N/A – no guideline value or not analysed.

Bold – above ANZECC 2000 guideline (applied to TSD only; TND, TED and TMB04 and TMB05 are not compared to the guideline).

Table 3.2 Tiedman dams and seepage monitoring bores results for May 2014

Analyte[a]	Units	ANZECC (2000) irrigation[b]	TSD	TND	TED	TMB04	TMB05
pH	pH units	6.00–9.00	**9.28**	9.73	9.85	6.36	5.34
EC	µS/cm	2,000[c]	1,455	5,047	1,143	7,050	7,156
Chloride	mg/L	700	219	731	164	1,800	2,370
Sodium	mg/L	460	240	924	214	1,100	1,030
Boron	mg/L	0.50	0.18	0.54	0.25	<0.05	<0.05
Iron	mg/L	0.20	**0.57**	0.16	0.25	2.08	10.0
Manganese	mg/L	0.20	0.014	0.006	0.064	12.100	21.700
Total phosphorus	mg/L	0.05	**0.83**	1.37	0.80	0.08	<0.01
Ammonia	mg/L	N/A	0.45	0.07	<0.01	0.10	0.32

Notes:
(a) All metals are dissolved.
(b) ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, long-term threshold values.
(c) Average root zone salinity threshold for Lucerne, Hunter River.
N/A – no guideline value.
Bold – above ANZECC 2000 guideline (TSD only; TND, TED and TMB04 and TMB05 are not compared to the guideline).

3.2 Tiedman dams

TND stores produced water from the exploration programs while TED (at the present time) stores mostly fresh water captured and ready for preparing the next batch of blended irrigation water (blended and stored in TSD prior to irrigation). Fresh water is sourced from local farm dams and the Avon River to optimise its water quality to within irrigation guideline values and to minimise soil degradation.

3.2.1 Water quality

3.2.1.1 Field parameters and major ion chemistry

The salinity (EC) measurements in February and May 2014 for TSD were similar to the salinity of samples collected in the second half of 2013 and were below the adopted ANZECC (2000) guideline value of 2,000 µS/cm. The EC was marginal to brackish at TED and was brackish at TND.

The pH measurements exceeded the ANZECC guideline range of 6.00-9.00 at all dams for both monitoring events.

The water type for the Tiedman dams was generally Na-Cl-CO_3-HCO_3 as shown on the piper diagrams in Appendix C. TSD and TED had chloride and sodium concentrations below the ANZECC (2000) irrigation guidelines (700 mg/L and 460 mg/L, respectively), while chloride and sodium both exceeded the guideline at TND.

The continuous EC logger data for the TSD from October 2011 to December 2012 are plotted in Figure 3.1. The logger was removed from this dam in December 2012 and redeployed in August 2013. Between March and August 2013 the logger was deployed in TED and a plot of the salinity trend in this dam is also shown in Figure 3.1.

No logger data are provided from mid-September 2013 to mid-February 2014 because of logger inconsistencies and suspected failure.

The salinity in TSD changed from brackish (between October 2011 and December 2012) to marginal (from April 2013 onwards). This is the result of water batching and ensuring that the blended irrigation water quality is around 1,500 µS/cm. The salinity in TED was marginal; decreasing to fresh between March and August 2013.

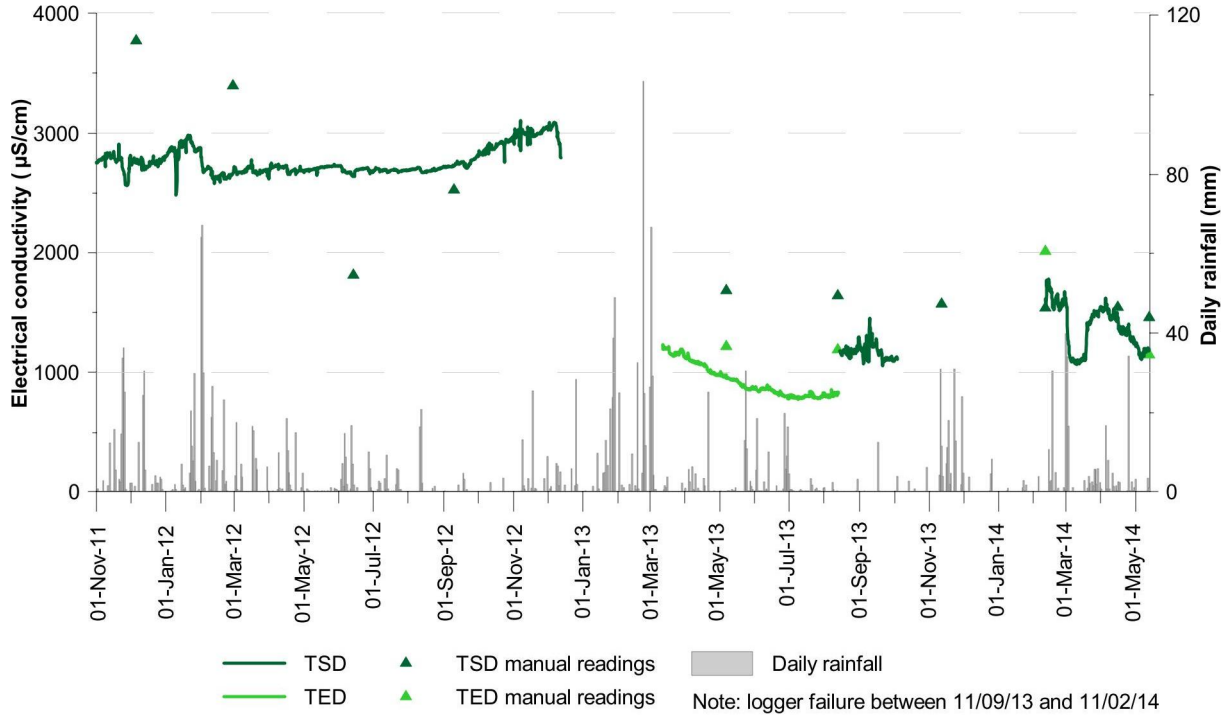

Figure 3.1 Continuous EC data at Tiedman south dam and Tiedman east dam

3.2.1.2 Dissolved metals

The Tiedman dams all had aluminium, arsenic, barium, boron, bromine, chromium, cobalt, copper, iron, manganese, molybdenum, nickel, strontium, and zinc concentrations slightly above the laboratory limit of reporting (LOR). All other dissolved metal analytes were either equivalent to or were below the laboratory LOR. Iron concentrations exceeded the ANZECC (2000) guidelines for both monitoring events (Appendix B). Elevated iron is not uncommon for natural groundwater.

3.2.1.3 Nutrients

Ammonia concentrations in the dams ranged from below the laboratory LOR to 0.05 mg/L in February 2014 and from below the laboratory LOR to 0.45 mg/L in May 2014. The ammonia concentration recorded at TSD in May 2014 was the highest (0.45 mg/L) concentration recorded since the beginning of irrigation. Ammonia concentrations decreased from the late 2013 results at TND and TED.

The total phosphorus concentrations ranged from 1.33 mg/L to 1.72 mg/L in February 2014 and from 0.80 mg/L to 1.37 mg/L in May 2014. Total phosphorus concentrations at all dams remained above the ANZECC guideline value for irrigation (0.05 mg/L). It should be noted that the guideline is only set at this low concentration to minimise bioclogging of irrigation equipment (ANZECC 2000).

3.3 Seepage monitoring around the Tiedman dams

3.3.1 Water levels

The groundwater levels in the seepage bores are shown in Figure 3.2 along with daily rainfall and the monthly cumulative rainfall deviation from the mean (CDFM). (A positive slope in the CDFM indicates above average rainfall and a negative slope indicates below average rainfall.) Both seepage bores around the Tiedman dams have occasionally been dry following periods of low rainfall during the baseline monitoring period; however the bores consistently indicated perched water at shallow depth (Parsons Brinckerhoff 2013a). Groundwater levels increased at TMB05 in March 2013 after high rainfall in January and February 2013. To confirm the correlation with rainfall, dataloggers were installed in May 2013. Over the last 12 months of monitoring, no clear response to rainfall (or the lack of rainfall) is visible even though perched water was present throughout this whole period. Both seepage bores show a fast recovery after each sampling event and return to levels consistent with the baseline monitoring period (Figure 3.2).

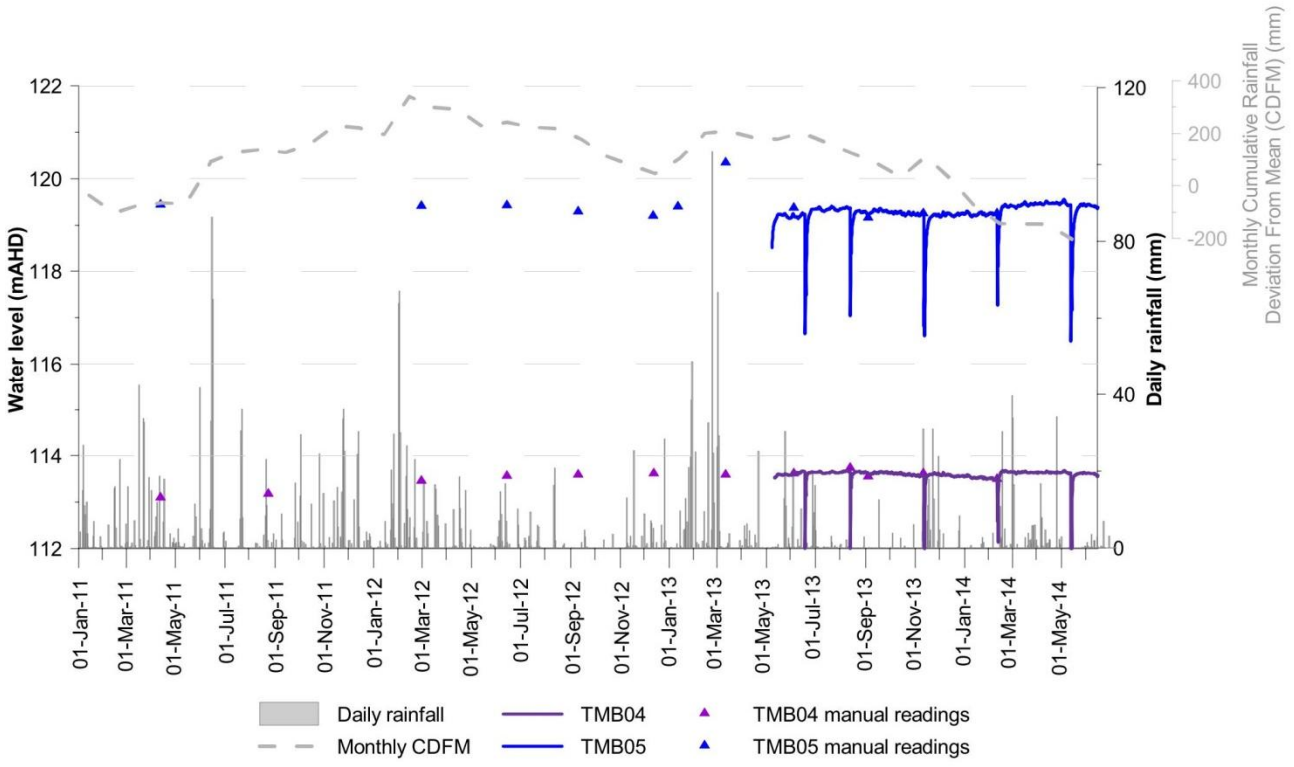

Figure 3.2 Groundwater levels for seepage monitoring bores (TMB04 and TMB05)

3.3.2 Water quality

Accumulated water in both seepage monitoring bores was sampled during the February and May 2014 sampling events.

3.3.2.1 Field parameters and major ions

The seepage water remained slightly saline over the monitoring period. The pH conditions remained acidic, which is characteristic of the shallow soils. In comparison to the results from the Tiedman dams, the pH is much lower and EC much higher.

Analysis of major ion components indicates that the water type for the seepage bores remained as Na–Mg–Cl dominant (Appendix C). The proportion of chloride in the seepage bores, in particular, is notably higher than the proportion of chloride in the water within the Tiedman dams.

3.3.2.2 Dissolved metals

Concentrations of dissolved metals were comparable to the late 2013 results. Aluminium, arsenic, barium, beryllium, bromine, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, strontium and zinc were detected above the laboratory LOR in at least one of the two seepage monitoring bores. In particular, manganese concentrations were elevated at both seepage monitoring bores. All other dissolved metal analytes were either equivalent to, or were below the laboratory LOR.

There are distinct differences in the concentration of metals between the seepage bores and Tiedman dams, such as higher iron, manganese and zinc concentrations in the seepage bores. The water quality results are characteristic of the shallow soils. The monitoring results suggest there are no seepage losses from the Tiedman dams and that there appears to be permanent perched water in the soil and weathered rock profile at these two locations.

3.3.2.3 Nutrients

Ammonia concentrations fluctuated from the late 2013 concentrations at TMB04 and TMB05. Total phosphorus concentrations were comparable to the late 2013 concentrations at both seepage bores.

4. Surface water monitoring

4.1 Surface water levels

Surface water levels from stream level gauges TSW01, TSW02, and ASW01 are shown in Figure 4.1. All three stream gauges on the Avon River and Dog Trap Creek show sharp increases in water level in response to rainfall events, and relatively steep recession curves. This is consistent with a rapid runoff response from a relatively small upstream catchment with limited riverbank storage. Stream levels decrease over several weeks following each rainfall event to a relatively consistent base level that represents a small groundwater baseflow component in the Avon River.

Anecdotal information suggests that the Avon River and its major tributaries cease to flow during prolonged drought conditions. From early December 2013 to mid-February 2014, very low rainfall was recorded leading to a reduction of stream flow and the formation of disconnected pools along the Avon River and Dog Trap Creek (Figure 4.1). Continuous stream flow returned following rainfall mid-February 2014 through to the end of May 2014, and flows declined again in June and July 2014 to form disconnected pools along the Avon River and Dog Trap Creek.

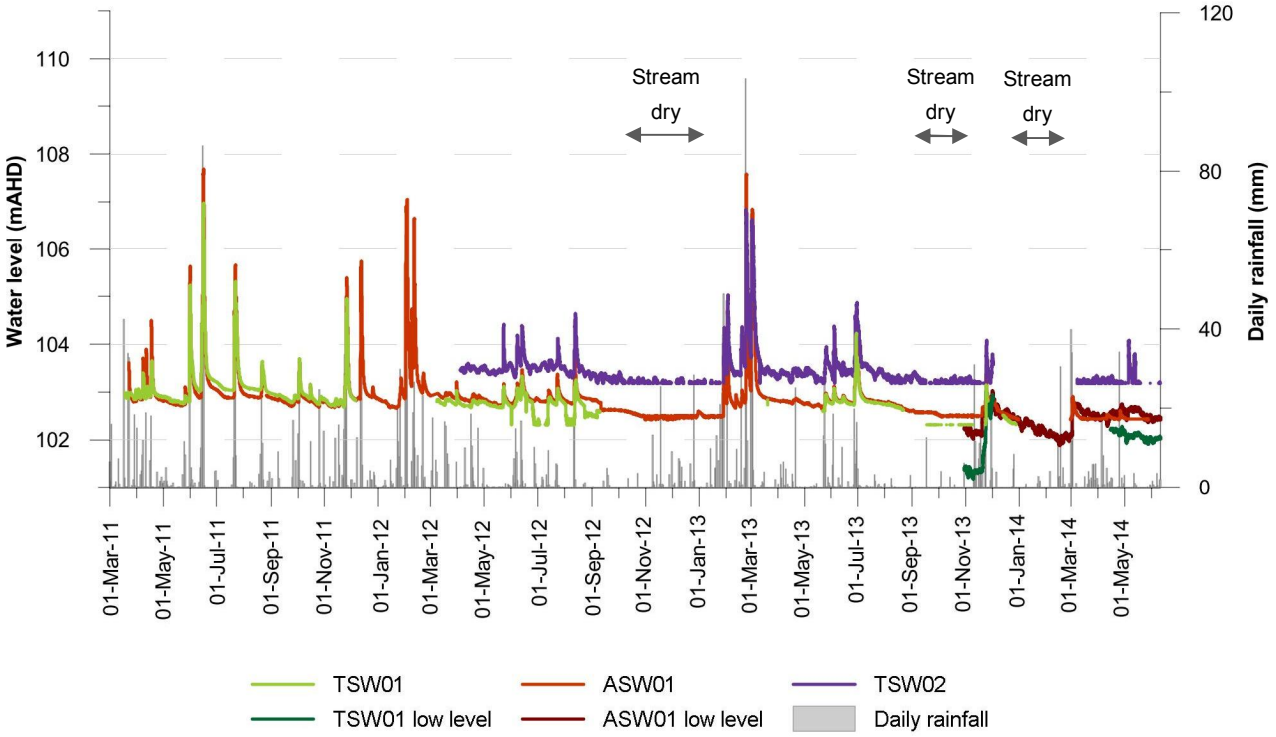

Figure 4.1 Surface water levels

4.2 Surface water quality

4.2.1 Surface water

In February and May 2014, surface water was sampled at ASW01, TSW01 and TSW02, with a high rainfall event sampled at FSW01 and ASW01 in March 2014. No sample could be collected at TSW02 in February 2014 as Dog Trap Creek was dry. In May 2014, a sample was collected from a disconnected pool at TSW02; this is not considered to be representative of the salinity of flowing water in the creek.

The surface water quality results for the main analytes are presented in Table 4.1 for the quarterly sampling events. The event water sample results from March 2014 are also presented in Table 4.1.

Water quality time-series plots are provided in Figures B-1 to B-23 of Appendix B, piper diagrams in Appendix C and laboratory analysis reports in Appendix D.

Table 4.1 February, March and May 2014 results for surface water monitoring locations

Analyte[a]	Units	ANZECC 2000 guidelines[b]		TSW01		TSW02[(f)]	ASW01			FSW01
		95%[e]	80%[e]	Feb 2014	May 2014	May 2014	Feb 2014	Mar 2014[d]	May 2014	Mar 2014[d]
pH	pH units	6.5-8.0[c]		6.66	7.35	7.19	**8.33**	7.42	7.31	**8.55**
EC	µS/cm	125-2,200[c]		576	566	1,678	475	416	449	484
Sodium	mg/L	-	-	75	75	214	51	49	55	56
Chloride	mg/L	-	-	111	123	454	80	66	88	91
Boron	mg/L	0.37	1.30	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	mg/L	ID	ID	2.14	1.28	0.26	2.38	0.89	1.36	1.34
Manganese	mg/L	1.9	3.6	0.920	0.294	2.080	0.693	0.221	0.740	0.521
Total phosphorus	mg/L	0.05[c]		**0.18**	**0.09**	0.05	**0.09**	**0.21**	**0.09**	**0.28**
Ammonia	mg/L	0.9	2.3	0.12	0.13	0.02	0.01	0.19	0.16	0.17

Notes:

(a) All metals are dissolved.

(b) ANZECC 2000 – Water Quality Guidelines: trigger values for the protection of freshwater aquatic ecosystems.

(c) ANZECC 2000 – Water Quality Guidelines: default trigger values for aquatic ecosystems, south-east Australia, low lying river ecosystems.

(d) High rainfall event sampling early March 2014 (also shaded grey to highlight differences).

(e) Protection level signifies the percentage of species expected to be protected. In most cases the 95% protection level trigger values apply to ecosystems classified as slightly-moderately disturbed and the 80% protection level relates to highly disturbed systems.

(f) Sample collected from a disconnected pool and is not considered representative of the water quality of flowing water in the creek.

Bold – above trigger value.

ID = insufficient data to derive a reliable trigger value.

- = no guideline value.

4.2.1.1 Field parameters and major ion chemistry

Surface water salinity (EC) is inversely correlated with rainfall and surface water flow. Typically surface water EC spikes then sharply decreases after rainfall events as relatively fresh runoff is routed into streams (Figure 4.2). This trend has been consistent since AGL commenced surface water monitoring in March 2011. The initial spike (sudden transient increase) in EC is often seen in the initial runoff phase as readily dissolvable salts are flushed from the ground surface and shallow soils across the whole catchment. After the initial salinity spike and a reduction in EC levels, the EC gradually increases as flow decreases during periods of recession, and as groundwater discharge becomes a more dominant component of flow. Evaporative concentration of salts may also be taking place in residual and connected pools.

A period of low rainfall occurred between December 2013 and February 2014, which resulted in a period of 'no flow' or very low flow, when the river was characterised by multiple disconnected pools. EC measurements from these periods are therefore not considered to be representative of the salinity of flowing water in the Avon River and Dog Trap Creek; however the EC measurements provide some indication of local groundwater accessions. For the majority of the first half of 2014, water levels fell below the level at which the dataloggers were set at TSW01 and TSW02, so no EC data was collected for that period at those

locations. Additional "low-level" loggers were installed at TSW01 and ASW01 to enable EC measurements below the initial data logger level setting (Figure 4.2).

The surface water continued to be classified mostly as fresh. From continuous EC logging during the first half of 2014, the minimum EC was approximately 100 µS/cm (ASW01) and the maximum EC was 696 µS/cm (ASW01). The spike in EC at ASW01 in May 2014 can be attributed to the rainfall events in late April 2014.

Salinity was slightly more elevated at FSW01 compared to the upstream Avon River location at ASW01 at the time of the high rainfall event in March 2014. The extra salinity load is attributed to inflows from Dog Trap Creek (as seen in TSW02) rather than runoff from the irrigation area. The Dog Trap Creek tributary contributes more saline inflows than the contribution from the upstream Avon River.

The pH values were slightly acidic to basic across the three sampling locations for the routine February and May 2014 sampling events, with pH outside the ANZECC (2000) guideline range at ASW01 in February 2014. For the event monitoring sample in March 2014, the pH at the downstream location FSW01 was comparable to that of the upstream location ASW01 and outside the ANZECC (2000) guideline value range.

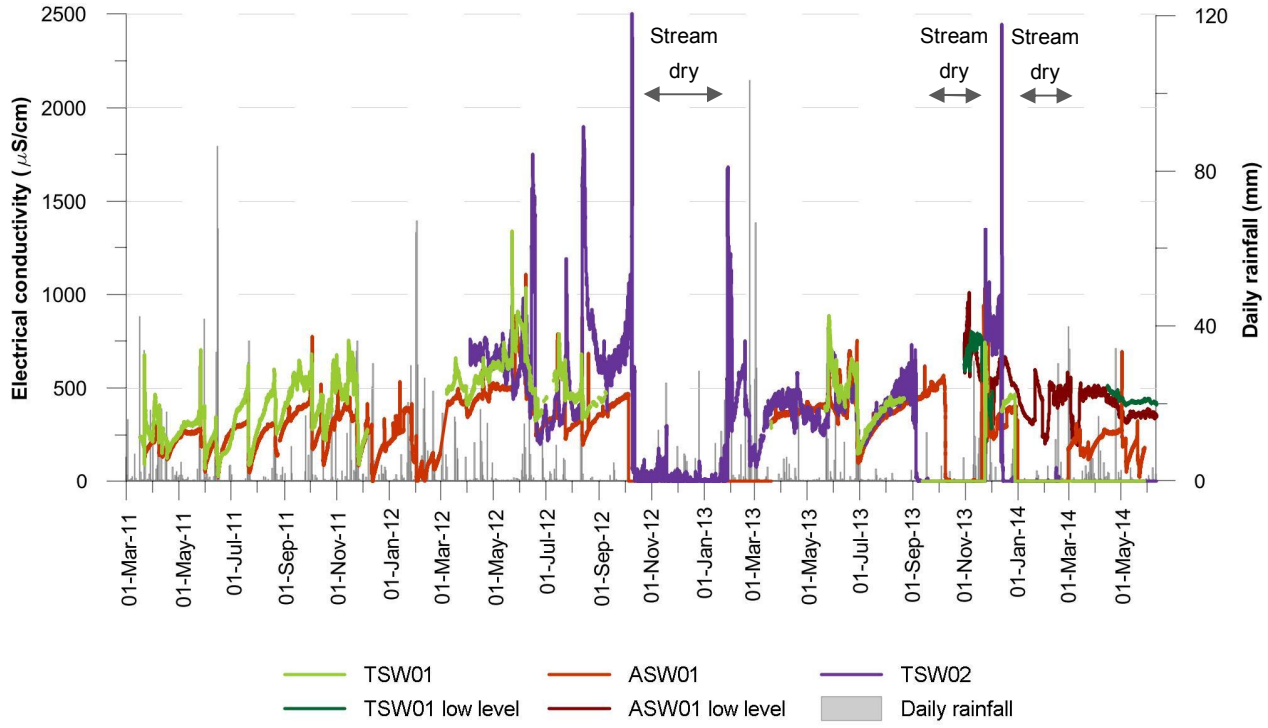

Figure 4.2 Continuous EC logging results at stream gauges

The water type was Na–Mg–Cl–HCO_3 in February 2014 at TSW01 and Na–Mg–Ca-Cl–HCO_3 at ASW01, as shown on the piper diagrams (Appendix C). The water type was Na-Cl-HCO_3 in May 2014 at TSW01 and ASW01 and was Na-Mg-Cl at TSW02.

4.2.1.2 Dissolved metals

Concentration of dissolved aluminium, arsenic, barium, bromine, cobalt, copper, iron, manganese, nickel, strontium and zinc were detected above the laboratory LOR in at least one of the three surface water sites. All these values were consistently below the ANZECC (2000) guidelines, except for aluminium at TSW02 in May 2014. All other dissolved metal analytes were either equivalent to or were below the laboratory LOR.

4.2.1.3 Nutrients

Nutrient concentrations were consistently below the ANZECC (2000) guidelines for the routine February and May 2014 sampling events, except for total phosphorus at TSW01 and ASW01 in February and May 2014. The total phosphorus concentration at TSW02 in May 2014 was equal to the ANZECC (2000) guideline. The total phosphorus concentration increased at ASW01 during the event sampling in March 2014, and is likely related to the high rainfall event in March 2014 and the associated surface runoff.

4.2.2 Irrigation plot runoff

Irrigation plot runoff is captured by CDE and CDW. These catch dams are designed to capture runoff from the trial Stage 1A area during larger rainfall events. The irrigation plan is to maintain an irrigation deficit so there will always be capacity in the treated soil profile to accept rain events in a similar manner to the surrounding soils. Subject to the frequency, intensity, and duration of larger rain events, surface runoff may occur from the irrigation area. In such instances, the initial runoff from the area is captured in the catch dams and returned to the Tiedman water storage dams. After capturing the first flush, any further runoff is allowed to overflow the catch dams as overland flow.

During the routine February and May 2014 sampling events there was minimal runoff water stored in the catch dams; however there was sufficient water to enable sampling. Water collected in the catch dams was subsequently recycled back into the Tiedman dams and not released into the environment. As there was no overland flow to the Avon River, there is no comparison of the February and May 2014 data to the adopted ANZECC (2000) guidelines.

Following the large rainfall event in early March 2014 both catch dams were allowed to overflow and water samples were collected. The February, March and May 2014 results for key analytes are presented in Table 4.2, along with the ANZECC (2000) guideline for the protection of fresh water ecosystems for comparison with the March 2014 event only.

Water quality time-series plots are provided in Figures B-1 to B-23 of Appendix B, piper diagrams in Appendix C and laboratory analysis reports in Appendix D.

Table 4.2 February, March and May 2014 results for the catch dams

Analyte[a]	Units	ANZECC 2000 guidelines[b]		CDE			CDW		
		95%[e]	80%[e]	Feb 2014	Mar 2014[d]	May 2014	Feb 2014	Mar 2014[d]	May 2014
pH	pH units	6.5-8.0[c]		7.34	7.77	9.27	9.24	7.49	9.29
EC	µS/cm	125-2,200[c]		287	145	214	772	296	162
Sodium	mg/L	-	-	28	16	23	86	38	16
Chloride	mg/L	-	-	26	9	26	111	26	21
Boron	mg/L	0.37	1.30	<0.05	<0.05	<0.05	0.07	<0.05	<0.05
Iron	mg/L	ID	ID	4.10	0.50	0.08	0.66	0.84	0.27
Manganese	mg/L	1.9	3.6	0.207	0.078	0.006	0.964	0.013	0.024
Total phosphorus	mg/L	0.05[c]		2.16	**1.08**	0.65	2.21	**1.76**	0.75
Ammonia	mg/L	0.9	2.3	1.36	0.06	0.01	0.05	0.19	<0.01

Notes:

(a) All metals are dissolved.

(b) ANZECC 2000 – Water Quality Guidelines: trigger values for the protection of freshwater aquatic ecosystems.

(c) ANZECC 2000 – Water Quality Guidelines: default trigger values for aquatic ecosystems, south-east Australia, low lying river ecosystems.

(d) High rainfall event sampling early March 2014 (also shaded grey to highlight differences).

(e) Protection level signifies the percentage of species expected to be protected. In most cases the 95% protection level trigger values apply to ecosystems classified as slightly-moderately disturbed and the 80% protection level relates to highly disturbed systems.

Bold – above trigger value (March 2014 data only).

ID = insufficient data to derive a reliable trigger value.

- = no guideline value.

4.2.2.1 Field parameters and major ion chemistry

The water in the catch dams can be classified as fresh and neutral to slightly alkaline. The slightly alkaline pH is typical for CDE and CDW, particularly when there has been minimal rainfall, such as in May 2014. The EC values at CDW and CDE in the first half of 2014 were lower compared to the late 2013 results.

Analysis of major ion components indicate that the water in the catch dams is dominated by sodium, calcium, sulphate and bicarbonate, as illustrated on the piper diagrams (Appendix C). It is different in character to the blended irrigation water quality because the water is predominantly runoff across the amended soil profile.

The continuous EC logger data for the CDW and CDE from 7 May 2013 to 13 May 2014 are plotted in Figure 4.3. The increases in salinity in the catch dams (in late 2013 and again in early 2014 to March 2014) are mainly attributable to limited rainfall (and runoff) and evaporative concentration of stored water within each of the dams. Decreases in salinity are visible in both catchment dams as a response to rainfall. Salinities have remained low after rainfall in March 2014 because of lesser evaporation.

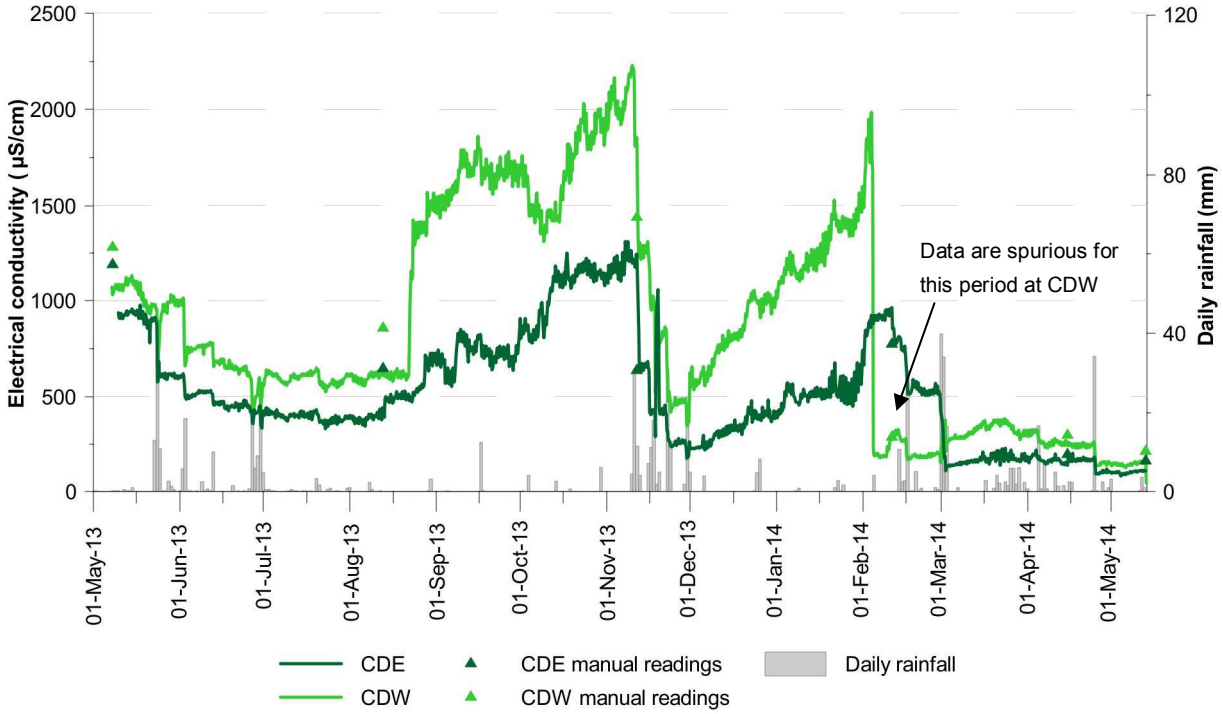

Figure 4.3 Continuous EC data at CDE and CDW

4.2.2.2 Dissolved metals

Concentrations of dissolved aluminium, arsenic, barium, boron, bromine, cobalt, copper, iron, manganese, molybdenum, nickel, strontium and zinc were detected above the laboratory LOR during at least one monitoring event. All other dissolved metal analytes were either equivalent to or were below the laboratory

LOR. Concentrations of dissolved metals were generally comparable to the late 2013 results, with the exception of CDW in February 2014, where higher concentrations were detected.

For the overflow event in March 2014, aluminium and zinc concentrations were above the ANZECC (2000) guidelines at CDW and CDE, and copper concentrations were above the ANZECC (2000) guidelines at CDW only.

4.2.2.3 Nutrients

Ammonia and total phosphorus concentrations measured at the two catchment dams deviated from the late 2013 results. The total phosphorus concentrations recorded in February 2014 were the highest recorded since the beginning of irrigation.

In March 2014, the (overflow) catch dam water quality was below the ANZECC (2000) guideline values except for total phosphorus at both catch dams.

5. Groundwater monitoring

5.1 Groundwater occurrence

This section is included to provide additional explanation of the different groundwater systems that occur in the immediate area of the Tiedman irrigation program areas. It has been included to specifically address Condition 6a) (5) in the REF approval extension that states:

"Provide a justification for the absence of monitoring of the water table beneath the area irrigated with blended produced water."

Groundwater in the vicinity of the Stage 1A and 1B areas occurs in two different geologies:

- groundwater in the alluvial sediments beneath the alluvial floodplain (located adjacent to the western end of the Stage 1A irrigation area)
- groundwater in shallow fractured rock (located beneath and adjacent to both irrigation areas on the valley sides off the floodplain).

Both these systems contain a water table. The alluvial water table is shallow (generally less than 3 m from surface) and the hydraulic gradient is from south to north following the topography. In the vicinity of the Avon River, shallow groundwater from the alluvium discharges to the river during periods of low flow (i.e. the river is a gaining stream) while during flood events the river loses water to the alluvial groundwater system for a short time. Water table rises and falls are quite dynamic and respond quickly to rainfall and river stage events. AGL has three monitoring bores into the alluvium near the irrigation areas (TMB01, TMB02 and TMB03), and the trends at these locations is described in Sections 5.2.1 and 5.3.1.

The shallow fractured rock water table tends to be deeper than the alluvial water table however there is still a general hydraulic gradient down-valley and towards the river. There is diffuse discharge from the fractured rock aquifer to the alluvial aquifer along the floor of the valley. The influence of rainfall recharge on this groundwater system is low and is lagged by weeks and months. AGL is monitoring this water table at S4MB01 (adjacent Stage 1A), TTMB02 (east of Stage 1A) and TCMB01 (adjacent Stage 1B) in the near vicinity of the irrigation area.

Additional monitoring of this water table beneath the irrigation area is not warranted given that deficit irrigation is practiced and the only recharge to this aquifer system is via large rainfall events. There is no rise or fall at any of these adjacent sites that can be attributed to irrigation so there is no justification for monitoring beneath the irrigation area at multiple sites.

The only other sub-surface water is soil water in the unsaturated zone. This is monitored at the SP locations (see Section 5.3.3 and Fodder King 2014). This water is not groundwater, it is normally ephemeral, localised, and does not flow like the above regional aquifer systems.

5.2 Groundwater levels

5.2.1 Shallow alluvium

In general, groundwater levels show a clear response to rainfall events and no response to irrigation events. The magnitude and rate of the response to rainfall varies between the shallow alluvial bores (Figure 5.1). The greatest groundwater level response continued to be recorded at TMB01, followed by TMB02 and TMB03.

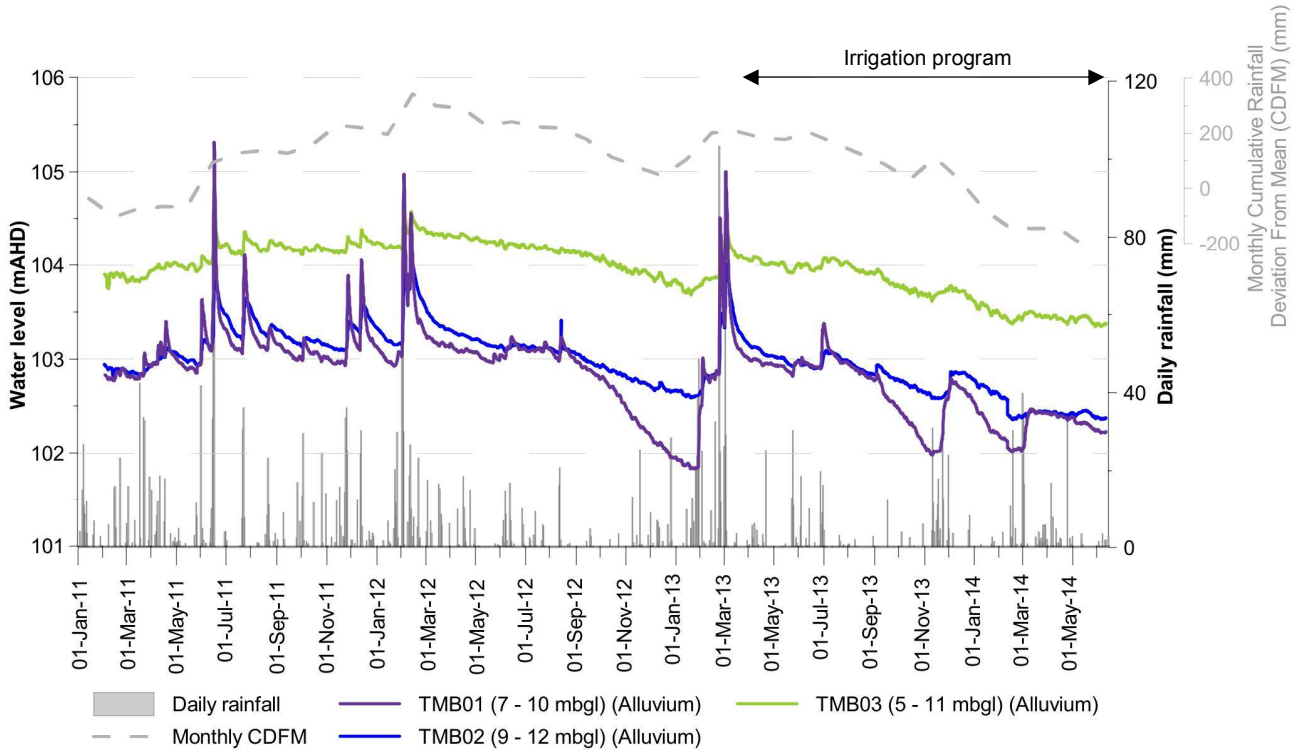

Figure 5.1 Groundwater levels for alluvial monitoring bores (TMB01, TMB02 and TMB03)

The groundwater level hydrographs can be divided into two main response types:

1. Monitoring bores TMB01 and TMB02 show a rapid response to rainfall recharge followed by a return to near-previous levels over a period of one to two months (i.e. a short term increase in storage). These responses imply direct recharge from rainfall and/or flooding and relatively high permeability of the alluvium. TMB01 also demonstrates that groundwater (near the river) quickly drains and contributes to stream baseflows during extended dry periods such as in Spring 2012 and Spring 2013.
2. Monitoring bore TMB03 shows a more subdued response to rainfall recharge. In addition groundwater responses are more pronounced for larger rainfall events that exceed a certain threshold (> ~35 mm/day). However smaller rainfall events show little or no obvious responses. Such responses imply rapid recharge during larger surface runoff and flooding events, although less significant recharge than by direct rainfall infiltration alone.

These observations are consistent with field observations during bore installation that show that there is a clay layer (approximately 1–2 m in thickness) above the alluvial mixed gravels at some locations. The clay layer would impede recharge to groundwater due to smaller rainfall events.

A decline in the groundwater levels is visible since irrigation begun in April 2013, although the decline is in line with declining CDFM. No change in groundwater levels in the alluvial monitoring bores has been observed as a result of the irrigation program.

5.2.2 Shallow bedrock

The hydrograph for S4MB01 is presented in Figure 5.2. The groundwater level shows no direct response to rainfall or irrigation. There has been a small 0.3 m increase in water level since early 2011 which is attributable to gradual recharge due to slow rainfall infiltration over a broad area. The effects of hydraulic testing (‘slug’ testing) and low flow sampling are visible in April 2011 and December 2011. The very slow recovery of groundwater levels after these events is consistent with low permeability in this unit (Parsons Brinckerhoff 2012).

Groundwater levels slightly decreased (0.2 m) over the first part of 2014, with only a minimal increase in groundwater levels after the rainfall events in February/March and April 2014. Water levels are now starting to decline because of the extended dry period since late 2013. Groundwater levels have not changed as a result of the irrigation program.

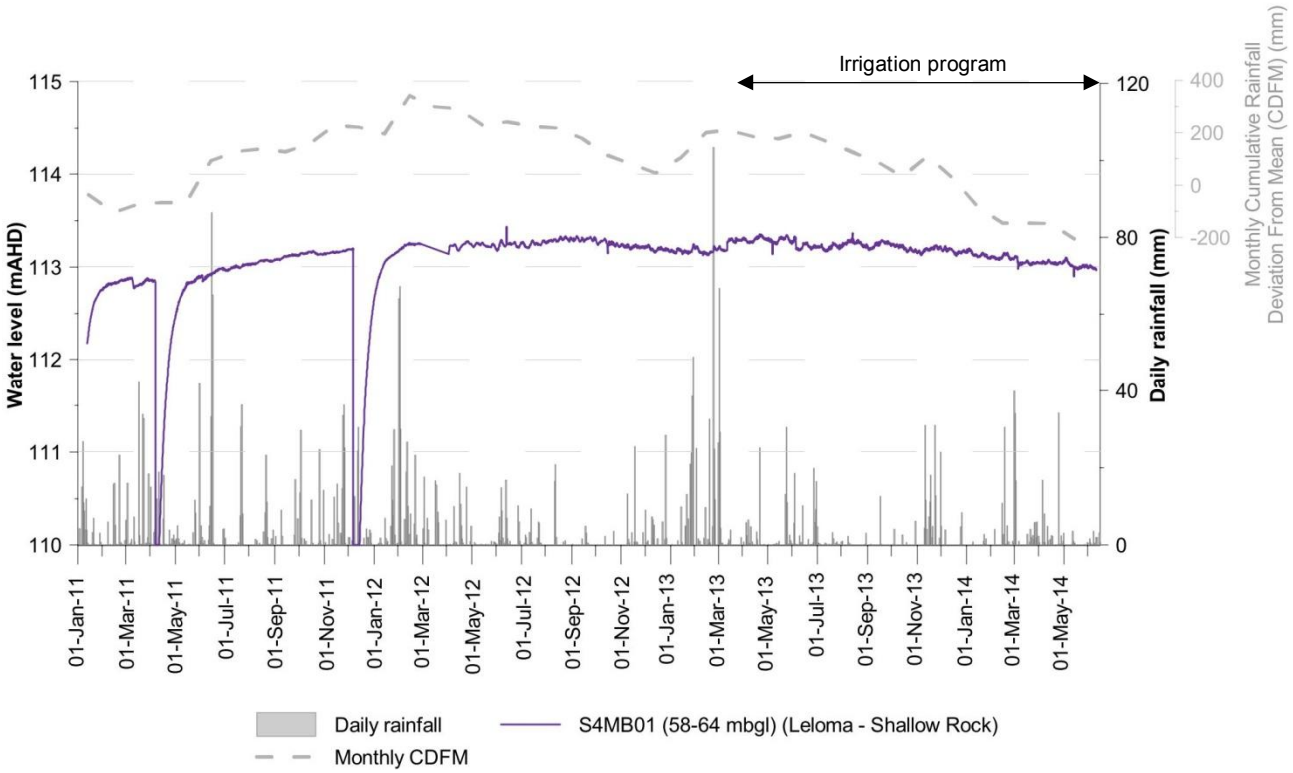

Figure 5.2 Groundwater levels for the shallow bedrock monitoring bore (S4MB01)

5.3 Groundwater quality

The water quality for shallow alluvial groundwater and shallow bedrock groundwater sampled in February and May 2014 is assessed in this section and is compared to the groundwater pre-irrigation baseline values (Table 2.11) and the results obtained during the late 2013 sampling events. Water quality data are presented in Appendix A. Time-series plots are provided in Figures B-1 to B-23 in Appendix B, piper diagrams in Appendix C and laboratory analysis reports in Appendix D.

5.3.1 Shallow alluvium

The groundwater quality results for the main analytes for the shallow alluvium bores (TMB01, TMB02 and TMB03) are presented in Table 5.1.

Table 5.1 February and May 2014 results for the shallow alluvium monitoring bores

Analyte[a]	Units	Groundwater baseline range[b]	TMB01		TMB02		TMB03	
			Feb 2014	May 2014	Feb 2014	May 2014	Feb 2014	May 2014
pH	pH units	6.32-7.77	6.53	6.55	**6.17**	**6.19**	6.38	6.48
EC	µS/cm	3,199-13,848	8,657	8,879	4,031	3,765	6,197	5,708
Sodium	mg/L	484-1,350	1,310	1,290	566	452	767	777
Chloride	mg/L	841-2,940	2,450	2,770	1,040	970	1,560	1,310
Boron	mg/L	<0.05-0.27	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	mg/L	0.36-6.53	2.48	2.47	4.34	6.44	5.68	2.28
Manganese	mg/L	0.223-1.730	1.04	1.02	1.71	1.48	1.66	1.62
Total P	mg/L	0.02-0.10	na	0.06	na	0.04	na	0.06
Ammonia	mg/L	<0.10-2.45	na	0.20	na	0.32	na	0.15

Notes:
(a) All metals are dissolved.
(b) Groundwater pre-irrigation baseline data from Parsons Brinckerhoff (2013a).
Bold – outside groundwater baseline range.
na – not analysed.

5.3.1.1 Field parameters and major ion chemistry

Groundwater in the shallow alluvium remained slightly saline in both monitoring rounds. Salinity fluctuated in a comparable way at TMB02 and TMB03, showing an increase in February 2014, followed by a decrease in May 2014. TMB01 remained saline during both monitoring events.

The pH conditions slightly decreased at all bores from the previous monitoring round in November 2013. At TMB02 and TMB03 the pH levels are slightly acidic and are below the pre-irrigation baseline range.

Analysis of major ion components indicate that the alluvial groundwater is generally a Na–Mg–Cl type or Na-Mg-Ca-Cl types as shown on the piper diagrams.

5.3.1.2 Dissolved metals

The dissolved metal concentrations in the February and May 2014 sampling events were generally low and within the baseline range.

5.3.1.3 Nutrients

Nutrient concentrations remained within the baseline range for the May 2014 sampling event.

5.3.2 Shallow bedrock

One monitoring bore, S4MB01, is screened within the shallow bedrock for this monitoring program. The groundwater quality results for the main analytes are presented in Table 5.2.

Table 5.2 February and May 2014 results for the shallow bedrock monitoring bore

Analyte[a]	Units	Groundwater baseline range[b]	S4MB01	
			Feb 2014	May 2014
pH	pH units	6.32 - 7.77	7.29	7.41
EC	µS/cm	3,199 - 13,848	4,841	4,871
Sodium	mg/L	484 - 1,350	751	640
Chloride	mg/L	841 - 2,940	1,180	1,130
Boron	mg/L	<0.05 - 0.27	0.17	0.12
Iron	mg/L	0.36 - 6.53	**0.07**	**0.07**
Manganese	mg/L	0.223 - 1.730	0.241	0.245
Total P	mg/L	0.02 - 0.10	na	0.06
Ammonia	mg/L	<0.10 - 2.45	na	1.88

Notes:
(a) All metals are dissolved.
(b) Groundwater pre-irrigation baseline data from Parsons Brinckerhoff (2013a).
Bold – outside groundwater baseline range.
na – not analysed.

5.3.2.1 Field parameters and major ion chemistry

Groundwater sampled from S4MB01 was slightly saline with neutral pH. All results are within groundwater pre-irrigation baseline range (Table 2.11).

The water type at S4MB01 was a Na-Ca-Cl type as shown on the piper diagrams (Appendix C).

5.3.2.2 Dissolved metals

Most dissolved metals were below the laboratory LOR for the monitoring period, with the exception of the following metals, for which concentrations were above the laboratory LOR for at least one monitoring event:

- Aluminium, arsenic, barium, boron, bromine, copper, iron, manganese, nickel, uranium and zinc; although concentrations were in line with baseline ranges.
- Chromium; concentrations were higher than the other groundwater locations and no baseline measurements were taken.
- Strontium; concentrations have consistently been the highest of the groundwater locations throughout the baseline period and they continue to be the highest for this monitoring period.

5.3.2.3 Nutrients

Nutrient concentrations were consistently below the baseline range for the February and May 2014 sampling events.

5.3.3 Perched water

Perched water was present in some dual piezometers associated with the irrigation area when inspected during the routine February and May 2014 sampling events. Overall, rainfall dominated over irrigation over this monitoring period, with 59.5% of water across to the irrigation areas being precipitation. However during the months preceding the February 2014 sampling event, irrigation was more dominant than rainfall and monitoring bore SP5B had accumulated enough water to allow a water sample to be collected. During the

months preceding the May 2014 sampling event, rainfall was more dominant than irrigation. Monitoring bores SP5B, SP6A, SP6B, SP7A and SP8A had accumulated enough water to allow for a water sample to be collected.

“A” locations are located inside the irrigation areas while “B” locations are located adjacent and outside the irrigated areas. There were only two locations where soil water persisted outside of the irrigated areas suggesting that there was minimal lateral migration of perched water in the soil profile and that most irrigation water was being transpired by the crops within the main irrigation area.

The only paired location with sufficient water for sampling was the SP6A/6B site located beside CDW (Figure 1.1). The water quality results for the main analytes for the perched water monitoring piezometers in and around the irrigation area are presented in Table 5.3.

Table 5.3 February and May 2014 results for the perched water monitoring bores

Analyte[a]	Units	SP5B		SP6A	SP6B	SP7A	SP8B
		Feb 2014	May 2014	May 2014	May 2014	May 2014	May 2014
pH	pH units	7.24	7.24	7.15	6.98	7.12	7.10
EC	µS/cm	3,877	5,050	4,548	4,720	1,847	1,661
Sodium	mg/L	803	941	803	806	283	258
Chloride	mg/L	879	1,320	1,100	1,210	339	361
Boron	mg/L	0.1	<0.05	<0.05	<0.05	0.12	0.14
Iron	mg/L	1.27	2.26	1.50	2.03	0.71	0.49
Manganese	mg/L	0.229	0.224	0.092	0.499	0.072	0.136
Total P	mg/L	6.03	1.39	0.06	0.17	3.65	2.30
Ammonia	mg/L	0.14	0.03	0.02	0.13	0.63	0.07

5.3.3.1 Field parameters and major ion chemistry

Water from the perched water monitoring piezometers was brackish and there is no consistent trend in salinity from site to site. The pH conditions were mainly neutral which is typical of the shallow soil profile.

Analysis of major ion components indicate that the water is generally a Na–Cl type as shown on the piper diagrams (Appendix C).

Comparison between the paired 6A/6B site piezometers (either side of CDW) indicates that the water is of similar chemical composition which is reflective of the soil water at this location and there no losses from the lined catch dam.

5.3.3.2 Dissolved metals

Dissolved metal concentrations were detected at all monitoring piezometers. These levels are indicative of the shallow soil characteristics.

6. Discussion

6.1 Water levels

Continuous monitoring indicates that the alluvial groundwater levels and surface water levels respond to rainfall recharge. The rainfall response is immediate and pronounced, and sharp recession curves are often observed. Such a response suggests moderate to high permeability in the shallow alluvial bores; and for the surface water a rapid runoff response from a relatively small upstream catchment. There appears to be limited riverbank storage and groundwater baseflow contributions.

A minimal and lagged rainfall response is observed at the shallow bedrock monitoring bore (S4MB01) suggesting groundwater levels respond to rainfall recharge over a broad area.

Water levels have not altered in the alluvium, shallow fractured rock, or the river in response to the irrigation program.

6.2 Water quality

The surface water quality parameters were assessed against the ANZECC (2000) guidelines for the protection of freshwater aquatic ecosystems (95% protection levels) (for toxicants) and the default trigger values for aquatic ecosystems, south-east Australia, low lying river ecosystems (for physical and chemical stressors). When overflow occurred from the catch dams, the water quality was also assessed against these guidelines. TSD water quality was assessed against the ANZECC (2000) guidelines for Primary Industries (irrigation). Groundwater quality is compared to pre-irrigation baseline values.

No guidelines apply to the perched water in the seepage monitoring bores adjacent to the Tiedman dams or the soil water piezometers within and adjacent to the irrigation area.

6.2.1 Produced and blended irrigation water

6.2.1.1 Tiedman dams

TND and TED store produced water and mostly fresh water respectively from exploration programs, while at TSD the water from TND and TED is blended and stored prior to irrigation. Water quality monitoring in the Tiedman dams indicates that the water is alkaline and marginal to slightly saline. The EC measurements in February and May 2014 for the blended water irrigation dam (TSD) remained below the ANZECC (2000) irrigation guideline value of 2,000 µS/cm. Latest pH values were generally above the ANZECC guideline range (6.00-9.00) for all dams. Dissolved metal concentrations were mostly above the laboratory LOR, below the ANZECC (2000) guidelines, and comparable between the three dams and the previous monitoring rounds.

Total phosphorus, ammonia and TOC concentrations typically remained elevated compared to the whole monitoring period and overall nutrient concentrations were highest at TND (the dam storing the remaining produced water).

The water quality in the blended water irrigation dam (TSD) was within the ANZECC (2000) irrigation guidelines, with the exception of pH, which exceeded the guideline in February (pH 9.72) and May 2014 (pH 9.28). Iron concentrations exceeded the ANZECC (2000) guideline in February 2014 (5.38 mg/L) and May 2014 (0.57 mg/L). Elevated iron concentrations are not unusual for groundwaters. The total phosphorus level was also in excess of the ANZECC irrigation guideline; however the guideline is only set at this low concentration to minimise bioclogging of irrigation equipment.

6.2.1.2 Seepage monitoring bores

The perched groundwater intersected by the seepage monitoring bores around the Tiedman dams remained slightly saline and acidic. The pH and salinity of this water differs from that within the Tiedman dams: salinity measurements are much higher and pH concentrations much lower in the soil/pore water compared to the dam water.

Dissolved metals were slightly elevated, in particular iron and manganese concentrations. Overall dissolved metal concentrations were higher in the seepage bores because of the nature of the parent soils and the weathered rock. Ammonia and total phosphorus were detected at concentrations lower than in the holding dams.

The differences in major/minor ions and dissolved metal chemistry, in addition to different nutrient concentrations, indicate that the soil/pore water in TMB04 and TMB05 is not derived from leakage from the Tiedman dams and is not shallow groundwater in the fractured rock.

6.2.2 Surface water

The salinity of the surface water is inversely correlated with rainfall and surface water flow. Typically surface water salinity sharply decreases after rainfall events (after an initial salinity spike) as relatively fresh runoff is routed into streams. The surface water can be classified as fresh and pH values were near neutral.
The salinity in Dog Trap Creek as recorded during the May 2014 sampling event was brackish.
This concentration is not considered to be representative of the salinity of flowing readings recorded by the datalogger.

Concentration of dissolved aluminium, arsenic, barium, bromine, cobalt, copper, iron, manganese, nickel, strontium and zinc were detected above the laboratory LOR in at least one of the three surface water sites. All these values were consistently below the ANZECC (2000) guidelines for the protection of freshwater aquatic ecosystems (95% protection levels), except for aluminium at TSW02 in May 2014. All other dissolved metal analytes were either equivalent to or were below the laboratory LOR.

Dissolved metal concentrations in surface water were typically lower than concentrations observed in the shallow alluvium and shallow bedrock groundwater samples highlighting the dominance of surface water runoff over groundwater accessions. Surface water consistently has a different character to the blended irrigation water.

Total phosphorus concentrations typically exceeded the ANZECC (2000) trigger values for aquatic ecosystems (south-east Australia, low lying river ecosystems).

There was no salinity or pH impact at the downstream monitoring location FSW01 as a result of the rainfall and high river flow event in early March 2014. Total phosphorus concentrations increased at FSW01 and ASW01 during sampling in March 2014 and are likely related to the high rainfall event in March 2014 and associated surface runoff over a broad area.

No change in water quality in adjacent surface water receptors is observed as a result of the irrigation program.

6.2.3 Irrigation plot runoff

Samples taken during the routine sampling events in February and May 2014 from the two catch dams (CDW and CDE) were taken of the residual stored waters that were recycled back to the Tiedman dams and not released into the environment. The water quality results are expected given the evaporative concentration effects and the residual effect of the feedlot compost, and lime, gypsum, and zeolite additives that were used to improve the soils across the Stage 1A irrigation area.

The water quality at CDW and CDE during the overflow event in March 2014 was fresh and pH values were neutral. The total phosphorus concentrations at CDW and CDE exceeded the ANZECC (2000) trigger values for aquatic ecosystems (south-east Australia, low lying river ecosystems).

6.2.4 Groundwater

Groundwater within the shallow alluvium continued to be slightly saline and slightly acidic. At TMB02 the pH was below the pre-irrigation baseline range. Most dissolved metals were above the laboratory LOR and within the pre-irrigation baseline range for all analytes. Nutrient concentrations were all within the pre-irrigation baseline range.

Groundwater in the shallow bedrock remained slightly saline with neutral pH. Dissolved metal and nutrient concentrations were within the pre-irrigation baseline range.

No change in shallow groundwater quality is observed as a result of the irrigation program.

6.2.5 Soil water

The perched water in soils in and near the irrigation area was fresh to brackish and near neutral pH. Dissolved metals concentrations were detected at most piezometers within the soil water and are indicative of the shallow soil characteristics.

This soil water is generally ephemeral (although it persists at some sites) and does not flow in the landscape like groundwater.

7. Conclusions and recommendations

Surface water and groundwater monitoring for the Tiedman irrigation program commenced in October 2011 and was established in accordance with the approved Water Management Plan (AGL 2012). The monitoring aims to ensure that the quality of the water used for irrigation is in accordance with this plan and adopted guidelines, and that the application of irrigated water does not result in impacts on the local surface water or groundwater resources.

ANZECC (2000) irrigation guidelines were used for the blended water that was irrigated across the Stage 1A and Stage 1B areas. ANZECC (2000) guidelines for the protection of aquatic ecosystems (freshwater) were compared with surface water quality analyses.

Monitoring during the six month period to 4 July 2014 showed there was no change in stream levels, alluvial or shallow fractured rock groundwater levels attributable to the irrigation program activities. Surface water and groundwater levels remained comparable to the results from the previous compliance report (Parsons Brinckerhoff 2014).

The blended water used for irrigation complied with the ANZECC (2000) irrigation guidelines, with the exception of pH (all events), iron (all events) and total phosphorus (all events) which continued to exceed the guidelines. The pH exceedance was just over the guideline for the February and May 2014 events, and the phosphorus exceedance relates to a guideline that is set to minimise bioclogging of irrigation equipment. The blended water in the Tiedman South dam (TSD) is assessed as suitable for irrigation.

There were a few minor exceedances of the ANZECC (2000) guidelines for the protection of freshwater aquatic ecosystems (95% protection levels) and the trigger values for aquatic ecosystems (south-east Australia, low lying river ecosystems) during the monitoring period for surface water, however there was no change in overall natural (baseline) surface water quality as a result of the irrigation program activities.

Monitoring during the 6 month period to 4 July 2014 showed there was no change in stream, alluvial or shallow fractured rock groundwater water quality that is attributable to irrigation program activities. Surface water and groundwater quality remained comparable to the results from the previous compliance report.

It is recommended surface water and groundwater monitoring should continue as outlined in the approved WMP (AGL 2012) given the extension of the irrigation program to 30 April 2015. If blended water irrigation is proposed for the period to 30 April 2015 then the pH of the water should be checked to ensure that it is below the irrigation guideline of 9. If elevated, it is recommended that adjustment of the blended water in TSD occur to slightly lower the pH to within baseline range.

8. Statement of limitations

8.1 Scope of services

This water compliance report (the report) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and Parsons Brinckerhoff (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

8.2 Reliance on data

In preparing the report, Parsons Brinckerhoff has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, Parsons Brinckerhoff has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Parsons Brinckerhoff will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Parsons Brinckerhoff.

8.3 Environmental conclusions

In accordance with the scope of services, Parsons Brinckerhoff has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

On all sites, varying degrees of non-uniformity of the vertical and horizontal soil or groundwater conditions are encountered. Hence no monitoring, common testing or sampling technique can eliminate the possibility that monitoring or testing results/samples are not totally representative of soil and/or groundwater conditions encountered. The conclusions are based upon the data and the environmental field monitoring and/or testing and are therefore merely indicative of the environmental condition of the sites at the time of preparing the report. Also, it should be recognised that site conditions can change with time.

Within the limitations imposed by the scope of services, the monitoring and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

8.4 Report for the benefit of the client

The report has been prepared for the benefit of the client (and no other party), but may be relied upon by the administering authority. Parsons Brinckerhoff assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of Parsons Brinckerhoff or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Except as provided below, parties other than the client should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

8.5 Other limitations

Parsons Brinckerhoff will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

9. References

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Appendix A

Summary tables

Summary table A1: May 2013 Water quality results

Water quality parameters	Units	TMB01	TMB02	TMB03	TMB04	TMB05	S4MB01	Tiedman south dam (TSD)^^	Tiedman south dam (TSD)	Tiedman north dam (TND)	Tiedman east dam (TED)	Catch dam west	Catch dam east	TSW01	TSW02	ASW01
Sample date		6/05/2013	7/05/2013	6/05/2013	7/05/2013	7/05/2013	6/05/2013	24/04/2013	7/05/2013	7/05/2013	7/05/2013	7/05/2013	7/05/2013	6/05/2013	6/05/2013	8/05/2013
Formation		Alluvium	Alluvium	Alluvium	Seepage	Seepage	Shallow Bedrock	Dam	Dam	Dam	Dam	Irrigation plot runoff	Irrigation plot runoff	Surface Water	Surface Water	Surface Water
Field parameters																
Temperature	oC	18.80	17.78	18.14	18.36	17.95	19.68	21.62	19.66	19.89	18.02	18.09	17.94	15.29	16.95	12.49
EC	µS/cm	7,841	3,605	5,827	6,987	6,779	4,722	1,543	1,679	3,991	1,214	1,277	1,186	454	371	397
Dissolved Oxygen	% sat	na	61.7	91.2	42.6	111.1	94.5	na	71.3	79.5	89.6	172.7	121.6	104.3	92.0	48.3
Dissolved Oxygen	mg/L	na	5.83	8.43	3.93	10.42	8.59	na	6.46	7.05	8.48	16.19	11.97	na	8.87	5.15
pH	pH units	6.50	6.27	6.52	7.27	6.11	6.91	na	**9.09**	9.58	9.79	9.43	9.39	7.59	7.11	7.29
TDS	mg/L	na	na	na	na	na	na	1003	na	na	787	na	771	na	242	na
Redox	mV	-180.5	-103.8	-138.8	-119.0	0.8	-208.3	na	-121.3	-129.3	-135.2	-120.8	-131.4	-156.1	-95.1	-94
General parameters																
pH	pH units	7.10	6.98	7.18	6.54	5.98	7.58	**9.28**	**9.24**	9.54	9.84	9.26	9.18	7.21	7.20	7.49
EC	µS/cm	8,170	3,690	5,980	7,220	6,770	4,850	1,380	1,730	4,080	1,220	1,330	1,210	402	365	397
TDS	mg/L	4,240	2,150	3,420	3,910	3,930	2,790	924	914	2,430	720	958	865	168	150	161
Laboratory analytes																
Hydroxide alkalinity as $CaCO_3$	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate alkalinity as $CaCO_3$	mg/L	<1	<1	<1	<1	<1	<1	109	109	586	180	55	62	<1	<1	<1
Bicarbonate alkalinity as $CaCO_3$	mg/L	483	170	427	166	37	298	194	213	669	74	82	102	50	40	74
Total alkalinity as $CaCO_3$	mg/L	483	170	427	166	37	298	303	321	1,260	254	136	164	50	50	74
Total hardness as $CaCO_3$	mg/L	na	na	na	na	na	na	36	42	na	na	na	na	na	na	na
Sulfate as SO_4^{2-}	mg/L	93	37	215	683	245	138	87	103	<1	128	443	380	31	48	8
Sulphur as S	mg/L	na	na	na	na	na	na	27	29	na	na	na	na	na	na	na
Chloride	mg/L	2,430	1,000	1,480	1,890	2,150	1,210	218	266	563	164	102	94	72	48	72
Calcium	mg/L	203	126	228	90	44	217	6	7	3	11	89	78	12	7	16
Magnesium	mg/L	218	82	146	221	218	49	5	6	1	13	58	59	9	8	9
Sodium	mg/L	1,120	495	782	1,090	952	691	200	214	763	218	100	90	52	53	45
Potassium	mg/L	3	4	3	26	33	7	160	195	266	40	32	30	2	2	3
Fluoride	mg/L	0.2	0.1	0.2	0.8	0.7	0.2	**0.2**	**0.2**	0.6	0.2	0.3	0.2	<0.1	<0.1	0.1
Dissolved metals																
Aluminium	mg/L	<0.01	0.01	0.04	0.04	0.38	0.02	0.04	0.05	0.12	0.08	0.02	0.11	0.05	0.07	0.02
Arsenic	mg/L	0.001	0.003	0.004	0.002	<0.001	0.002	0.002	0.002	0.005	0.002	0.002	0.003	<0.001	<0.001	<0.001
Beryllium	mg/L	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	0.212	0.624	0.270	0.078	0.087	1.160	0.110	0.115	0.222	0.058	0.077	0.121	0.050	0.038	0.044
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	0.0002	0.0025	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt	mg/L	<0.001	0.006	0.003	0.055	0.248	<0.001	<0.001	<0.001	<0.001	0.001	0.002	0.004	<0.001	<0.001	0.002
Copper	mg/L	0.003	<0.001	0.002	0.001	0.01	0.001	0.002	0.001	<0.001	0.001	<0.001	0.004	0.005	0.002	<0.001
Lead	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.874	1.410	1.920	9.340	16.200	0.280	0.009	0.012	0.003	0.108	0.039	0.452	0.106	0.083	0.078
Molybdenum	mg/L	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.009	0.007	0.019	0.006	0.001	0.001	<0.001	<0.001	<0.001
Nickel	mg/L	<0.001	0.002	<0.001	0.028	0.116	<0.001	<0.001	<0.001	<0.001	0.001	0.002	0.004	0.003	0.004	0.001
Selenium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	5.490	2.870	6.670	0.918	0.695	25.00	0.218	0.262	0.280	0.177	0.559	0.452	0.249	0.191	0.23
Uranium	mg/L	0.002	<0.001	0.007	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.017	0.028	0.015	0.107	1.16	0.008	0.012	0.022	0.018	0.030	0.047	0.118	0.013	0.006	0.009
Boron	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	0.16	0.16	0.19	0.76	0.19	0.05	<0.05	**0.06**	<0.05	<0.05
Iron	mg/L	2.57	5.12	3.33	14.7	14.9	0.53	**0.54**	**0.47**	<0.05	0.15	<0.05	0.2	0.45	0.26	0.71
Bromine	mg/L	4.0	3.1	3.1	4.7	2.7	3.0	0.6	1.2	2.5	0.6	0.6	0.6	0.4	0.2	0.3
Nutrients																
Ammonia as N	mg/L	<0.01	0.34	0.18	0.29	3.96	1.85	0.06	0.03	0.02	0.02	0.06	0.12	<0.01	<0.01	0.02
Nitrite as N	mg/L	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/L	<0.01	<0.01	0.01	<0.01	0.23	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01
Total Phosphorous	mg/L	0.09	0.07	0.02	0.13	0.07	0.07	<0.01	**0.42**	1.69	0.51	0.84	0.47	**0.10**	**0.07**	<0.01
Reactive Phosphorous	mg/L	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.01	<0.01
Total Organic Carbon	mg/L	4	1	2	7	9	33	14	15	29	21	57	44	9	12	3
Total petroleum hydrocarbons																
C6-C9 Fraction	µg/L	<20	<20	<20	na	na	<20	na	<20	<20	<20	<20	<20	<20	<20	<20
C10-C14 Fraction	µg/L	<50	<50	<50	na	na	<50	na	<50	70	<50	<50	<50	<50	<50	<50
C15-C28 Fraction	µg/L	<100	<100	<100	na	na	<100	na	<100	270	310	<100	<100	<100	<100	<100
C29-C36 Fraction	µg/L	<50	<50	<50	na	na	<50	na	<50	50	70	<50	<50	<50	<50	<50
C10-C36 Fraction (sum)	µg/L	<50	<50	<50	na	na	<50	na	<50	390	380	<50	<50	<50	<50	<50
Total recoverable hydrocarbons																
C6-C10 Fraction	µg/L	<20	<20	<20	na	na	<20	na	<20	<20	<20	<20	<20	<20	<20	<20
C6-C10 Fraction minus BTEX (F1)	µg/L	<20	<20	<20	na	na	<20	na	<20	<20	<20	<20	<20	<20	<20	<20
>C10-C16 Fraction	µg/L	<100	<100	<100	na	na	<100	na	<100	110	<100	<100	<100	<100	<100	<100
>C16-C34 Fraction	µg/L	<100	<100	<100	na	na	<100	na	<100	270	340	<100	<100	<100	<100	<100
>C34-C40 Fraction	µg/L	<100	<100	<100	na	na	<100	na	<100	<100	<100	<100	<100	<100	<100	<100
>C10-C40 Fraction (sum)	µg/L	<100	<100	<100	na	na	<100	na	<100	380	340	<100	<100	<100	<100	<100
Aromatic hydrocarbons																
Benzene	µg/L	<1	<1	<1	na	na	<1	na	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	na	na	<2	na	<2	<2	<2	<2	<2	<2	<2	<2
Ethyl Benzene	µg/L	<2	<2	<2	na	na	<2	na	<2	<2	<2	<2	<2	<2	<2	<2
m&p-Xylenes	µg/L	<2	<2	<2	na	na	<2	na	<2	<2	<2	<2	<2	<2	<2	<2
o-Xylenes	µg/L	<2	<2	<2	na	na	<2	na	<2	<2	<2	<2	<2	<2	<2	<2
Total xlyenes	µg/L	<2	<2	<2	na	na	<2	na	<2	<2	<2	<2	<2	<2	<2	<2
Sum of BTEX	µg/L	<1	<1	<1	na	na	<1	na	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	µg/L	<5	<5	<5	na	na	<5	na	<5	<5	<5	<5	<5	<5	<5	<5
Dissolved gases																
Methane	µg/L	na	na	na	na	na	na	na	26	<10	<10	na	na	<10	<10	14.00
Phenolic compounds																
Phenol	µg/L	1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Chlorophenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2-Methylphenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
3-&4-Methylphenol	µg/L	102	<2.0	<2.0	na	na	<2.0	na	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
2-Nitrophenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dimethylphenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dichlorophenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2.6-Dichlorophenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
4-Chloro-3-Methylphenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2.4.6-Trichlorophenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
2.4.5-Trichlorophenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Pentachlorophenol	µg/L	<2.0	<2.0	<2.0	na	na	<2.0	na	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Polycyclic aromatic hydrocarbons																
Naphthalene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(b)fluoranthene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	µg/L	<0.5	<0.5	<0.5	na	na	<0.5	na	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g.h.i)perylene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	na	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Notes:

Bold number indicates that result exceeds applicable guideline values

^^ Pre-Irrigation sample

na - not analysed

PARSONS BRINCKERHOFF

Summary table A2: August 2013 Water quality results

Water quality parameters	Units	TMB01	TMB02	TMB03	TMB04	TMB05	S4MB01	Tiedman south dam (TSD)	Tiedman north dam (TND)	Tiedman east dam (TED)	Catch dam west	Catch dam east	TSW01	TSW02	ASW01
Sample date		13/08/2013	13/08/2013	13/08/2013	13/08/2013	13/08/2013	13/08/2013	13/08/2013	13/08/2013	13/08/2013	13/08/2013	13/08/2013	13/08/2013	13/08/2013	13/08/2013
Formation		Alluvium	Alluvium	Alluvium	Seepage	Seepage	Shallow Bedrock	Dam	Dam	Dam	Irrigation plot runoff	Irrigation plot runoff	Surface Water	Surface Water	Surface Water
Field parameters															
Temperature	^{o}C	18.46	17.93	17.57	19.11	17.51	20.56	14.78	14.55	16.51	18.71	12.49	13.42	15.01	12.5
EC	µS/cm	7,877	3,679	5,623	6,954	5,398	4,684	1,636	4,350	1,189	854	646	467	623	410
Dissolved Oxygen	% sat	18.1	16.8	12.6	11.2	17.0	10.0	25.4	28.9	25.0	20.5	50.8	18.6	21.6	14.0
Dissolved Oxygen	mg/L	1.65	1.59	1.18	1.01	1.60	0.89	2.57	2.91	2.42	1.91	5.38	1.91	2.17	1.48
pH	pH units	5.61	5.85	6.01	5.90	5.09	5.93	8.39	8.24	9.21	7.88	7.84	**6.11**	6.63	**8.67**
TDS	mg/L	6,855	3,201	4,892	6,050	4,697	4,076	1,424	3,785	1,034	743	420	406	542	357
Redox	mV	-29.7	-9.7	-14.6	76.4	139.4	-124.3	19.3	-21.2	4.4	1.1	40.6	-10	49.7	19.8
General parameters															
pH	pH units	7.07	6.82	7.19	6.26	5.88	7.73	**9.04**	9.43	9.36	8.83	8.2	7.53	7.56	7.46
EC	µS/cm	8,060	3,770	5,740	7,120	5,470	4,900	1,680	4,430	1,200	873	663	440	628	413
TDS	mg/L	5,170	2,280	3,420	5,140	3,360	3,030	1,020	2,640	708	632	453	228	325	279
Laboratory analytes															
Hydroxide alkalinity as $CaCO_3$	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate alkalinity as $CaCO_3$	mg/L	<1	<1	<1	<1	<1	<1	83	557	112	41	<1	<1	<1	<1
Bicarbonate alkalinity as $CaCO_3$	mg/L	613	195	586	138	32	517	248	828	154	176	170	74	76	80
Total alkalinity as $CaCO_3$	mg/L	613	195	586	138	32	517	331	1,380	276	216	170	74	76	80
Total hardness as $CaCO_3$	mg/L	1,330	683	982	1,120	818	820	50	5	69	295	222	74	95	74
Sulfate as SO_4^{2-}	mg/L	75	30	186	558	158	53	69	<1	96	181	104	12	27	8
Chloride	mg/L	2,400	985	1,310	1,830	1,540	1,170	276	616	159	49	47	82	132	74
Calcium	mg/L	168	130	169	85	34	223	10	2	8	62	46	13	15	13
Magnesium	mg/L	222	87	136	220	178	64	6	<1	12	34	26	10	14	10
Sodium	mg/L	1,150	503	869	1,070	800	688	229	777	211	78	57	54	81	53
Potassium	mg/L	3	4	2	25	40	7	142	288	44	21	22	3	6	3
Silicon as SiO_2	mg/L	35.4	32.4	30.4	52.6	46.4	27.2	10.9	16.6	10.4	0.5	1	11.6	1.8	14.2
Fluoride	mg/L	0.2	0.1	0.2	0.8	0.4	0.4	0.2	0.6	0.2	0.3	0.2	<0.1	<0.1	0.1
Dissolved metals															
Aluminium	mg/L	0.040	0.010	0.020	0.040	0.170	<0.01	0.040	0.580	0.070	0.150	0.040	0.030	0.020	0.040
Arsenic	mg/L	0.002	0.003	0.002	<0.001	<0.001	<0.001	0.005	0.006	0.002	0.003	0.002	<0.001	<0.001	<0.001
Beryllium	mg/L	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	0.265	0.738	0.183	0.071	0.087	1.370	0.213	0.242	0.056	0.050	0.091	0.073	0.068	0.063
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	0.0006	0.0018	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001
Cobalt	mg/L	<0.001	<0.001	0.004	0.078	0.201	<0.001	<0.001	<0.001	<0.001	0.002	0.001	<0.001	0.004	<0.001
Copper	mg/L	<0.001	0.008	0.001	0.002	0.004	<0.001	0.002	0.003	<0.001	0.002	0.004	0.001	<0.001	<0.001
Lead	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.888	1.240	1.350	9.700	12.500	0.238	<0.001	0.023	0.004	0.047	0.026	0.082	0.447	0.129
Mercury	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.011**	0.024	0.006	0.002	0.002	<0.001	0.002	<0.001
Nickel	mg/L	<0.001	0.001	<0.001	0.048	0.101	<0.001	0.002	0.004	<0.001	0.002	0.002	<0.001	<0.001	<0.001
Selenium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	6.150	3.170	4.460	0.815	0.551	23.500	0.317	0.337	0.178	0.389	0.267	0.373	0.258	0.274
Uranium	mg/L	0.003	<0.001	0.011	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.007	0.010	0.020	0.230	0.780	0.008	0.014	0.013	<0.005	0.025	0.040	0.007	0.015	0.021
Boron	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	0.16	0.16	0.63	0.17	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	mg/L	2.81	5.67	1.58	2.43	0.09	0.18	<0.05	0.36	0.06	0.24	0.89	0.72	0.46	1.04
Bromine	mg/L	3.9	2.1	2.5	2.9	1.3	2.4	0.8	1.8	0.4	0.3	0.3	0.2	0.3	0.2
Nutrients															
Ammonia as N	mg/L	na	na	na	0.14	1.37	na	0.03	1.10	0.03	0.05	0.03	0.01	0.01	0.01
Nitrite as N	mg/L	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.02	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/L	<0.01	0.01	<0.01	0.06	0.16	0.01	1.9	0.01	0.01	<0.01	<0.01	0.03	0.01	0.02
Total Phosphorous	mg/L	na	na	na	0.05	0.02	na	**0.64**	1.81	0.20	1.25	0.65	0.03	0.03	0.02
Reactive Phosphorous	mg/L	na	na	na	0.01	<0.01	na	<0.01	<0.01	<0.01	0.45	0.06	<0.01	<0.01	0.01
Total Organic Carbon	mg/L	na	na	na	7	6	na	37	34	21	49	38	5	9	5
Total petroleum hydrocarbons															
C6-C9 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
C10-C14 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
C15-C28 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
C29-C36 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
C10-C36 Fraction (sum)	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Total recoverable hydrocarbons															
C6-C10 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
C6-C10 Fraction minus BTEX (F1)	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
>C10-C16 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
>C16-C34 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
>C34-C40 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
>C10-C40 Fraction (sum)	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Aromatic hydrocarbons															
Benzene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Toluene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Ethyl Benzene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
m&p-Xylenes	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
o-Xylenes	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Total xlyenes	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Sum of BTEX	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Naphthalene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Dissolved gases		na	na	na	na	na	na	na	na	na	na	na	na	na	na
Methane	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Phenolic compounds															
Phenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
2-Chlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
2-Methylphenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
3-&4-Methylphenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
2-Nitrophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
2.4-Dimethylphenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
2.4-Dichlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
2.6-Dichlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
4-Chloro-3-Methylphenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
2.4.6-Trichlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
2.4.5-Trichlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Pentachlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Polycyclic aromatic hydrocarbons															
Naphthalene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Acenaphthylene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Acenaphthene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Fluorene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Phenanthrene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Anthracene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Fluoranthene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Pyrene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Benz(a)anthracene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Chrysene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Benzo(b)fluoranthene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Benzo(k)fluoranthene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Benzo(a)pyrene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Indeno(1.2.3.cd)pyrene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Dibenz(a.h)anthracene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Benzo(g.h.i)perylene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na	na	na

Notes:

Bold number indicates that result exceeds applicable guideline values

na - not analysed

PARSONS BRINCKERHOFF

Summary table A3: November 2013 Water quality results

Water quality parameters	Units	TMB01	TMB02	TMB03	TMB04	TMB05	S4MB01	Tiedman south dam (TSD)	Tiedman north dam (TND)	Tiedman east dam (TED)	Catch dam west	Catch dam east	TSW01	TSW02	ASW01
Sample date		12/11/2013	12/11/2013	12/11/2013	12/11/2013	12/11/2013	12/11/2013	12/11/2013	12/11/2013	12/11/2013	12/11/2013	12/11/2013	12/11/2013	12/11/2013	12/11/2013
Formation		Alluvium	Alluvium	Alluvium	Seepage	Seepage	Shallow Bedrock	Dam	Dam	Dam	Irrigation plot runoff	Irrigation plot runoff	Surface Water	Surface Water	Surface Water
Field parameters															
Temperature	°C	18.34	18.05	17.42	19.00	18.90	22.55	20.83	21.86	20.93	20.99	21.16	19.74	**No sample (dry)**	19.80
EC	µS/cm	9,064	3,894	6,039	7,098	7,050	4,834	1,567	4,681	1,237	1,438	636	799		696
Dissolved Oxygen	% sat	14.4	14.9	14.7	17.0	51.0	13.0	81.7	107.5	112.1	79.0	78.4	86.4		46.8
Dissolved Oxygen	mg/L	1.31	1.37	1.38	1.53	4.63	1.11	7.24	9.27	9.88	7.01	6.93	7.87		4.28
pH	pH units	6.56	6.29	6.41	5.67	4.88	7.10	**9.37**	9.68	9.15	8.99	8.30	7.42		7.13
TDS	mg/L	5,892	2,531	3,925	4,631	4,582	3,142	1,019	3,043	804	935	413	520		452
Redox	mV	-75	-33.4	-20.3	87.0	148.5	-156.9	67.1	23.2	-12.3	-5.9	10.7	40.4		35.9
General parameters (lab)															
pH	pH units	7.04	6.73	6.91	6.27	4.49	7.56	**9.38**	9.67	9.00	8.47	7.61	7.64		7.48
EC	µS/cm	**9,830**	4,280	6,590	7,760	7,750	5,270	1,730	5,150	1,380	1,620	724	897		777
TDS	mg/L	6,220	2,460	4,330	4,810	4,780	3,050	939	2,770	804	986	534	468		404
Laboratory analytes															
Hydroxide alkalinity as $CaCO_3$	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1
Carbonate alkalinity as $CaCO_3$	mg/L	<1	<1	<1	<1	<1	<1	152	733	57	13	<1	<1		<1
Bicarbonate alkalinity as $CaCO_3$	mg/L	560	179	413	125	<1	409	170	466	199	142	120	95		91
Total alkalinity as $CaCO_3$	mg/L	560	179	413	125	<1	409	322	1,200	256	154	120	95		91
Total hardness as $CaCO_3$	mg/L	1,720	603	1,160	991	976	793	59	9	95	146	95	127		117
Sulfate as SO_4^{2-}	mg/L	91	44	155	591	206	60	87	21	97	145	57	9		2
Chloride	mg/L	2,680	956	1,370	1,590	1,790	1,070	222	626	159	237	84	177		151
Calcium	mg/L	245	116	246	82	46	232	7	2	15	22	15	23		22
Magnesium	mg/L	268	76	132	191	209	52	10	1	14	22	14	17		15
Sodium	mg/L	1,240	506	657	959	916	610	271	790	207	190	80	99		87
Potassium	mg/L	4	4	4	25	19	8	75	250	46	81	31	6		6
Silicon as SiO_2	mg/L	36.4	35.3	30.3	54.2	62.6	28.2	12.0	61.5	10.7	10.5	8.8	11.3		10.3
Fluoride	mg/L	0.2	<0.1	0.2	0.8	0.6	0.3	0.2	0.7	0.2	0.4	0.2	<0.1		<0.1
Dissolved metals															
Aluminium	mg/L	0.03	0.03	<0.01	0.06	0.89	<0.01	0.14	0.23	0.07	0.03	0.13	0.02		0.02
Arsenic	mg/L	0.002	0.003	0.006	<0.001	0.001	0.001	0.005	0.007	0.030	0.004	0.006	<0.001		<0.001
Beryllium	mg/L	<0.001	<0.001	<0.001	<0.001	0.007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001
Barium	mg/L	1.950	0.674	0.210	0.071	0.097	0.247	0.107	0.385	0.097	0.052	0.004	0.069		0.088
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	0.0006	0.0027	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001
Chromium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001
Cobalt	mg/L	<0.001	0.003	0.002	0.088	0.315	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001
Copper	mg/L	0.001	0.002	<0.001	0.002	0.026	<0.001	0.003	0.006	0.003	0.004	0.003	0.001		<0.001
Lead	mg/L	<0.001	<0.001	<0.001	<0.001	0.009	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001
Manganese	mg/L	0.258	1.470	1.760	11.200	20.700	0.980	0.010	0.006	0.025	0.023	0.137	0.646		0.536
Mercury	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001
Molybdenum	mg/L	0.001	<0.001	<0.001	0.001	0.001	<0.001	0.006	0.019	0.004	0.006	0.002	<0.001		<0.001
Nickel	mg/L	0.002	<0.001	0.002	0.041	0.156	<0.001	<0.001	0.004	<0.001	0.002	0.002	<0.001		<0.001
Selenium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01
Strontium	mg/L	25.9	3.03	6.87	0.882	0.763	6.8	0.301	0.376	0.324	0.232	0.141	0.458		0.398
Uranium	mg/L	<0.001	<0.001	0.002	<0.001	<0.001	0.006	<0.001	<0.001	<0.001	0.001	<0.001	<0.001		<0.001
Vanadium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01		<0.01
Zinc	mg/L	0.012	0.049	0.022	0.27	1.12	0.008	0.019	<0.005	0.03	<0.005	<0.005	0.018		0.009
Boron	mg/L	0.19	<0.05	<0.05	<0.05	<0.05	<0.05	0.21	0.68	0.16	0.09	<0.05	<0.05		<0.05
Iron	mg/L	0.79	5.13	6.25	5.99	6.39	2.98	0.08	0.12	0.12	0.06	0.21	0.25		0.33
Bromine	mg/L	2.5	2.3	3.0	2.9	1.8	4.5	0.7	1.8	0.5	0.6	0.3	0.4		0.4
Nutrients															
Ammonia as N	mg/L	na	na	na	0.18	0.25	na	0.03	0.06	0.17	0.08	0.70	0.02		0.03
Nitrite as N	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.18	0.06	<0.01		<0.01
Nitrate as N	mg/L	0.03	0.02	<0.01	0.06	0.16	0.02	0.01	0.02	0.02	3.36	0.92	0.02		0.02
Total Phosphorous	mg/L	na	na	na	0.26	0.02	na	**0.38**	1.52	0.47	0.43	1.37	**0.06**		**0.06**
Reactive Phosphorous	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.75	<0.01		<0.01
Total Organic Carbon	mg/L	na	na	na	21	14	na	38	135	40	60	63	13		13
Total petroleum hydrocarbons															
C6-C9 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
C10-C14 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
C15-C28 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
C29-C36 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
C10-C36 Fraction (sum)	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Total recoverable hydrocarbons															
C6-C10 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
C6-C10 Fraction minus BTEX (F1)	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
>C10-C16 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
>C16-C34 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
>C34-C40 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
>C10-C40 Fraction (sum)	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Aromatic hydrocarbons															
Benzene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Toluene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Ethyl Benzene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
m&p-Xylenes	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
o-Xylenes	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Total xlyenes	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Sum of BTEX	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Naphthalene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Dissolved gases		na	na	na	na	na	na	na	na	na	na	na	na		na
Methane	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Phenolic compounds															
Phenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
2-Chlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
2-Methylphenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
3-&4-Methylphenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
2-Nitrophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
2.4-Dimethylphenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
2.4-Dichlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
2.6-Dichlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
4-Chloro-3-Methylphenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
2.4.6-Trichlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
2.4.5-Trichlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Pentachlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Polycyclic aromatic hydrocarbons															
Naphthalene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Acenaphthylene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Acenaphthene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Fluorene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Phenanthrene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Anthracene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Fluoranthene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Pyrene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Benz(a)anthracene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Chrysene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Benzo(b)fluoranthene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Benzo(k)fluoranthene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Benzo(a)pyrene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Indeno(1.2.3.cd)pyrene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Dibenz(a.h)anthracene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na
Benzo(g.h.i)perylene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na

Notes:

Bold number indicates that result exceeds applicable guideline values

na - not analysed

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Summary table A3 (continued): November 2013 Water quality results

Water quality parameters	Units	SP3A	SP4A	SP5B	SP6A	SP6B	Catch dam west	Catch dam east	ASW01	FSW01
Sample date		12/11/2013	12/11/2013	12/11/2013	12/11/2013	12/11/2013	20/11/2013	20/11/2013	20/11/2013	20/11/2013
Formation		Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Shallow Bedrock	Irrigation plot runoff	Irrigation plot runoff	Surface Water	Surface Water
Field parameters										
Temperature	°C	21.27	21.14	20.82	22.27	21.65	16.00	26.15	22.00	22.76
EC	µS/cm	3,271	2,662	2,537	2,814	1,025	937	455	671	728
Dissolved Oxygen	% sat	58.0	23.5	34.7	55.8	30.5	12.3	17.8	15.7	11.9
Dissolved Oxygen	mg/L	5.07	2.06	3.06	4.80	2.67				
pH	pH units	5.82	6.38	6.95	7.52	6.55	7.79	7.76	7.55	7.88
TDS	mg/L	2,126	1,730	1,649	1,829	666	na	na	na	na
Redox	mV	71	6.3	-6.1	-32.5	-3.1	-15.1	26	43.4	14.9
General parameters										
pH	pH units	6.23	7.06	7.41	7.29	6.79	7.62	7.43	7.48	7.3
EC	µS/cm	3,610	2,980	2,760	3,080	1,140	416	904	686	703
TDS	mg/L	2,100	1,770	2,020	1,750	1,140	459	900	389	383
Laboratory analytes										
Hydroxide alkalinity as $CaCO_3$	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate alkalinity as $CaCO_3$	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate alkalinity as $CaCO_3$	mg/L	24	225	153	68	43	87	140	<1	100
Total alkalinity as $CaCO_3$	mg/L	24	225	153	68	43	87	140	<1	100
Total hardness as $CaCO_3$	mg/L	579	527	202	178	47				
Sulfate as SO_4^{2-}	mg/L	591	398	144	23	93	42	126	88	3
Chloride	mg/L	571	417	576	748	224	49	116	126	152
Calcium	mg/L	82	61	10	12	4	15	33	25	24
Magnesium	mg/L	91	91	43	36	9	9	19	14	15
Sodium	mg/L	453	361	443	495	190	54	104	92	96
Potassium	mg/L	15	18	11	2	6	23	42	6	6
Silicon as SiO_2	mg/L	7.9	9.3	21.6	8.4	23.5	18.4	9.39	19.2	10.2
Fluoride	mg/L	0.1	0.4	0.4	0.6	0.2	0.3	0.3	0.1	0.2
Dissolved metals										
Aluminium	mg/L	0.10	0.32	0.66	2.10	0.44	0.10	0.04	<0.01	<0.01
Arsenic	mg/L	0.001	0.003	0.003	0.002	0.002	0.003	0.003	0.002	0.001
Beryllium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	0.115	0.092	0.104	0.253	0.033	0.047	0.058	0.081	0.085
Cadmium	mg/L	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	<0.001	0.001	0.002	0.019	0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	mg/L	0.012	0.013	0.004	0.006	0.002	0.001	0.002	0.001	<0.001
Copper	mg/L	0.005	0.010	0.010	0.015	0.010	0.003	0.006	0.002	0.002
Lead	mg/L	<0.001	<0.001	0.002	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.652	0.252	0.078	0.128	0.062	0.033	0.12	1.25	0.889
Mercury	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	<0.001	0.004	0.004	0.037	0.002	0.002	0.004	<0.001	<0.001
Nickel	mg/L	0.008	0.012	0.007	0.258	0.005	0.001	0.003	<0.001	<0.001
Selenium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	0.563	0.592	0.442	2.2	0.118	0.092	0.247	0.431	0.398
Uranium	mg/L	<0.001	<0.001	0.003	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.111	0.048	0.011	0.181	0.024	0.011	0.045	0.009	0.008
Boron	mg/L	0.08	0.09	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	<0.05
Iron	mg/L	0.10	0.18	4.02	1.22	0.93	0.2	0.23	1.86	0.72
Bromine	mg/L	1.2	1.2	1.1	1.1	0.4	0.2	0.3	0.4	0.3
Nutrients										
Ammonia as N	mg/L	0.22	0.38	0.09	0.02	0.06	0.18	0.7	<0.01	0.08
Nitrite as N	mg/L	0.01	0.14	0.03	<0.01	<0.01	0.02	0.06	<0.01	<0.01
Nitrate as N	mg/L	31.6	33.6	1.39	0.02	0.97	0.08	0.38	<0.01	0.02
Total Phosphorous	mg/L	0.59	0.55	1.07	0.33	0.82	1.09	2.32	**0.16**	**0.14**
Reactive Phosphorous	mg/L	0.07	0.25	0.51	0.02	0.47	0.78	1.78	0.02	<0.01
Total Organic Carbon	mg/L	42	78	33	12	17	na	na	na	na
Total petroleum hydrocarbons										
C6-C9 Fraction	µg/L	na	na	na	na	na	na	na	na	na
C10-C14 Fraction	µg/L	na	na	na	na	na	na	na	na	na
C15-C28 Fraction	µg/L	na	na	na	na	na	na	na	na	na
C29-C36 Fraction	µg/L	na	na	na	na	na	na	na	na	na
C10-C36 Fraction (sum)	µg/L	na	na	na	na	na	na	na	na	na
Total recoverable hydrocarbons										
C6-C10 Fraction	µg/L	na	na	na	na	na	na	na	na	na
C6-C10 Fraction minus BTEX (F1)	µg/L	na	na	na	na	na	na	na	na	na
>C10-C16 Fraction	µg/L	na	na	na	na	na	na	na	na	na
>C16-C34 Fraction	µg/L	na	na	na	na	na	na	na	na	na
>C34-C40 Fraction	µg/L	na	na	na	na	na	na	na	na	na
>C10-C40 Fraction (sum)	µg/L	na	na	na	na	na	na	na	na	na
Aromatic hydrocarbons										
Benzene	µg/L	na	na	na	na	na	na	na	na	na
Toluene	µg/L	na	na	na	na	na	na	na	na	na
Ethyl Benzene	µg/L	na	na	na	na	na	na	na	na	na
m&p-Xylenes	µg/L	na	na	na	na	na	na	na	na	na
o-Xylenes	µg/L	na	na	na	na	na	na	na	na	na
Total xlyenes	µg/L	na	na	na	na	na	na	na	na	na
Sum of BTEX	µg/L	na	na	na	na	na	na	na	na	na
Naphthalene	µg/L	na	na	na	na	na	na	na	na	na
Dissolved gases		na	na	na	na	na	na	na	na	na
Methane	µg/L	na	na	na	na	na	na	na	na	na
Phenolic compounds										
Phenol	µg/L	na	na	na	na	na	na	na	na	na
2-Chlorophenol	µg/L	na	na	na	na	na	na	na	na	na
2-Methylphenol	µg/L	na	na	na	na	na	na	na	na	na
3-&4-Methylphenol	µg/L	na	na	na	na	na	na	na	na	na
2-Nitrophenol	µg/L	na	na	na	na	na	na	na	na	na
2.4-Dimethylphenol	µg/L	na	na	na	na	na	na	na	na	na
2.4-Dichlorophenol	µg/L	na	na	na	na	na	na	na	na	na
2.6-Dichlorophenol	µg/L	na	na	na	na	na	na	na	na	na
4-Chloro-3-Methylphenol	µg/L	na	na	na	na	na	na	na	na	na
2.4.6-Trichlorophenol	µg/L	na	na	na	na	na	na	na	na	na
2.4.5-Trichlorophenol	µg/L	na	na	na	na	na	na	na	na	na
Pentachlorophenol	µg/L	na	na	na	na	na	na	na	na	na
Polycyclic aromatic hydrocarbons										
Naphthalene	µg/L	na	na	na	na	na	na	na	na	na
Acenaphthylene	µg/L	na	na	na	na	na	na	na	na	na
Acenaphthene	µg/L	na	na	na	na	na	na	na	na	na
Fluorene	µg/L	na	na	na	na	na	na	na	na	na
Phenanthrene	µg/L	na	na	na	na	na	na	na	na	na
Anthracene	µg/L	na	na	na	na	na	na	na	na	na
Fluoranthene	µg/L	na	na	na	na	na	na	na	na	na
Pyrene	µg/L	na	na	na	na	na	na	na	na	na
Benz(a)anthracene	µg/L	na	na	na	na	na	na	na	na	na
Chrysene	µg/L	na	na	na	na	na	na	na	na	na
Benzo(b)fluoranthene	µg/L	na	na	na	na	na	na	na	na	na
Benzo(k)fluoranthene	µg/L	na	na	na	na	na	na	na	na	na
Benzo(a)pyrene	µg/L	na	na	na	na	na	na	na	na	na
Indeno(1.2.3.cd)pyrene	µg/L	na	na	na	na	na	na	na	na	na
Dibenz(a.h)anthracene	µg/L	na	na	na	na	na	na	na	na	na
Benzo(g.h.i)perylene	µg/L	na	na	na	na	na	na	na	na	na

Notes:
Bold number indicates that result exceeds applicable guideline values
na - not analysed

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Summary table A4: February 2014 Water quality results

Water quality parameters	Units	TMB01	TMB02	TMB03	TMB04	TMB05	S4MB01	Tiedman south dam (TSD)	Tiedman north dam (TND)	Tiedman east dam (TED)	Catch dam west	Catch dam east	TSW01	TSW02	ASW01	SP5B
Sample date		10/02/2014	10/02/2014	10/02/2014	11/02/2014	11/02/2014	10/02/2014	11/02/2014	11/02/2014	11/02/2014	11/02/2014	11/02/2014	11/02/2014	11/02/2014	11/02/2014	11/02/2014
Formation		Alluvium	Alluvium	Alluvium	Seepage	Seepage	Shallow Bedrock	Dam	Dam	Dam	Irrigation plot runoff	Irrigation plot runoff	Surface Water	Surface Water	Surface Water	Shallow Bedrock
Field parameters																
Temperature	°C	19.16	18.89	18.61	20.84	22.97	23.20	25.73	25.75	26.74	29.90	29.00	25.16	**No sample (dry)**	28.53	27.46
EC	µS/cm	8,657	4,031	6,197	7,133	7,387	4,841	1,535	5,595	2,004	287	772	576		475	3,877
Dissolved Oxygen	% sat	12.8	7.9	9.3	31.6	37.7	14.0	70.2	80.8	104.9	55.8	144.9	33.0		61.8	18.0
Dissolved Oxygen	mg/L	1.13	0.72	0.84	2.75	3.11	1.18	5.69	6.33	8.22	41.90	10.62	2.69		4.72	1.39
pH	pH units	6.53	6.17	6.38	5.75	5.61	7.29	**9.72**	9.82	9.97	7.34	9.24	6.66		**8.33**	7.24
TDS	mg/L	5,692	4,031	4,029	4,636	4,802	3,147	998	3,637	1,303	187	501	374		309	2,520
Redox	mV	-63.5	-1.8	-18.0	70.4	63.8	-184.5	-15.4	-8.7	3.2	na	14.0	11.7		52.1	-21.4
General parameters (lab)																
pH	pH units	7.13	6.78	6.97	6.43	4.77	7.64	**9.66**	9.78	9.88	7.69	8.83	7.55		7.61	7.60
EC	µS/cm	8,920	4,330	6,300	7,320	7,500	4,920	1,540	5,670	2,000	283	783	582		465	4200
TDS	mg/L	4,940	2,400	3,980	3,590	3,030	2,740	978	3,280	1,200	376	622	314		262	2600
Laboratory analytes																
Hydroxide alkalinity as $CaCO_3$	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1
Carbonate alkalinity as $CaCO_3$	mg/L	<1	<1	<1	<1	<1	<1	204	990	391	<1	29	<1		<1	<1
Bicarbonate alkalinity as $CaCO_3$	mg/L	584	182	431	110	<1	295	165	529	121	68	164	83		86	326
Total alkalinity as $CaCO_3$	mg/L	584	182	431	110	<1	295	369	1,520	512	68	193	83		86	326
Total hardness as $CaCO_3$	mg/L	1,670	716	1,460	1,190	1,220	715	27	18	44	60	156	100		97	337
Sulfate as SO_4^{2-}	mg/L	82	50	163	548	203	121	26	<1	42	22	9	13		<1	158
Chloride	mg/L	2,450	1,040	1,560	1,970	2,250	1,180	207	711	262	26	111	111		80	879
Calcium	mg/L	245	135	311	92	55	212	6	4	6	14	31	17		19	13
Magnesium	mg/L	258	92	167	233	264	45	3	2	7	6	19	14		12	74
Sodium	mg/L	1,310	566	767	1,200	1,160	751	262	1,060	413	28	86	75		51	803
Potassium	mg/L	3	4	4	27	20	9	92	325	33	15	28	6		6	5
Silicon as SiO_2	mg/L	39.1	36.6	34.2	59.5	72.2	26.1	11.8	33.8	18.4	14.3	3.4	14.3		15.1	24.4
Fluoride	mg/L	0.2	<0.1	0.2	0.5	<0.1	0.4	0.8	0.9	0.6	0.6	0.4	0.1		0.1	0.7
Dissolved metals																
Aluminium	mg/L	0.22	0.01	0.02	0.10	0.30	0.06	**9.42**	0.52	0.75	0.63	0.07	0.05		0.14	0.02
Antimony	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001
Arsenic	mg/L	0.001	0.003	0.004	<0.001	<0.001	0.001	0.008	0.013	0.005	0.005	0.010	0.003		0.003	0.005
Beryllium	mg/L	<0.001	<0.001	<0.001	<0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001
Barium	mg/L	0.296	0.724	0.360	0.356	0.130	0.985	0.151	0.308	0.228	0.091	0.071	0.074		0.074	0.108
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	0.0006	0.0022	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		<0.0001	<0.0001
Chromium	mg/L	<0.001	<0.001	<0.001	0.008	<0.001	0.001	0.005	0.004	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001
Cobalt	mg/L	<0.001	0.003	<0.001	0.082	0.282	<0.001	0.002	0.001	<0.001	0.002	0.002	0.003		<0.001	0.006
Copper	mg/L	0.022	0.024	0.042	0.016	0.096	0.002	0.014	0.018	0.008	0.007	0.002	0.005		0.004	0.006
Lead	mg/L	0.001	<0.001	<0.001	0.001	0.007	<0.001	0.004	<0.001	<0.001	0.004	<0.001	<0.001		<0.001	<0.001
Manganese	mg/L	1.040	1.710	1.660	9.570	19.100	0.241	0.049	0.098	0.046	0.207	0.964	0.920		0.693	0.229
Mercury	mg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Molybdenum	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.009	0.032	0.006	0.002	0.002	<0.001		<0.001	0.118
Nickel	mg/L	0.001	0.002	<0.001	0.041	0.138	0.002	0.004	0.005	0.002	0.003	0.001	0.002		<0.001	0.093
Selenium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01
Strontium	mg/L	9.73	4.26	7.20	1.22	0.822	18.3	0.15	0.479	0.459	0.13	0.263	0.398		0.417	0.716
Uranium	mg/L	0.004	<0.001	0.003	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	0.007
Vanadium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.01	<0.01	0.01	<0.01	<0.01		<0.01	<0.01
Zinc	mg/L	0.014	0.022	0.014	0.22	1.25	<0.005	0.043	0.029	0.017	0.057	0.075	0.016		0.017	0.034
Boron	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	0.17	0.25	0.77	0.56	<0.05	0.07	<0.05		<0.05	0.1
Iron	mg/L	2.48	4.34	5.68	6.86	14.5	0.07	**5.38**	0.54	0.60	4.10	0.66	2.14		2.38	1.27
Bromine	mg/L	4.1	2.2	3.3	3.5	2.0	2.6	0.6	1.9	0.5	0.1	0.3	0.2		0.1	2.6
Nutrients																
Ammonia as N	mg/L	na	na	na	0.12	0.29	na	0.05	<0.01	0.05	1.36	0.05	0.12		0.01	0.14
Nitrite as N	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	0.02
Nitrate as N	mg/L	<0.01	<0.01	<0.01	0.06	0.11	<0.01	<0.01	0.01	0.02	<0.01	<0.01	<0.01		0.02	0.25
Total Phosphorous	mg/L	na	na	na	0.07	0.02	na	**1.61**	1.72	1.33	2.16	2.21	**0.18**		**0.09**	6.03
Reactive Phosphorous	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	0.63	<0.01	<0.01	0.84	0.24	0.1		0.02	0.34
Total Organic Carbon	mg/L	na	na	na	5	5	na	35	57	99	36	104	16		14	40
Total petroleum hydrocarbons																
C6-C9 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
C10-C14 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
C15-C28 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
C29-C36 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
C10-C36 Fraction (sum)	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Total recoverable hydrocarbons																
C6-C10 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
C6-C10 Fraction minus BTEX (F1)	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
>C10-C16 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
>C16-C34 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
>C34-C40 Fraction	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
>C10-C40 Fraction (sum)	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Aromatic hydrocarbons																
Benzene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Toluene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Ethyl Benzene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
m&p-Xylenes	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
o-Xylenes	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Total xlyenes	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Sum of BTEX	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Naphthalene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Dissolved gases																
Methane	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Phenolic compounds																
Phenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
2-Chlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
2-Methylphenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
3-&4-Methylphenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
2-Nitrophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
2.4-Dimethylphenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
2.4-Dichlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
2.6-Dichlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
4-Chloro-3-Methylphenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
2.4.6-Trichlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
2.4.5-Trichlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Pentachlorophenol	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Polycyclic aromatic hydrocarbons																
Naphthalene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Acenaphthylene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Acenaphthene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Fluorene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Phenanthrene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Anthracene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Fluoranthene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Pyrene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Benz(a)anthracene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Chrysene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Benzo(b)fluoranthene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Benzo(k)fluoranthene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Benzo(a)pyrene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Indeno(1.2.3.cd)pyrene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Dibenz(a.h)anthracene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na
Benzo(g.h.i)perylene	µg/L	na	na	na	na	na	na	na	na	na	na	na	na		na	na

Notes:

Bold number indicates that result exceeds applicable guideline values

na - not analysed

PARSONS BRINCKERHOFF

Summary table A5: March 2014 Water quality results

Water quality parameters	Units	Catch dam west	Catch dam east	FSW01	ASW01
Sample date		3/03/2014	3/03/2014	3/03/2014	3/03/2014
Formation		Irrigation plot runoff	Irrigation plot runoff	Surface Water	Surface Water
Field parameters					
Temperature	°C	23.87	24.62	24.03	21.51
EC	µS/cm	296	145	484	416
Dissolved Oxygen	% sat	15.0	23.1	13.5	14.0
Dissolved Oxygen	mg/L	na	na	na	na
pH	pH units	7.49	7.77	**8.55**	7.42
TDS	mg/L	na	na	na	na
Redox	mV	7.8	15.6	-3.5	-0.4
General parameters					
pH	pH units	7.55	7.36	7.41	7.41
EC	µS/cm	303	145	481	426
TDS	mg/L	529	180	284	254
Laboratory analytes					
Hydroxide alkalinity as $CaCO_3$	mg/L	<1	<1	<1	<1
Carbonate alkalinity as $CaCO_3$	mg/L	<1	<1	<1	<1
Bicarbonate alkalinity as $CaCO_3$	mg/L	74	45	74	69
Total alkalinity as $CaCO_3$	mg/L	74	45	74	69
Total hardness as $CaCO_3$	mg/L	38	16	78	76
Sulfate as SO_4^{2-}	mg/L	20	<1	8	22
Chloride	mg/L	26	9	91	66
Calcium	mg/L	7	3	13	14
Magnesium	mg/L	5	2	11	10
Sodium	mg/L	38	16	56	49
Potassium	mg/L	17	11	8	6
Silicon as SiO_2	mg/L	16.6	14.9	14.2	19.9
Fluoride	mg/L	0.2	0.1	0.1	0.1
Dissolved metals					
Aluminium	mg/L	**0.82**	**0.68**	0.04	0.03
Arsenic	mg/L	0.002	0.003	0.002	0.001
Beryllium	mg/L	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	0.031	0.024	0.06	0.071
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	<0.001	<0.001	<0.001	<0.001
Cobalt	mg/L	<0.001	<0.001	<0.001	0.001
Copper	mg/L	**0.005**	0.003	0.002	0.002
Lead	mg/L	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.013	0.078	0.521	0.221
Mercury	mg/L	na	na	na	na
Molybdenum	mg/L	0.002	<0.001	<0.001	<0.001
Nickel	mg/L	0.002	0.001	0.001	0.001
Selenium	mg/L	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	0.063	0.029	0.228	0.249
Uranium	mg/L	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	**0.023**	**0.029**	0.014	0.016
Boron	mg/L	<0.05	<0.05	<0.05	<0.05
Iron	mg/L	0.84	0.5	1.34	0.89
Bromine	mg/L	<0.1	<0.1	0.2	0.1
Nutrients					
Ammonia as N	mg/L	0.19	0.06	0.17	0.19
Nitrite as N	mg/L	0.02	<0.01	<0.01	0.01
Nitrate as N	mg/L	0.05	0.06	0.07	0.12
Total Phosphorous	mg/L	**1.76**	**1.08**	0.28	0.21
Reactive Phosphorous	mg/L	1.24	0.67	0.1	0.09
Total Organic Carbon	mg/L	19	13	19	13
Total petroleum hydrocarbons					
C6-C9 Fraction	µg/L	na	na	na	na
C10-C14 Fraction	µg/L	na	na	na	na
C15-C28 Fraction	µg/L	na	na	na	na
C29-C36 Fraction	µg/L	na	na	na	na
C10-C36 Fraction (sum)	µg/L	na	na	na	na
Total recoverable hydrocarbons					
C6-C10 Fraction	µg/L	na	na	na	na
C6-C10 Fraction minus BTEX (F1)	µg/L	na	na	na	na
>C10-C16 Fraction	µg/L	na	na	na	na
>C16-C34 Fraction	µg/L	na	na	na	na
>C34-C40 Fraction	µg/L	na	na	na	na
>C10-C40 Fraction (sum)	µg/L	na	na	na	na
Aromatic hydrocarbons					
Benzene	µg/L	na	na	na	na
Toluene	µg/L	na	na	na	na
Ethyl Benzene	µg/L	na	na	na	na
m&p-Xylenes	µg/L	na	na	na	na
o-Xylenes	µg/L	na	na	na	na
Total xlyenes	µg/L	na	na	na	na
Sum of BTEX	µg/L	na	na	na	na
Naphthalene	µg/L	na	na	na	na
Dissolved gases		na	na	na	na
Methane	µg/L	na	na	na	na
Phenolic compounds					
Phenol	µg/L	na	na	na	na
2-Chlorophenol	µg/L	na	na	na	na
2-Methylphenol	µg/L	na	na	na	na
3-&4-Methylphenol	µg/L	na	na	na	na
2-Nitrophenol	µg/L	na	na	na	na
2.4-Dimethylphenol	µg/L	na	na	na	na
2.4-Dichlorophenol	µg/L	na	na	na	na
2.6-Dichlorophenol	µg/L	na	na	na	na
4-Chloro-3-Methylphenol	µg/L	na	na	na	na
2.4.6-Trichlorophenol	µg/L	na	na	na	na
2.4.5-Trichlorophenol	µg/L	na	na	na	na
Pentachlorophenol	µg/L	na	na	na	na
Polycyclic aromatic hydrocarbons					
Naphthalene	µg/L	na	na	na	na
Acenaphthylene	µg/L	na	na	na	na
Acenaphthene	µg/L	na	na	na	na
Fluorene	µg/L	na	na	na	na
Phenanthrene	µg/L	na	na	na	na
Anthracene	µg/L	na	na	na	na
Fluoranthene	µg/L	na	na	na	na
Pyrene	µg/L	na	na	na	na
Benz(a)anthracene	µg/L	na	na	na	na
Chrysene	µg/L	na	na	na	na
Benzo(b)fluoranthene	µg/L	na	na	na	na
Benzo(k)fluoranthene	µg/L	na	na	na	na
Benzo(a)pyrene	µg/L	na	na	na	na
Indeno(1.2.3.cd)pyrene	µg/L	na	na	na	na
Dibenz(a.h)anthracene	µg/L	na	na	na	na
Benzo(g.h.i)perylene	µg/L	na	na	na	na

Notes:

Bold number indicates that result exceeds applicable guideline values

na - not analysed

PARSONS BRINCKERHOFF

Summary table A6: May 2014 Water quality results

Water quality parameters	Units	TMB01	TMB02	TMB03	TMB04	TMB05	S4MB01	Tiedman south dam (TSD)	Tiedman north dam (TND)	Tiedman east dam (TED)	Catch dam west	Catch dam east	TSW01	TSW02	ASW01
Sample date		14/05/2014	14/05/2014	14/05/2014	13/05/2014	13/05/2014	13/05/2014	13/05/2014	13/05/2014	13/05/2014	13/05/2014	13/05/2014	13/05/2014	13/05/2014	14/05/2014
Formation		Alluvium	Alluvium	Alluvium	Seepage	Seepage	Shallow Bedrock	Dam	Dam	Dam	Irrigation plot runoff	Irrigation plot runoff	Surface Water	Surface Water	Surface Water
Field parameters															
Temperature	°C	18.65	17.50	18.77	18.72	18.86	23.04	16.28	16.79	20.5	22.58	18.24	17.32	18.95	15.51
EC	µS/cm	8,879	3,765	5,708	7,050	7,156	4,871	1,455	5,047	1,143	214	162	566	1,678	449
Dissolved Oxygen	% sat	26.4	27.0	15.7	59.3	59.0	21.7	55.4	98.2	166.4	121.0	99.7	49.2	79.1	31.0
Dissolved Oxygen	mg/L	2.39	2.55	1.43	5.40	5.35	1.83	5.41	9.37	15.04	10.42	9.35	4.71	7.31	3.08
pH	pH units	6.55	6.19	6.48	6.36	5.34	7.41	**9.28**	9.73	9.85	9.27	9.29	7.35	7.19	7.31
TDS	mg/L	5,771	2,448	3,711	4,583	4,659	3,166	945	3,281	742	139	106	368	1,091	292
Redox	mV	-136.1	17.0	-91.5	-31.4	9.5	-270.5	59.1	61.5	-80.9	-123.3	55.3	-113.7	-83.2	-30.4
General parameters (lab)															
pH	pH units	7.20	6.86	7.15	6.55	5.69	7.67	**9.27**	9.70	9.78	9.16	7.84	7.54	7.56	7.46
EC	µS/cm	9,050	3,790	5,800	7,150	7,290	4,820	1,470	5,100	1,150	210	141	555	1690	446
TDS	mg/L	5,480	2,330	3,280	4,430	4,170	2,450	905	2,970	884	180	109	303	940	267
Laboratory analytes															
Hydroxide alkalinity as $CaCO_3$	mg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate alkalinity as $CaCO_3$	mg/L	<1	<1	<1	<1	<1	<1	115	767	176	14	<1	<1	<1	<1
Bicarbonate alkalinity as $CaCO_3$	mg/L	576	160	472	106	24	390	257	557	123	36	35	72	69	81
Total alkalinity as $CaCO_3$	mg/L	576	160	472	106	24	390	372	1,320	299	50	35	72	69	81
Total hardness as $CaCO_3$	mg/L	1,730	701	1,130	1,140	1,200	791	18	5	16	27	20	71	245	67
Sulfate as SO_4^{2-}	mg/L	77	33	199	493	221	69	12	<1	27	15	6	7	41	3
Chloride	mg/L	2,770	970	1,310	1,800	2,370	1,130	219	731	164	26	21	123	454	88
Calcium	mg/L	242	134	217	86	58	231	4	2	3	6	3	12	32	12
Magnesium	mg/L	273	89	144	224	256	52	2	<1	2	3	3	10	40	9
Sodium	mg/L	1,290	452	777	1,100	1,030	640	240	924	214	23	16	75	214	55
Potassium	mg/L	4	4	3	29	21	8	88	262	18	15	11	7	16	6
Silicon as SiO_2	mg/L	40.4	38.0	35.1	63.9	67.2	28.4	13.2	27.4	12.2	0.6	6.0	16.3	4.1	17.6
Fluoride	mg/L	0.3	0.1	0.3	0.9	0.7	0.5	0.5	0.9	0.3	0.2	0.1	0.1	0.1	0.1
Dissolved metals															
Aluminium	mg/L	0.07	<0.01	0.01	0.08	1.37	<0.01	1.91	0.22	0.35	0.07	0.27	0.07	**0.24**	0.08
Antimony	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	mg/L	0.002	0.003	0.003	0.001	<0.001	<0.001	0.006	0.01	0.004	<0.001	0.002	0.002	0.001	0.002
Beryllium	mg/L	<0.001	<0.001	<0.001	<0.001	0.007	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	0.287	0.798	0.204	0.068	0.085	1.000	0.143	0.440	0.097	0.028	0.016	0.072	0.096	0.065
Cadmium	mg/L	<0.0001	<0.0001	<0.0001	0.0008	0.0024	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	mg/L	<0.001	0.002	0.002	0.082	0.297	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.005	0.001
Copper	mg/L	<0.001	0.002	<0.001	0.005	0.021	<0.001	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001
Lead	mg/L	<0.001	<0.001	<0.001	<0.001	0.006	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Manganese	mg/L	1.020	1.480	1.620	12.100	21.700	0.245	0.014	0.006	0.064	0.006	0.024	0.294	2.080	0.740
Mercury	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	<0.001	<0.001	<0.001	0.001	0.001	<0.001	0.008	0.032	0.005	0.001	<0.001	<0.001	<0.001	<0.001
Nickel	mg/L	<0.001	<0.001	<0.001	0.035	0.146	0.002	0.002	0.002	0.001	<0.001	<0.001	0.001	0.003	0.002
Selenium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	7.76	3.72	5.96	0.979	0.87	21.2	0.167	0.43	0.176	0.08	0.04	0.431	0.695	0.268
Uranium	mg/L	0.005	<0.001	0.009	<0.001	<0.001	0.0	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.010	0.015	0.008	0.208	0.998	<0.005	0.007	0.058	0.016	0.047	0.018	0.008	0.005	<0.005
Boron	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	0.12	0.18	0.54	0.25	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	mg/L	2.47	6.44	2.28	2.08	10.0	0.07	**0.57**	0.16	0.25	0.08	0.27	1.28	0.26	1.36
Bromine	mg/L	4.5	2.1	2.7	3.1	1.7	2.5	0.6	1.9	0.3	<0.1	<0.1	0.3	0.6	0.2
Nutrients															
Ammonia as N	mg/L	0.20	0.32	0.15	0.10	0.32	1.88	0.45	0.07	<0.01	0.01	<0.01	0.13	0.02	0.16
Nitrite as N	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01
Nitrate as N	mg/L	0.03	<0.01	<0.01	0.04	0.15	0.07	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	<0.01	<0.01
Total Phosphorous	mg/L	0.06	0.04	0.06	0.08	<0.01	0.06	**0.83**	1.37	0.80	0.65	0.75	**0.09**	0.05	**0.09**
Reactive Phosphorous	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.32	<0.01	<0.01	<0.01	0.03	0.04	<0.01	0.02
Total Organic Carbon	mg/L	3	1	2	10	5	19	28	53	51	28	12	13	20	12
Total petroleum hydrocarbons															
C6-C9 Fraction	µg/L	<20	<20	<20	na	na	<20	<20	<20	<20	na	na	<20	<20	<20
C10-C14 Fraction	µg/L	<50	<50	<50	na	na	<50	<50	<50	<50	na	na	<50	<50	<50
C15-C28 Fraction	µg/L	<100	<100	<100	na	na	<100	<100	150	290	na	na	<100	<100	<100
C29-C36 Fraction	µg/L	<50	<50	<50	na	na	<50	<50	<50	70	na	na	<50	<50	<50
C10-C36 Fraction (sum)	µg/L	<50	<50	<50	na	na	<50	<50	150	360	na	na	<50	<50	<50
Total recoverable hydrocarbons															
C6-C10 Fraction	µg/L	<20	<20	<20	na	na	<20	<20	<20	<20	na	na	<20	<20	<20
C6-C10 Fraction minus BTEX (F1)	µg/L	<20	<20	<20	na	na	<20	<20	<20	<20	na	na	<20	<20	<20
>C10-C16 Fraction	µg/L	<100	<100	<100	na	na	<100	<100	<100	<100	na	na	<100	<100	<100
>C16-C34 Fraction	µg/L	<100	<100	<100	na	na	<100	<100	140	340	na	na	<100	<100	<100
>C34-C40 Fraction	µg/L	<100	<100	<100	na	na	<100	<100	<100	<100	na	na	<100	<100	<100
>C10-C40 Fraction (sum)	µg/L	<100	<100	<100	na	na	<100	<100	140	340	na	na	<100	<100	<100
Aromatic hydrocarbons															
Benzene	µg/L	<1	<1	<1	na	na	<1	<1	<1	<1	na	na	<1	<1	<1
Toluene	µg/L	<2	<2	<2	na	na	<2	<2	<2	<2	na	na	<2	<2	<2
Ethyl Benzene	µg/L	<2	<2	<2	na	na	<2	<2	<2	<2	na	na	<2	<2	<2
m&p-Xylenes	µg/L	<2	<2	<2	na	na	<2	<2	<2	<2	na	na	<2	<2	<2
o-Xylenes	µg/L	<2	<2	<2	na	na	<2	<2	<2	<2	na	na	<2	<2	<2
Total xlyenes	µg/L	<2	<2	<2	na	na	<2	<2	<2	<2	na	na	<2	<2	<2
Sum of BTEX	µg/L	<1	<1	<1	na	na	<1	<1	<1	<1	na	na	<1	<1	<1
Naphthalene	µg/L	<5	<5	<5	na	na	<5	<5	<5	<5	na	na	<5	<5	<5
Dissolved gases															
Methane	µg/L	11	<10	<10	na	na	1320	<10	<10	<10	na	na	<10	20	15
Phenolic compounds															
Phenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
2-Chlorophenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
2-Methylphenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
3-&4-Methylphenol	µg/L	<2.0	<2.0	<2.0	na	na	<2.0	<2.0	<2.0	<2.0	na	na	na	na	na
2-Nitrophenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
2.4-Dimethylphenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
2.4-Dichlorophenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
2.6-Dichlorophenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
4-Chloro-3-Methylphenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
2.4.6-Trichlorophenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
2.4.5-Trichlorophenol	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Pentachlorophenol	µg/L	<2.0	<2.0	<2.0	na	na	<2.0	<2.0	<2.0	<2.0	na	na	na	na	na
Polycyclic aromatic hydrocarbons															
Naphthalene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Acenaphthylene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Acenaphthene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Fluorene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Phenanthrene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Anthracene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Fluoranthene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Pyrene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Benz(a)anthracene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Chrysene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Benzo(b)fluoranthene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Benzo(k)fluoranthene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Benzo(a)pyrene	µg/L	<0.5	<0.5	<0.5	na	na	<0.5	<0.5	<0.5	<0.5	na	na	na	na	na
Indeno(1.2.3.cd)pyrene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Dibenz(a.h)anthracene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na
Benzo(g.h.i)perylene	µg/L	<1.0	<1.0	<1.0	na	na	<1.0	<1.0	<1.0	<1.0	na	na	na	na	na

Notes:

Bold number indicates that result exceeds applicable guideline values

na - not analysed

PARSONS BRINCKERHOFF

Summary table A7: Monthly water quality parameters (collected by AGL)

March 2013

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	26-Mar-13	3.947	27.8	9.71	31.8
Tiedman South Dam	26-Mar-13	0.530	28.3	9.02	41.1
Tiedman East Dam	26-Mar-13	1.333	29.9	10.67	4.1

April 2013

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	30-Apr-13	4.102	23.48	9.74	33.3
Tiedman South Dam	30-Apr-13	1.534	22.26	9.62	38.6
Tiedman East Dam	30-Apr-13	1.396	22.88	10.1	27.6
Catch dam 1 (east)	30-Apr-13	1.230	23.76	9.09	47.9
Catch dam 2 (west)	30-Apr-13	1.310	23.96	9.79	46.7
Avon River at pump site	23-Apr-13	0.406	16.75	8.37	111.4

May 2013

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	31-May-13	3.967	13.47	9.30	30.9
Tiedman South Dam	31-May-13	1.602	13.53	8.90	57.0
Tiedman East Dam	31-May-13	1.201	13.26	9.50	24.2
Stratford #3 Dam	31-May-13	1.855	14.11	9.41	28.2
Catch dam 1 (east)	31-May-13	0.676	12.61	8.19	73.3
Catch dam 2 (west)	31-May-13	0.953	12.52	8.17	72.4
Avon River at pump site	31-May-13	0.532	12.54	8.60	64.6

June 2013

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	28-Jun-13	3.942	13.77	8.94	64.0
Tiedman South Dam	28-Jun-13	1.581	13.69	8.66	72.6
Tiedman East Dam	28-Jun-13	1.133	13.80	8.93	60.8
Catch dam 1 (east)	28-Jun-13	0.581	13.55	8.36	95.6
Catch dam 2 (west)	28-Jun-13	0.749	13.64	7.95	106.5

July 2013

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	29-Jul-13	4.337	19.97	8.70	14.3
Tiedman South Dam	29-Jul-13	1.776	15.23	8.25	33.4
Tiedman East Dam	29-Jul-13	1.193	18.09	8.92	12.6
Catch dam 1 (east)	29-Jul-13	0.605	15.26	9.35	6.7
Catch dam 2 (west)	29-Jul-13	0.809	17.83	9.34	17.3
Avon River at pump site	29-Jul-13	0.391	15.82	8.33	54.6

August 2013

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	03-Sep-13	4.059	19.51	9.36	23.6
Tiedman South Dam	03-Sep-13	1.427	17.43	8.76	10.7
Tiedman East Dam	03-Sep-13	1.095	19.24	9.87	8.2
Stratford #3 Dam	03-Sep-13	2.049	25.46	9.69	10.2
Farley Dam	03-Sep-13	0.220	25.98	9.44	12.0
Catch dam 1 (east)	03-Sep-13	0.730	16.09	7.90	43.8
Catch dam 2 (west)	03-Sep-13	1.634	16.85	7.80	36.3
Avon River at pump site	03-Sep-13	0.371	15.41	6.51	76.5

September 2013

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	30-Sep-13	4.127	18.44	9.34	25.0
Tiedman South Dam	30-Sep-13	1.564	17.86	9.35	29.6
Tiedman East Dam	30-Sep-13	1.259	17.72	9.22	39.0

October 2013

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	30-Oct-13	4.866	18.93	10.09	13.5
Tiedman South Dam	30-Oct-13	1.535	18.51	9.19	30.9
Tiedman East Dam	30-Oct-13	1.332	17.88	8.56	33.5
Stratford #3 Dam	30-Oct-13	2.202	17.20	10.22	18.0
Farley Dam	30-Oct-13	0.202	18.91	9.44	35.2
Catch dam 1 (east)	30-Oct-13	1.292	16.18	9.71	26.4
Catch dam 2 (west)	30-Oct-13	2.515	17.63	9.84	21.9
Avon River at pump site	30-Oct-13	0.670	16.49	8.81	-103.2

November 2013

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	03-Dec-13	3.962	24.33	10.76	29.6
Tiedman South Dam	03-Dec-13	1.532	19.23	9.60	79.4
Tiedman East Dam	03-Dec-13	0.787	21.73	10.46	19.2
Stratford #3 Dam	03-Dec-13	1.999	22.79	10.42	-7.3
Catch dam 1 (east)	03-Dec-13	0.281	20.55	11.12	-14.5
Catch dam 2 (west)	03-Dec-13	0.652	19.41	9.48	-5.3
Avon River at pump site	03-Dec-13	0.613	21.61	10.84	-14.9

December 2013

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	30-Dec-13	4.754	27.90	10.01	-20.4
Tiedman South Dam	30-Dec-13	1.623	25.08	10.07	-2.6
Tiedman East Dam	30-Dec-13	0.678	27.56	10.32	7.6
Stratford #3 Dam	30-Dec-13	2.290	27.32	10.73	-2.3
Farley Dam	30-Dec-13	0.217	26.83	9.63	34.3
Catch dam 1 (east)	30-Dec-13	0.411	24.39	10.44	19.2
Catch dam 2 (west)	30-Dec-13	1.033	24.80	8.82	30.9
Avon River at pump site	30-Dec-13	0.473	23.00	9.46	39.0

January 2014

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	31-Jan-14	5.255	24.42	10.59	-17.8
Tiedman South Dam	31-Jan-14	1.846	26.94	10.38	-7.0
Tiedman East Dam	31-Jan-14	1.505	26.31	10.11	5.4
Stratford #3 Dam	31-Jan-14	2.547	26.49	10.31	5.4

February 2014

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	28-Feb-14	5.306	23.99	10.82	-8.7
Tiedman South Dam	28-Feb-14	1.617	23.64	10.19	-2.0
Tiedman East Dam	28-Feb-14	1.661	23.16	11.41	-23.4
Catch dam 1 (east)	28-Feb-14	0.557	22.47	9.18	12.9
Catch dam 2 (west)	28-Feb-14	0.221	22.72	8.75	19.9
Avon River at pump site	28-Feb-14	0.558	21.73	8.58	46.9

March 2014

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	28-Mar-14	5.037	25.60	10.72	-31.1
Tiedman South Dam	28-Mar-14	1.584	22.87	10.18	-20.1
Tiedman East Dam	28-Mar-14	1.315	24.62	10.91	-24.3
Catch dam 1 (east)	28-Mar-14	0.189	22.83	10.11	6.7
Catch dam 2 (west)	28-Mar-14	0.339	24.39	9.72	1.4
Avon River at pump site	28-Mar-14	0.579	21.58	8.69	-23.7

April 2014

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	01-May-14	5.013	22.91	9.76	-41.6
Tiedman South Dam	01-May-14	1.447	20.84	9.59	-30.4
Tiedman East Dam	01-May-14	1.129	21.09	10.43	-35.2
Farley Dam	01-May-14	0.256	20.64	8.88	-1.8
Catch dam 1 (east)	01-May-14	0.152	20.69	10.64	-24.9
Catch dam 2 (west)	01-May-14	0.195	20.36	10.22	-4.6
Bignell Dam	01-May-14	0.565	22.19	8.76	-4.2
Avon River at pump site	01-May-14	0.535	18.03	9.12	26.8

May 2014

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	02-Jun-14	4.871	15.56	9.72	-36.5
Tiedman South Dam	02-Jun-14	1.115	15.57	9.02	-45.8
Tiedman East Dam	02-Jun-14	1.160	15.54	9.78	-8.1
Stratford #3 Dam	02-Jun-14	0.764	15.77	8.53	-72.6
Farley Dam	02-Jun-14	0.237	17.91	7.23	-11.8
Catch dam 1 (east)	02-Jun-14	0.966	16.09	8.60	11.6
Catch dam 2 (west)	02-Jun-14	1.579	15.22	9.61	6.3
Avon River at pump site	02-Jun-14	0.541	13.49	7.59	-35.8

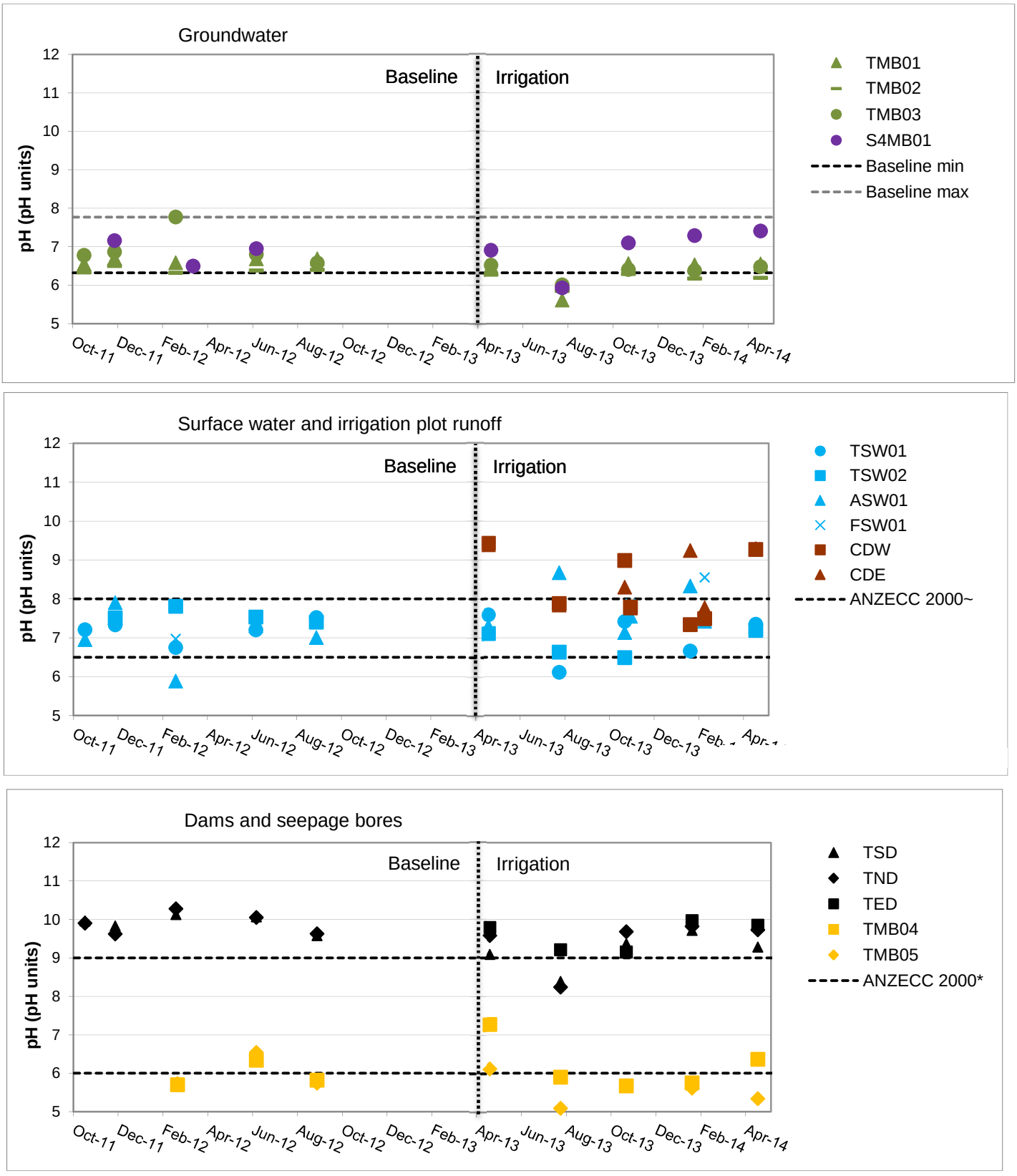
June 2014

WQ Parameters	Date	Salinity (EC)	Temp	pH	Redox
Units		*dS/m*	*°C*		*mV*
Sites					
Tiedman North Dam	04-Jul-14	5.049	13.62	10.69	-34.1
Tiedman East Dam	04-Jul-14	1.818	16.88	10.47	-36.1
Farley Dam	04-Jul-14	0.248	17.09	9.14	-34.3
Catch dam 1 (east)	04-Jul-14	1.847	8.32	9.62	-11.1
Catch dam 2 (west)	04-Jul-14	2.240	9.42	9.42	-9.8
Avon River at pump site	04-Jul-14	0.545	8.17	8.15	-7.7

Appendix B

Water quality graphs

Figure B.1: Field measured pH



Notes:

~ANZECC 2000 - Water Quality Guidelines: 95% protection levels for freshwater aquatic ecosystems,South-East Australia, low lying river ecosystems.

*ANZECC 2000. pH range of water for long-term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd

Project: Tiedman Irrigation Program - Gloucester Gas Project

Location: Gloucester Basin, NSW

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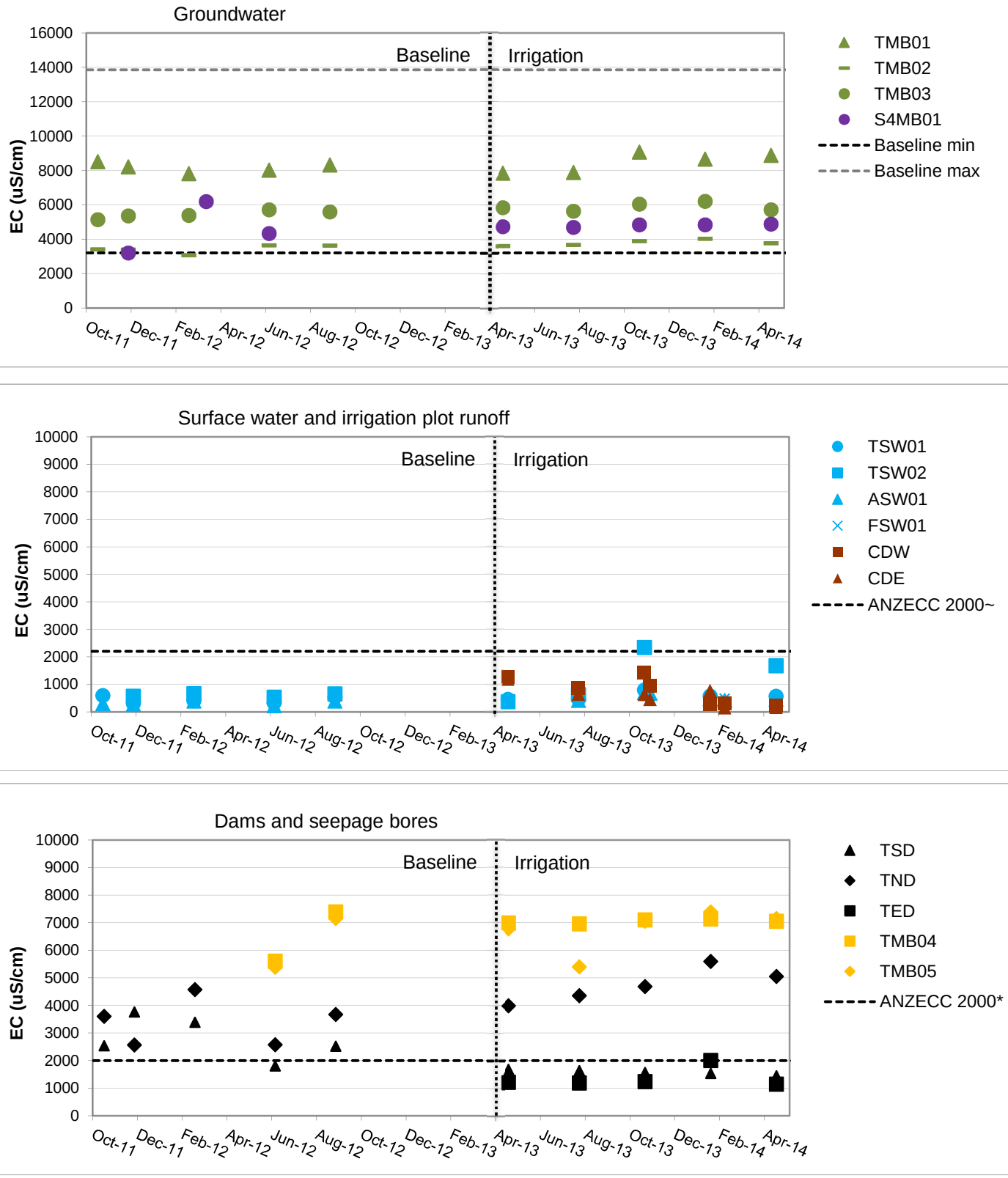
Figure B.2: Field measured EC



Notes:

~ANZECC 2000 - Water Quality Guidelines: 95% protection levels for freshwater aquatic ecosystems,South-East Australia, low lying river ecosystems.

*ANZECC 2000. Water for long-term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd

Project: Tiedman Irrigation Program - Gloucester Gas Project

Location: Gloucester Basin, NSW

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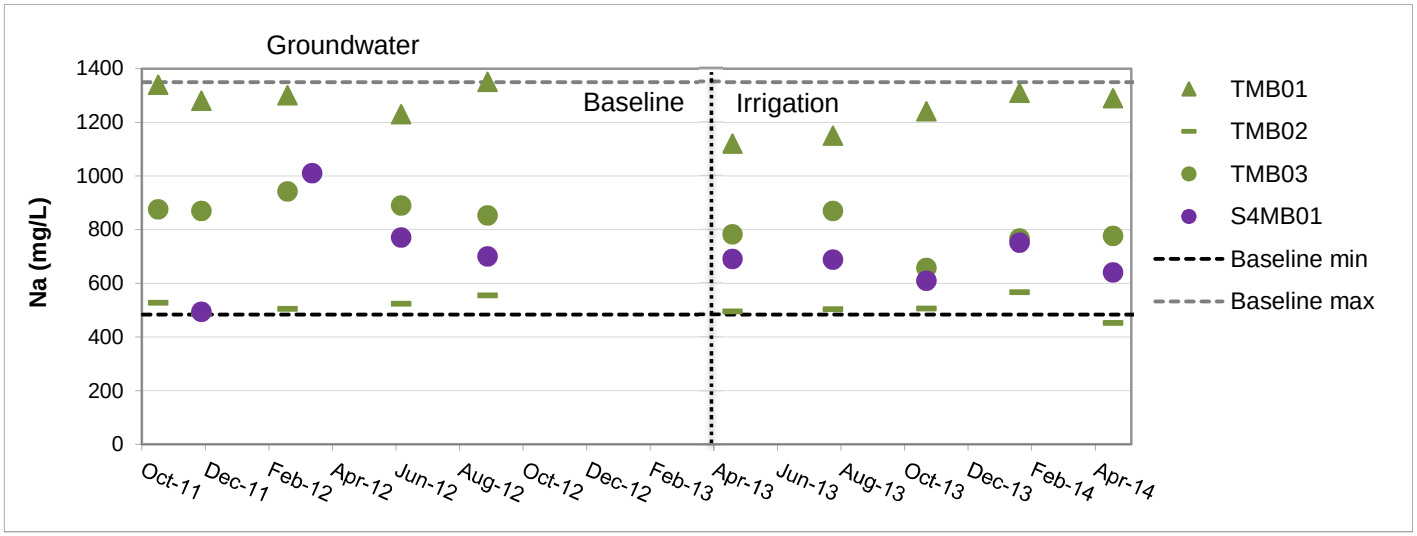
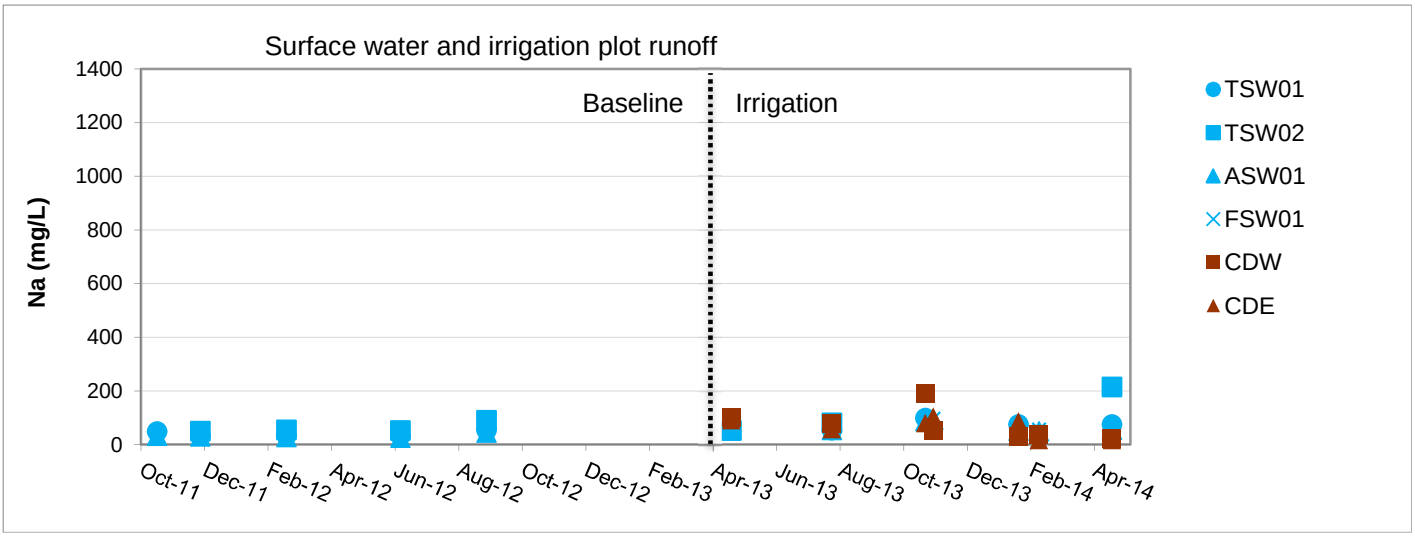
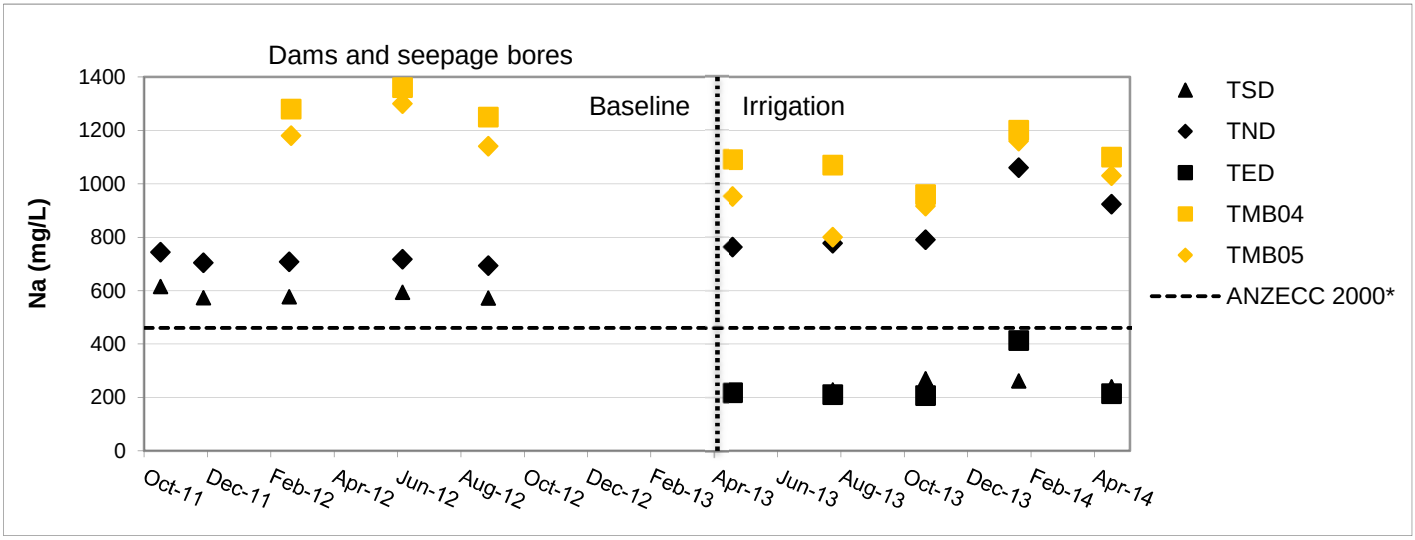
Figure B.3: Sodium concentrations







Note:

*ANZECC 2000. Water for irrigation and general water use. Moderately tolerant plants.

Client: AGL Upstream Investment Pty Ltd

Project: Tiedman Irrigation Program - Gloucester Gas Project

Location: Gloucester Basin, NSW

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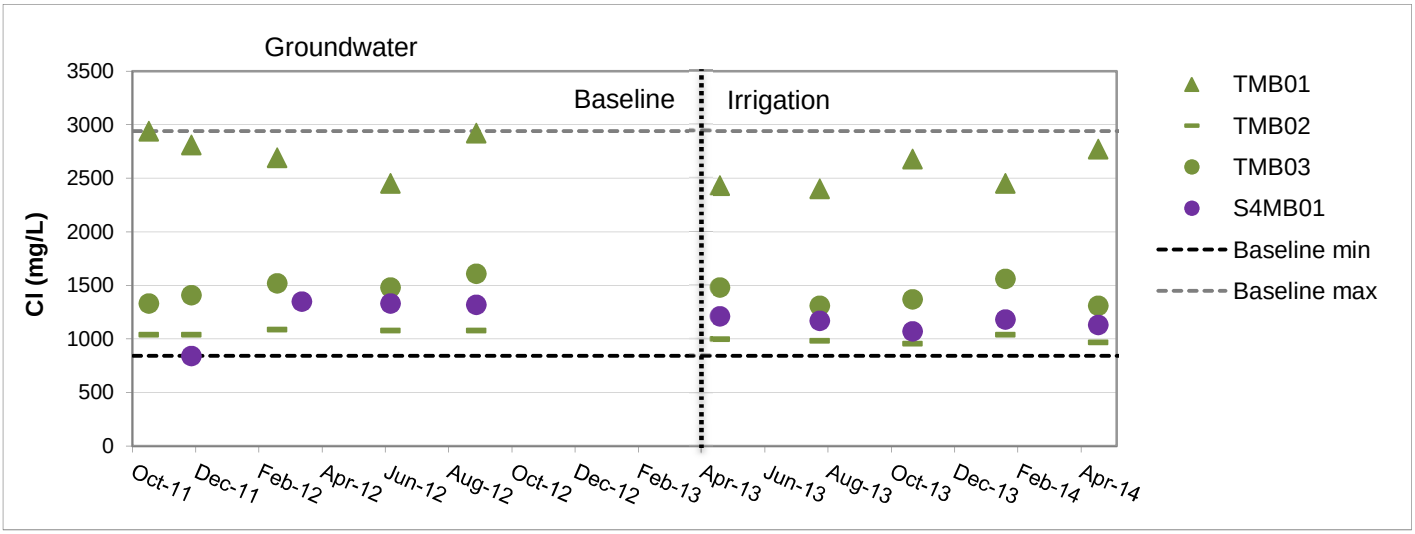
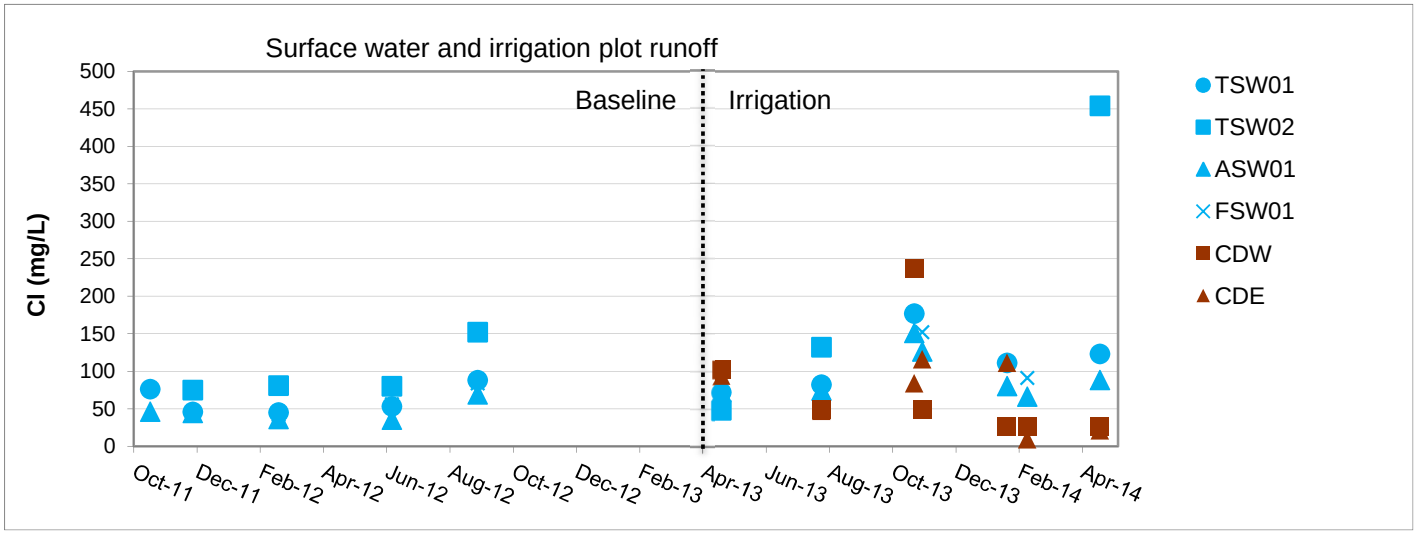
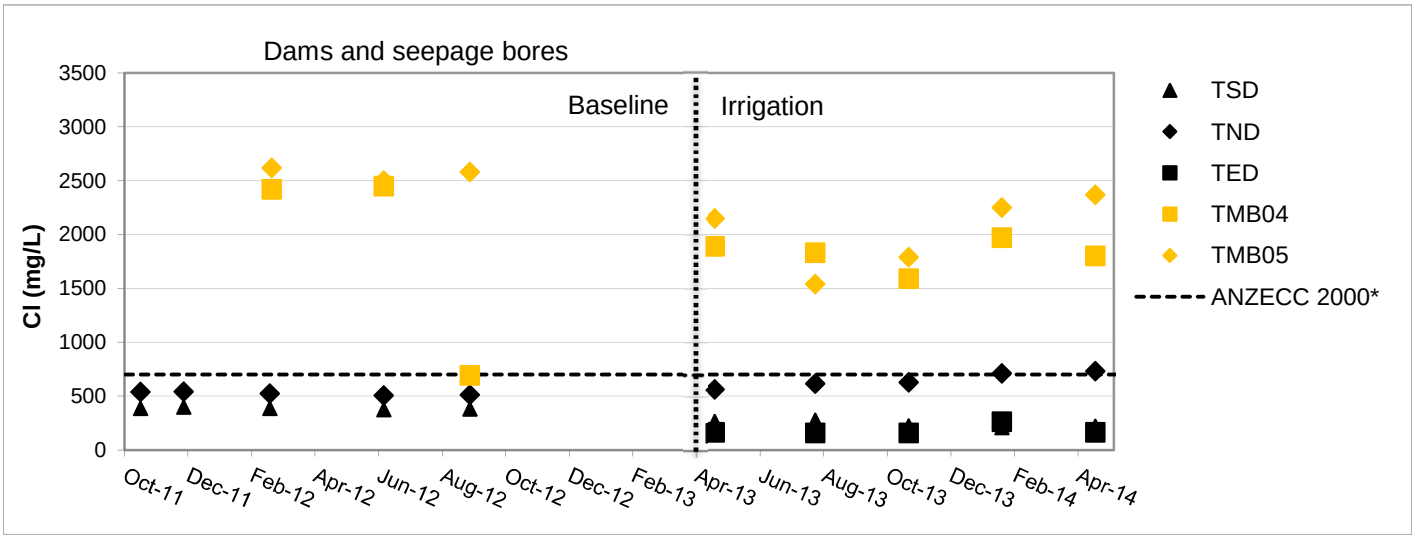
Figure B.4: Chloride concentrations







Note:

*ANZECC 2000. Water for irrigation and general water use. Moderately tolerant plants.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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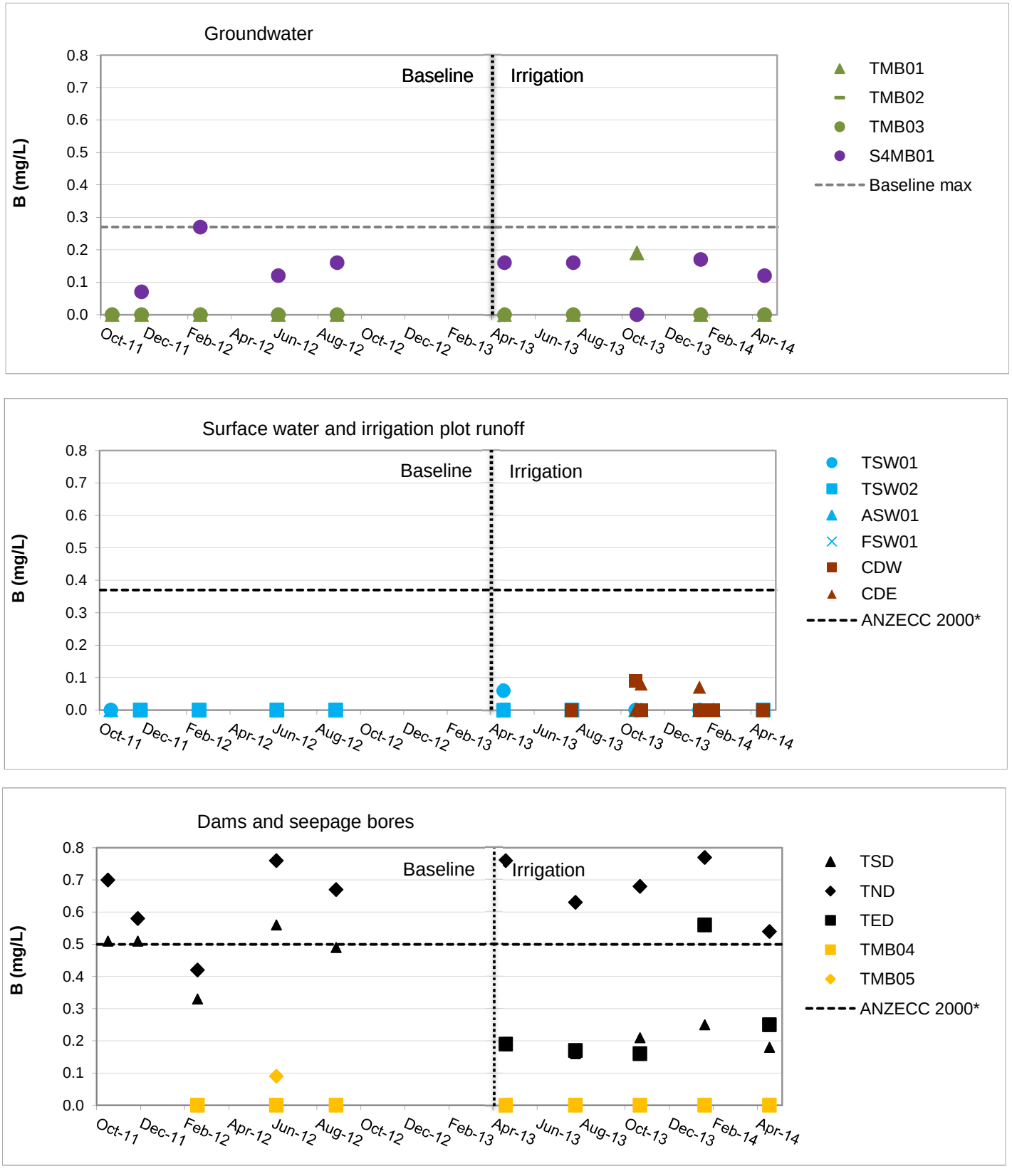
Figure B.5: Boron concentrations



Notes:

~ANZECC 2000 - Water Quality Guidelines: 95% protection levels for freshwater aquatic ecosystems

*ANZECC 2000. Water for long-term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd

Project: Tiedman Irrigation Program - Gloucester Gas Project

Location: Gloucester Basin, NSW

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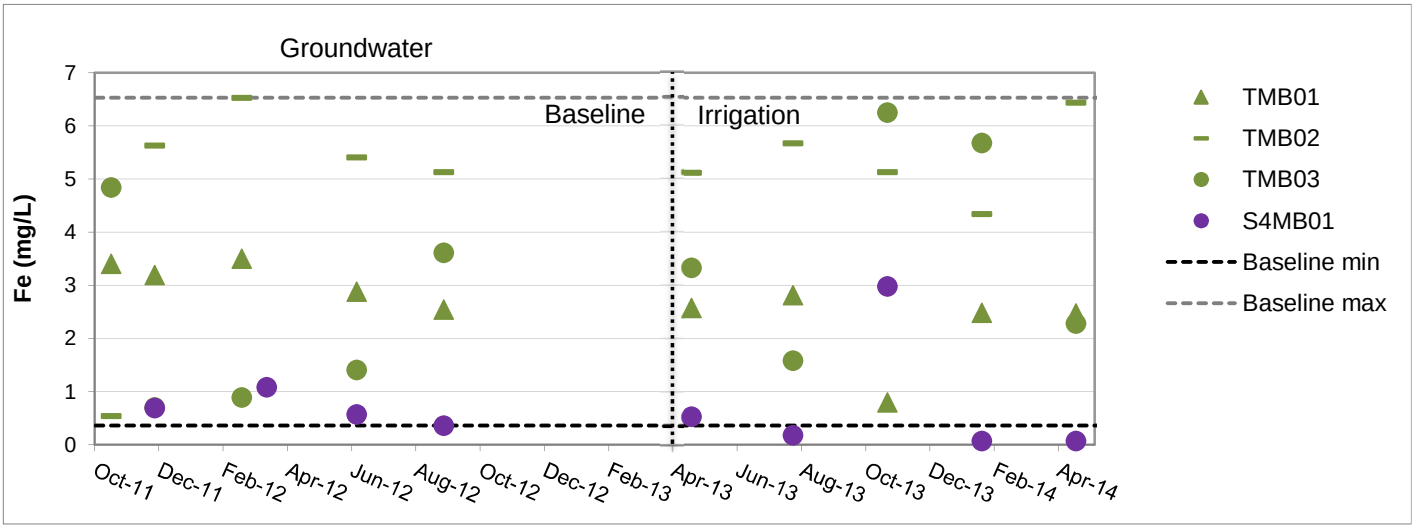
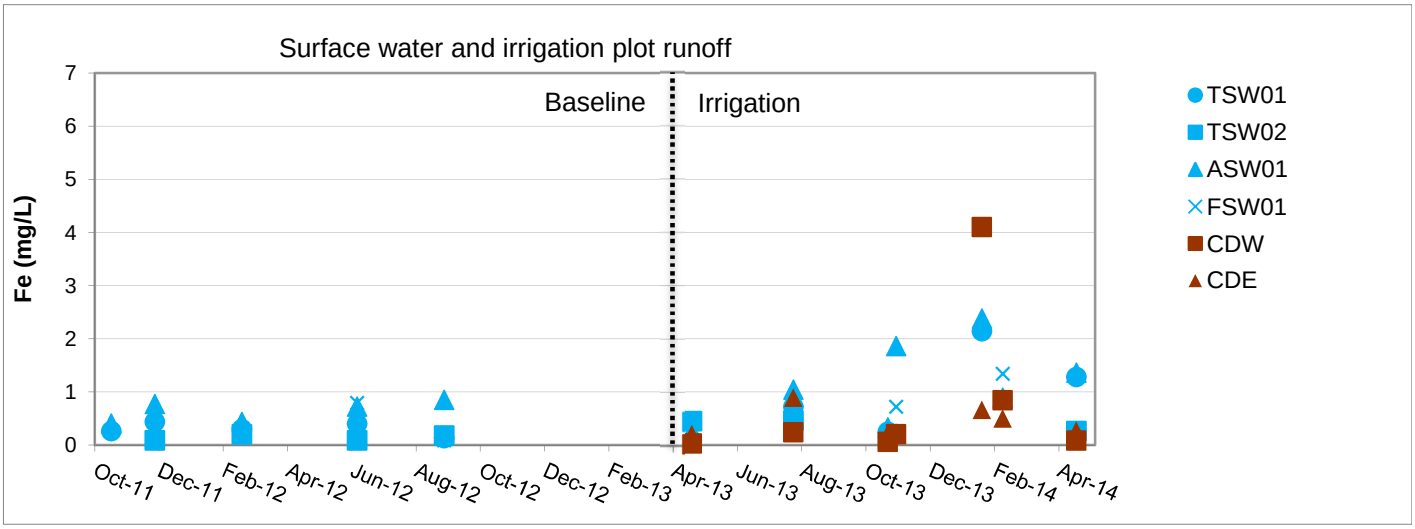
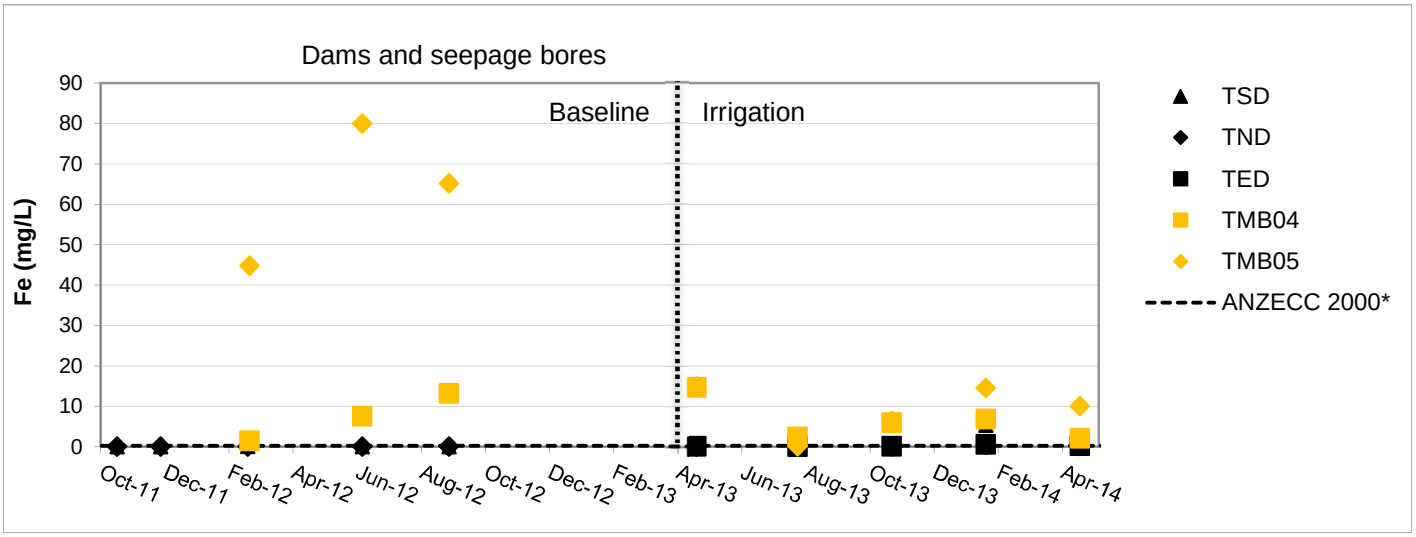
Figure B.6: Iron concentrations







Note:
*ANZECC 2000. Water for long term irrigation and general water use

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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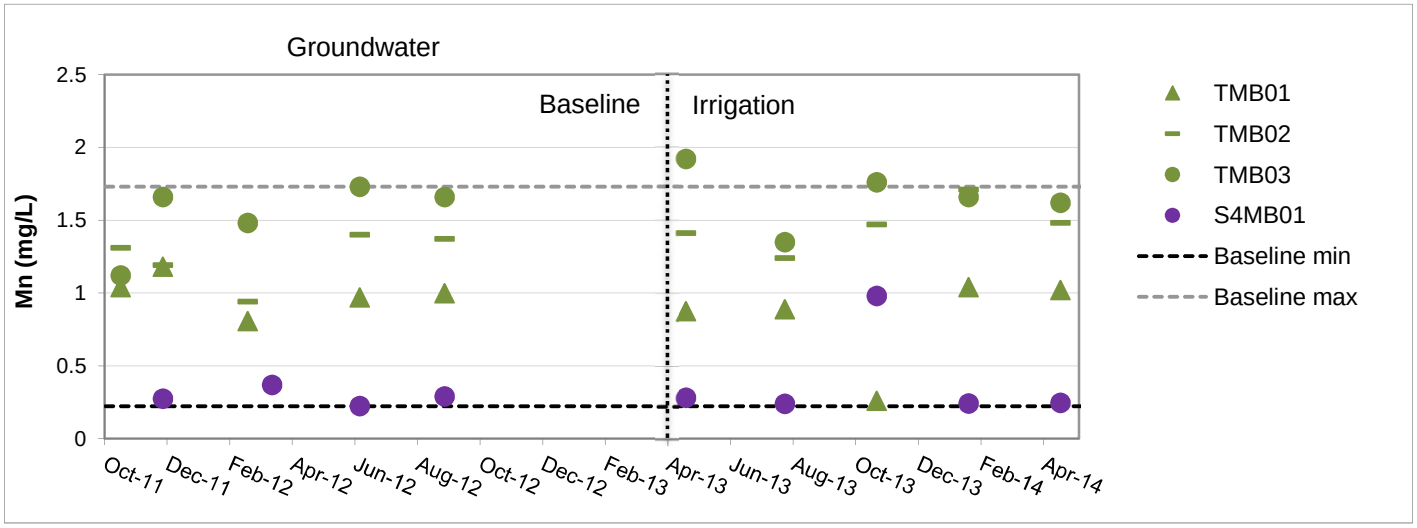
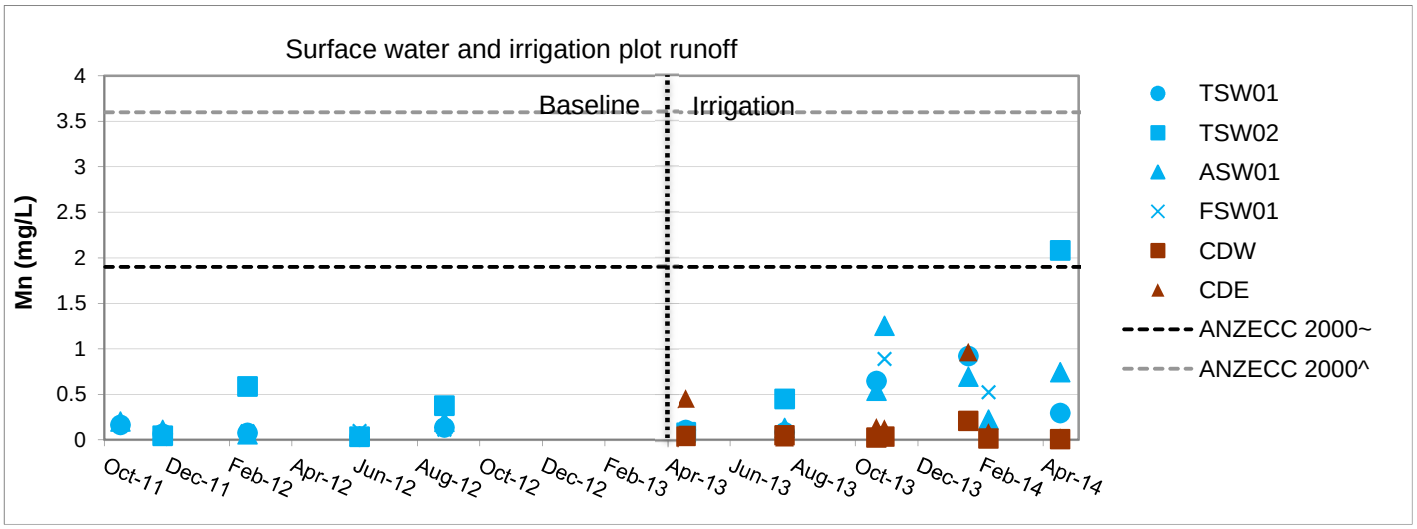
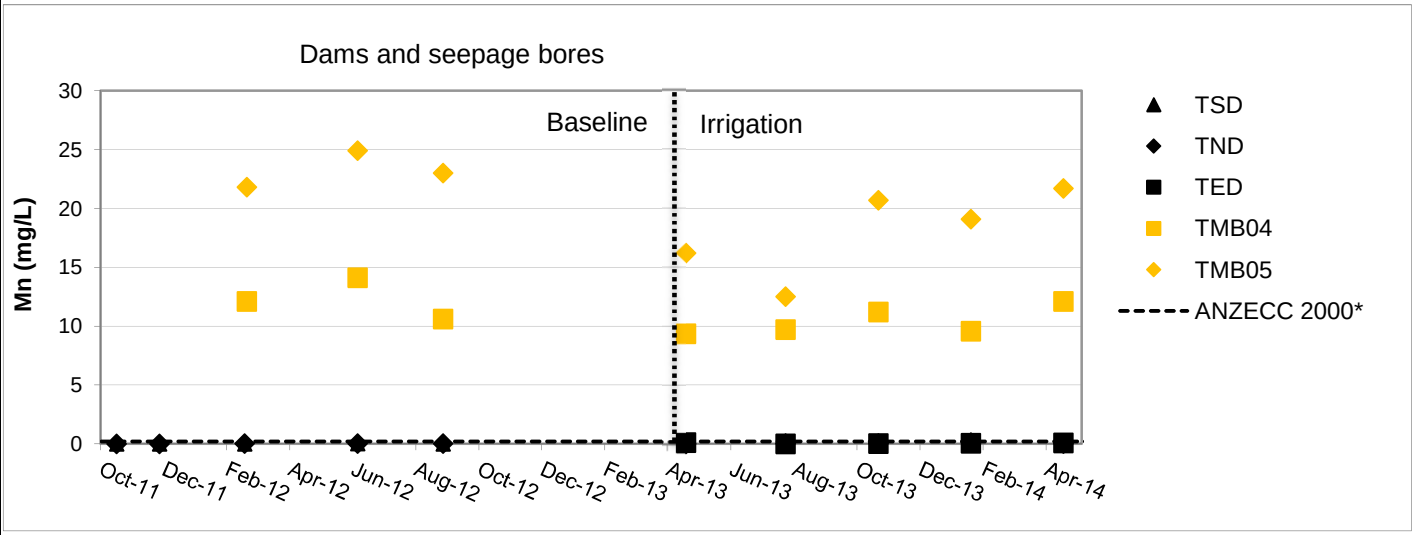
Figure B.7: Manganese concentrations







Notes:

~ANZECC 2000 - Water Quality Guidelines: 95 %protection levels for freshwater aquatic ecosystems

^ANZECC 2000 - Water Quality Guidelines: 80% protection levels for freshwater aquatic ecosystems

*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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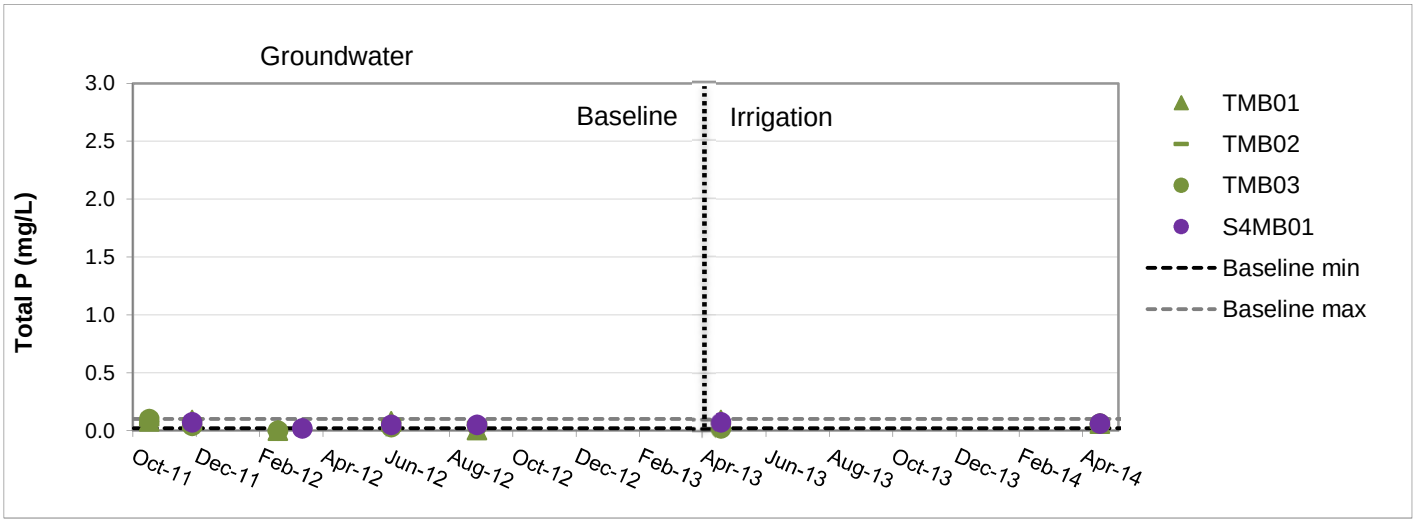
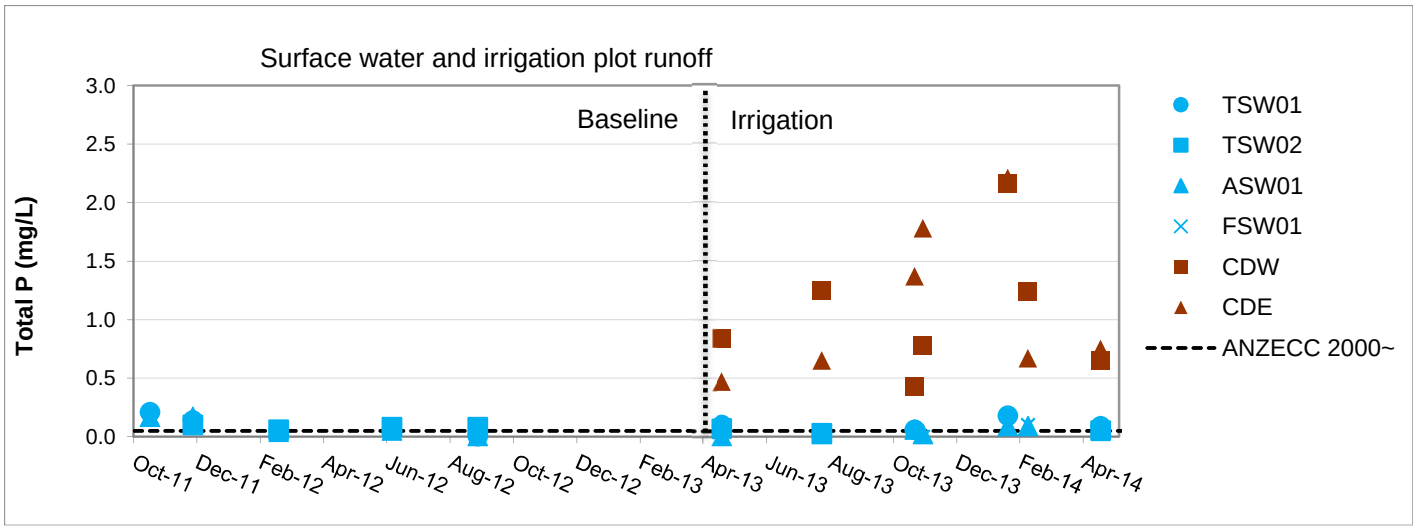
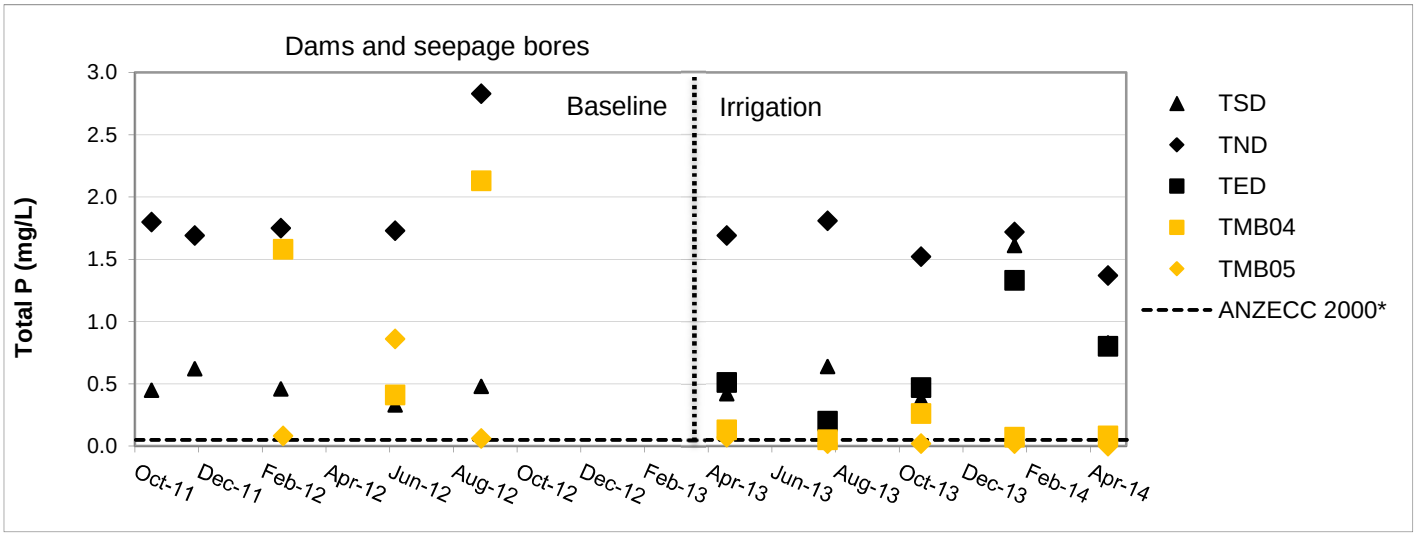
Figure B.8: Total Phosphorus concentrations







Note:

~ANZECC 2000 - Water Quality Guidelines: 95% protection levels for freshwater aquatic ecosystems,South-East Australia, low lying river ecosystems.

*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd

Project: Tiedman Irrigation Program - Gloucester Gas Project

Location: Gloucester Basin, NSW

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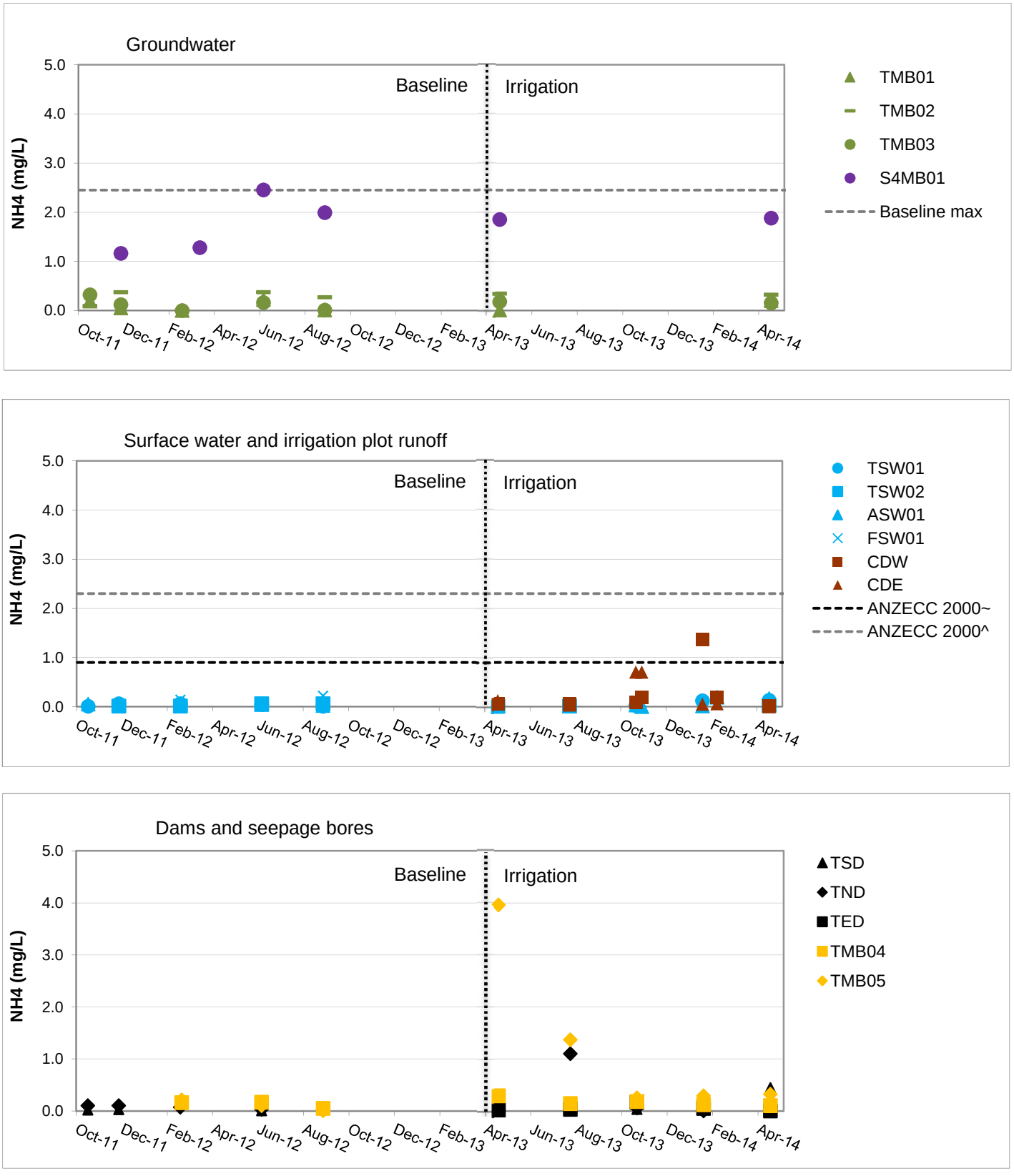
Figure B.9: Ammonia concentrations



Notes:
~ANZECC 2000 - Water Quality Guidelines: 95% protection levels for the protection of freshwater aquatic ecosystems
^ANZECC 2000 - Water Quality Guidelines: 80% protection levels for the protection of freshwater aquatic ecosystems

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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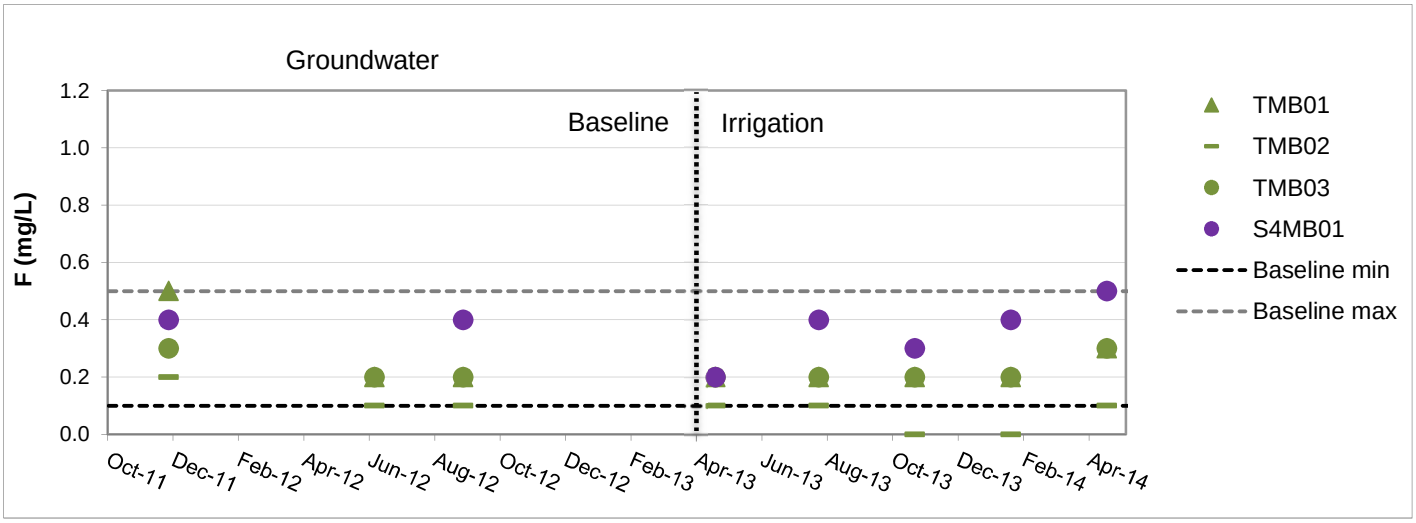
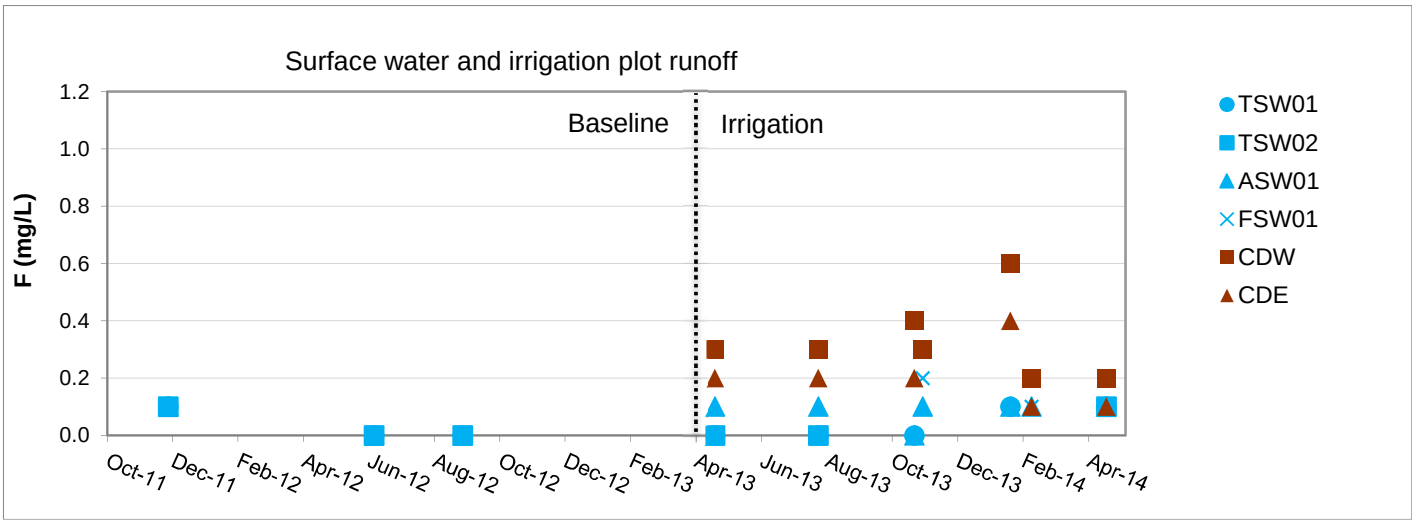
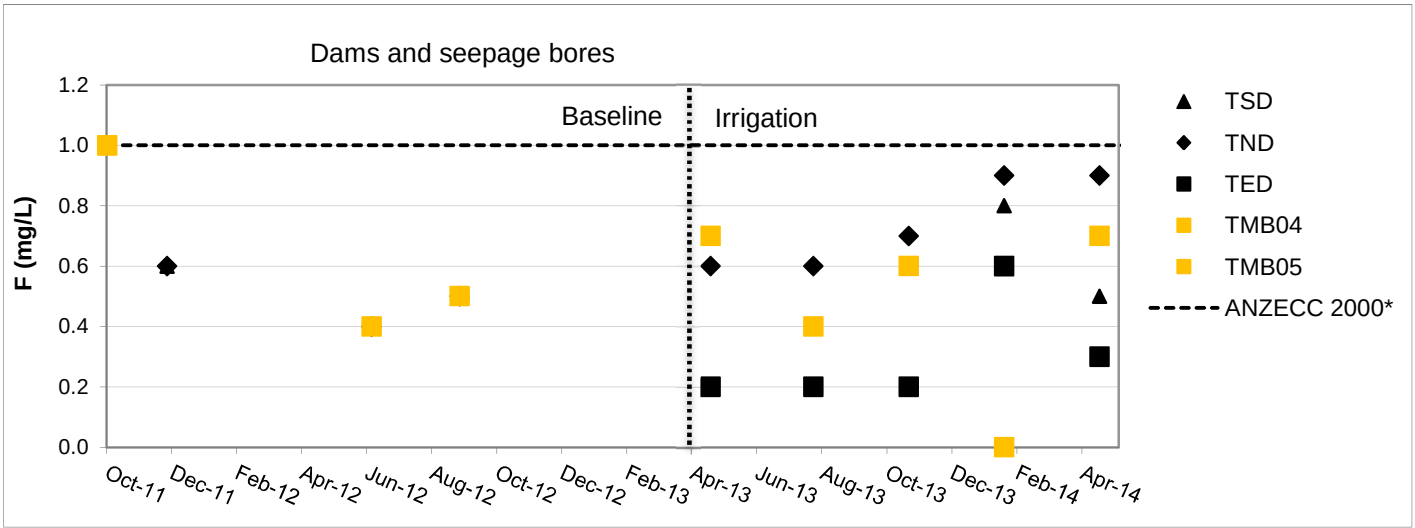
Figure B.10: Fluoride concentrations







Note:
*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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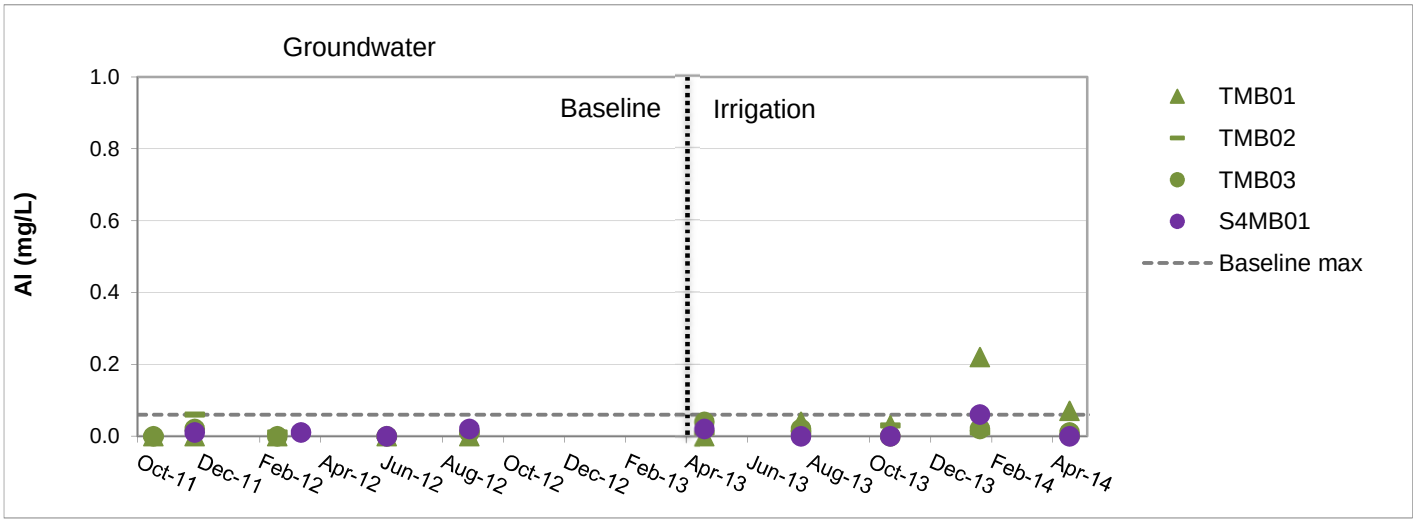
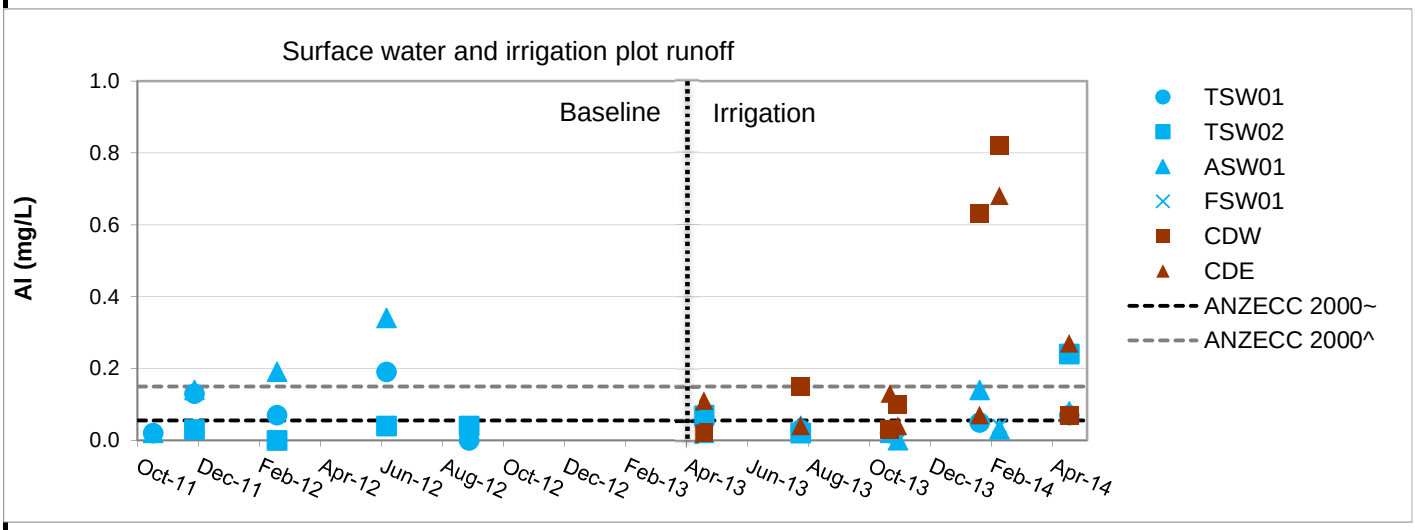
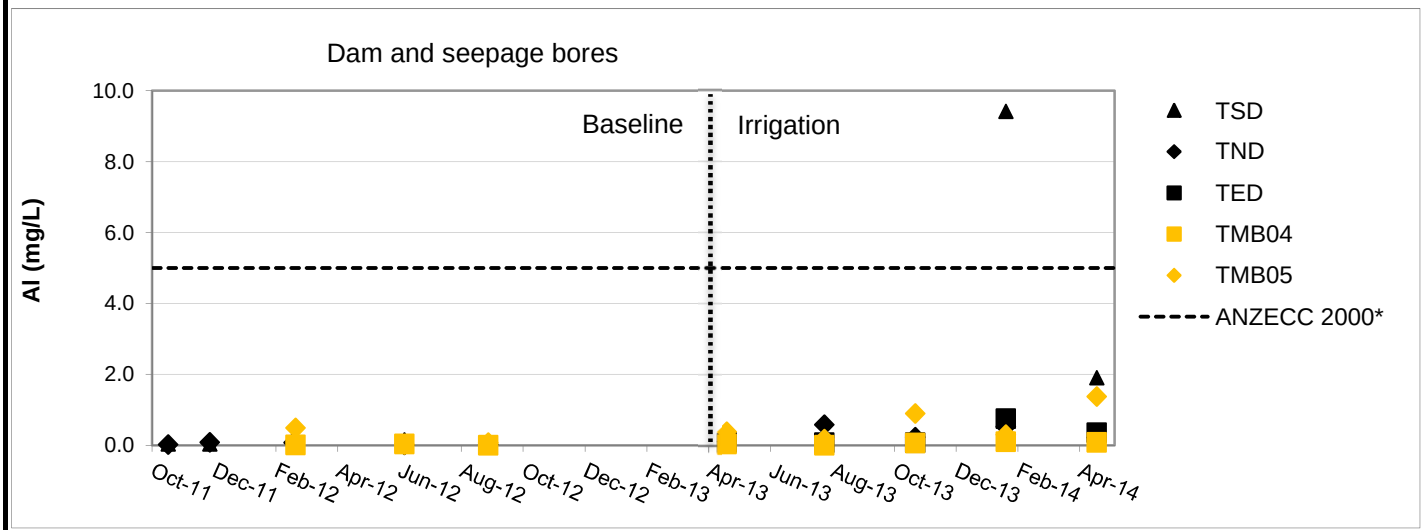
Figure B.11: Aluminium concentrations







Notes:

~ANZECC 2000 - Water Quality Guidelines: 95 %protection levels for freshwater aquatic ecosystems

^ANZECC 2000 - Water Quality Guidelines: 80% protection levels for freshwater aquatic ecosystems

*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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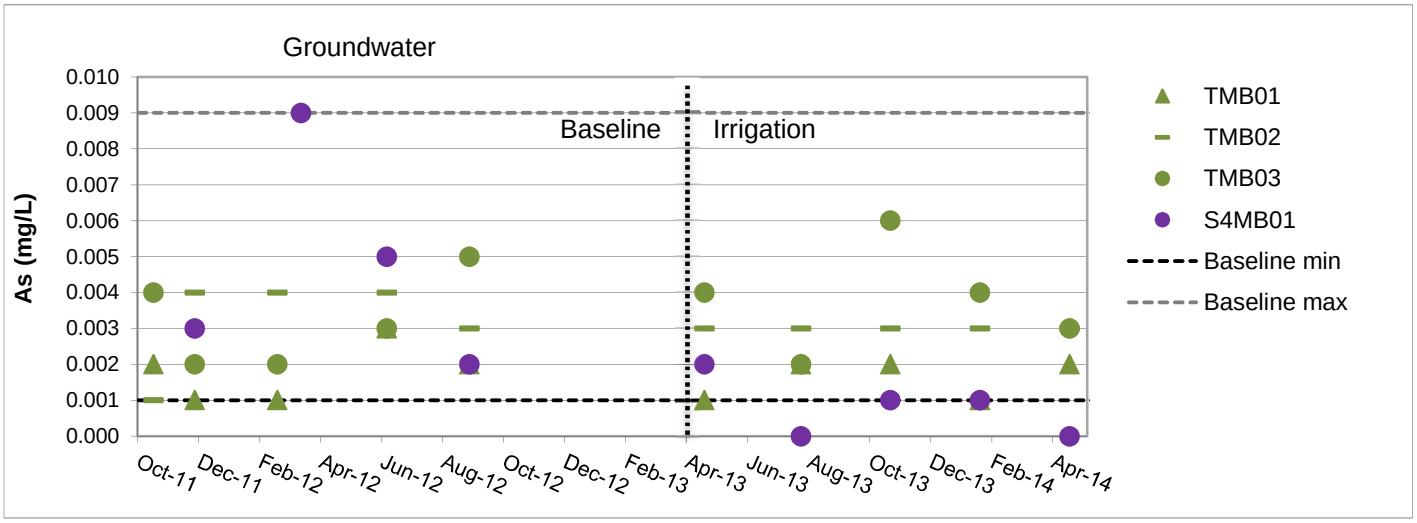
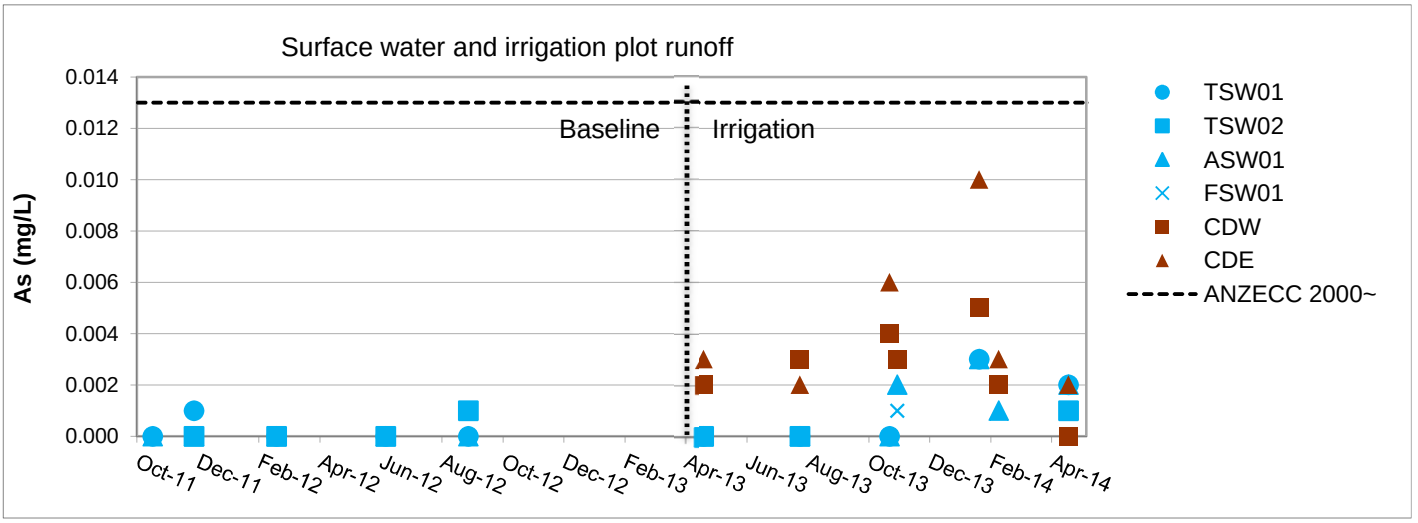
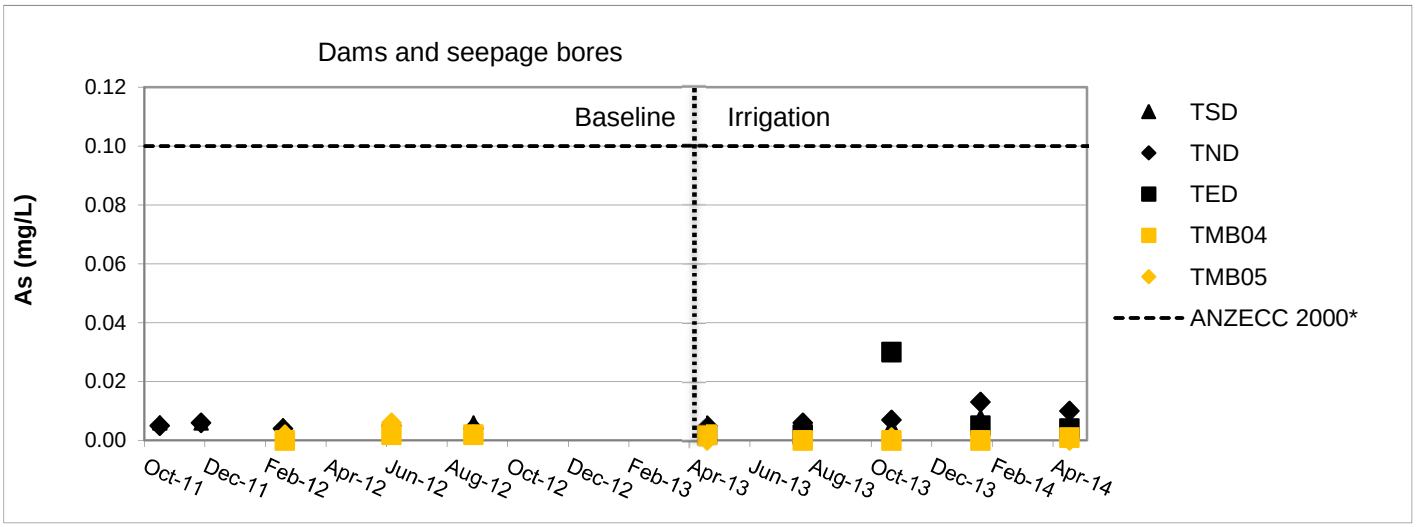
Figure B.12: Arsenic concentrations







Note:
~ANZECC 2000 – Water Quality Guideline: 95% protection levels for aquatic ecosystems
*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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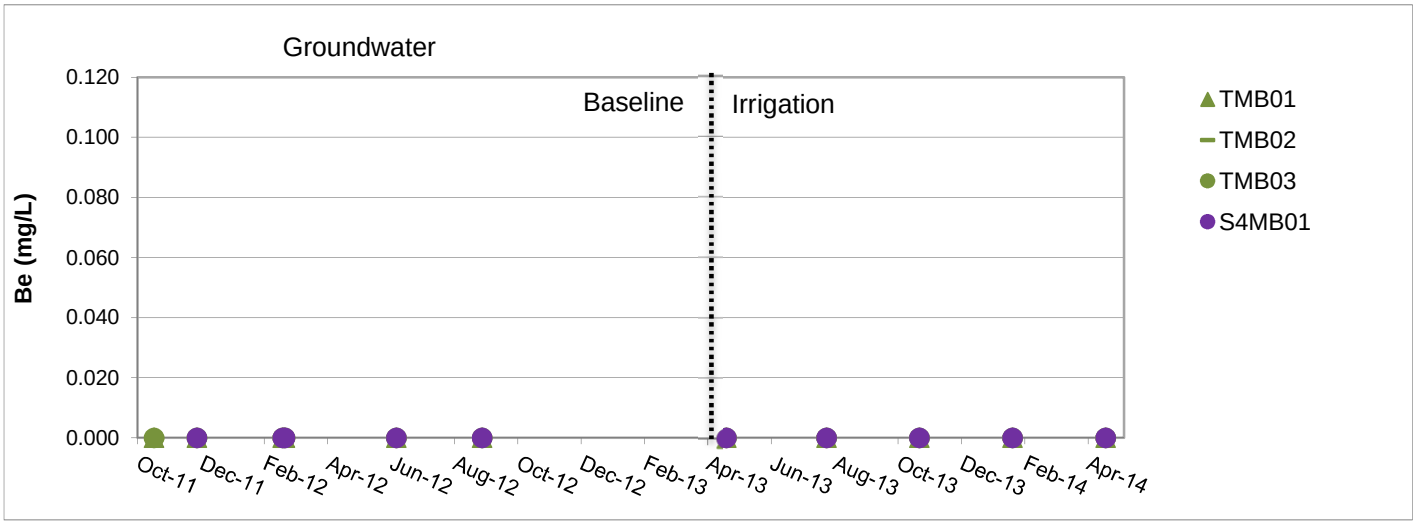
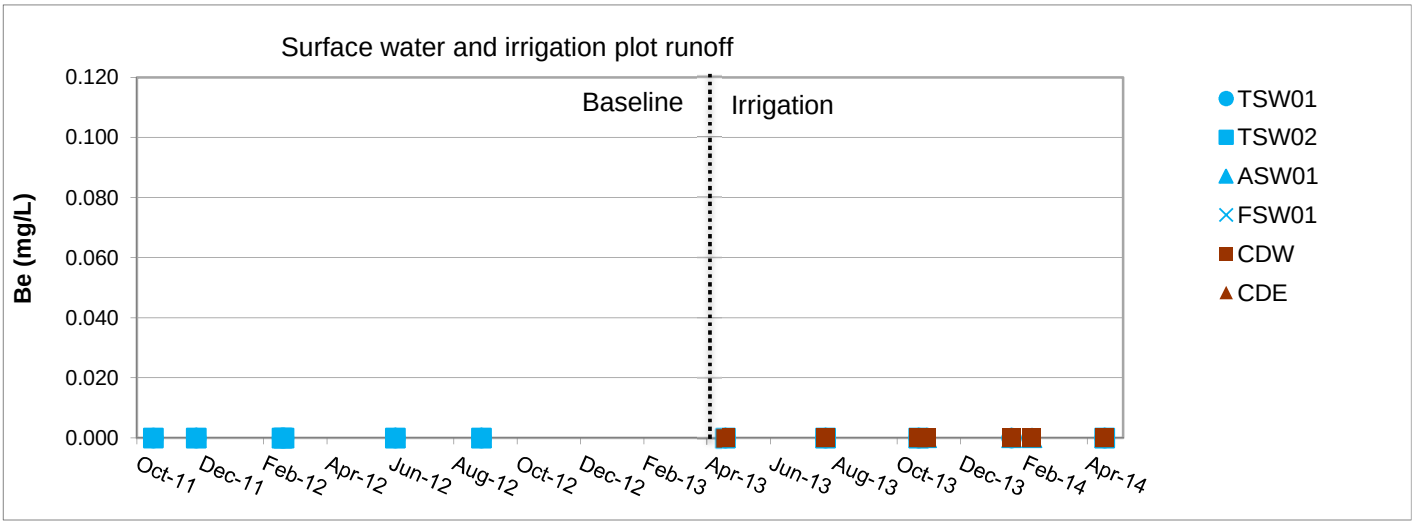
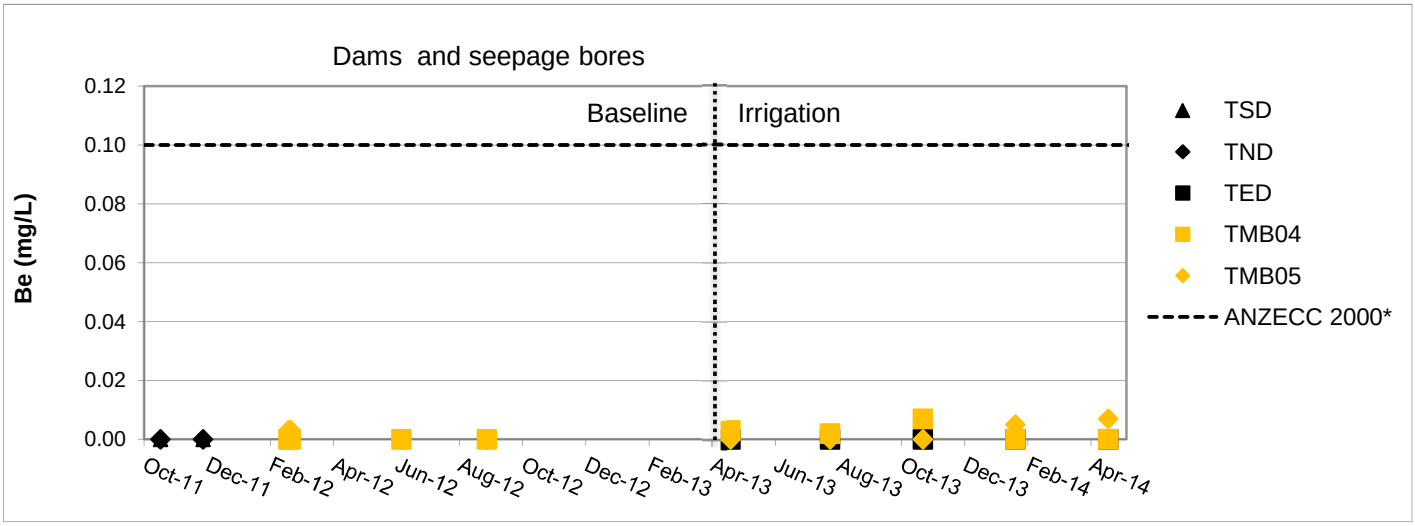
Figure B.13: Beryllium concentrations







Note:
*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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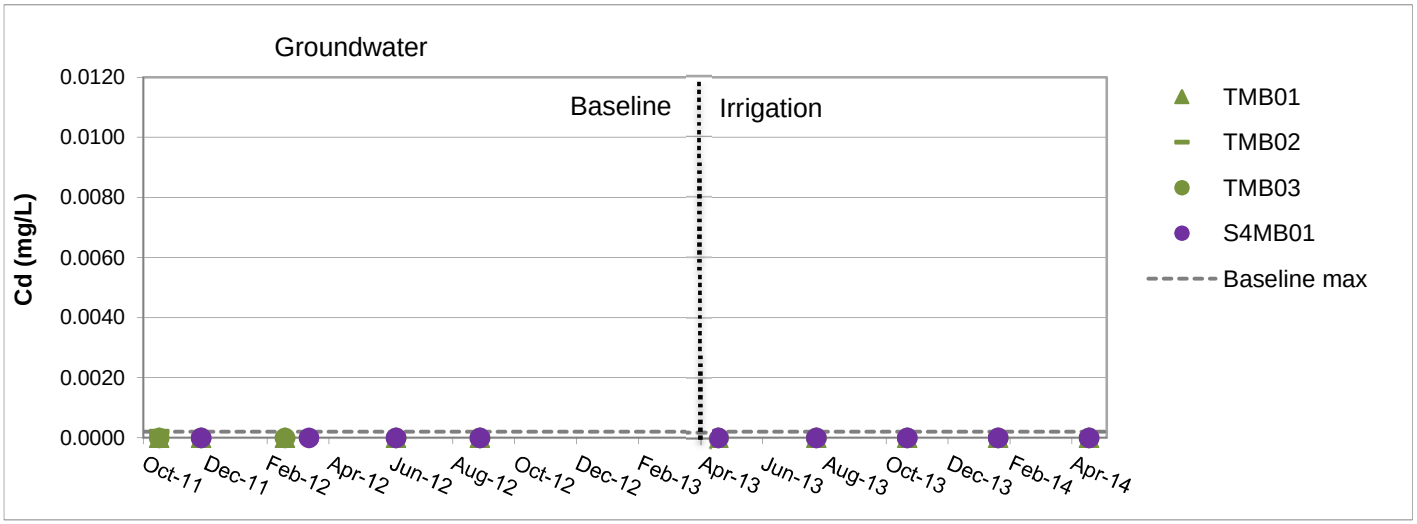
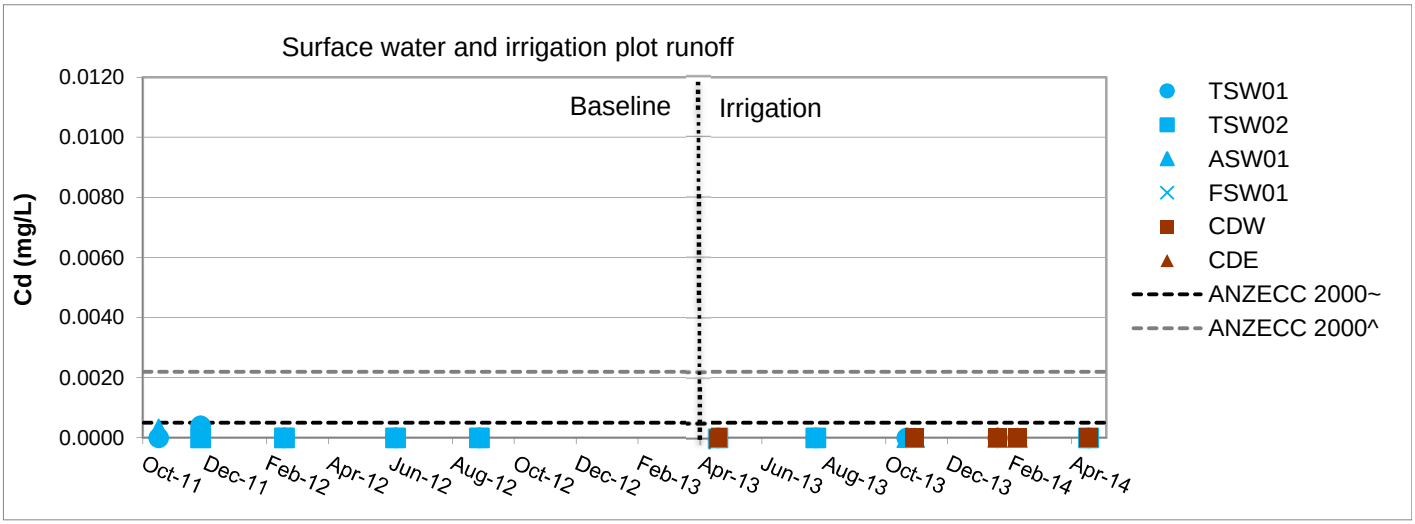
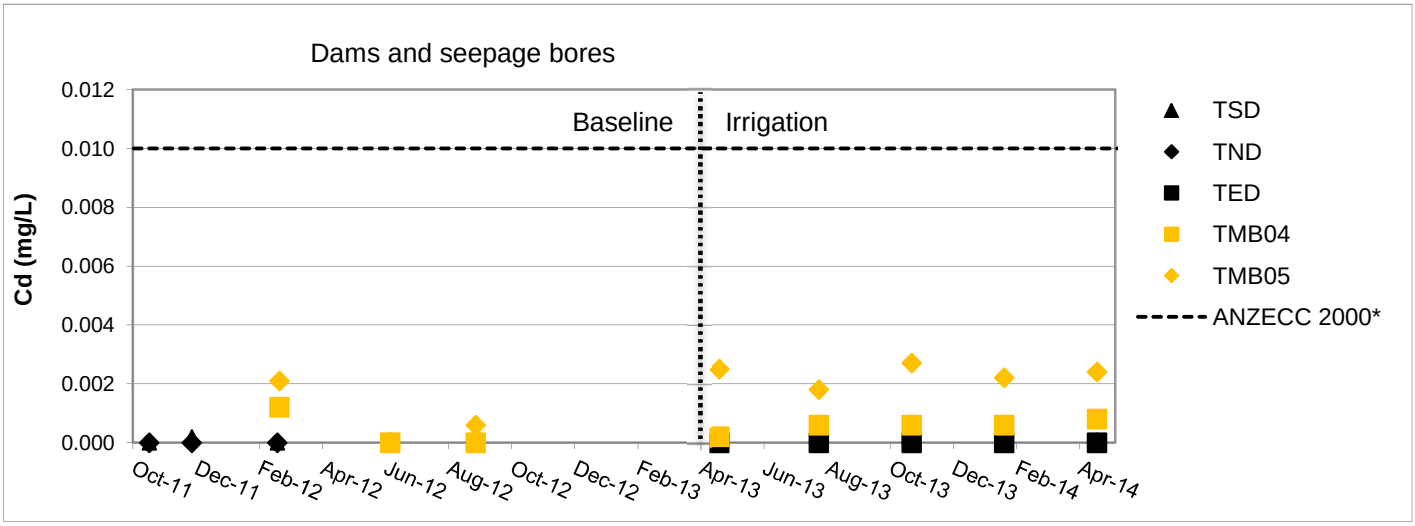
Figure B.14: Cadmium concentrations







Notes:

~ANZECC 2000 - Water Quality Guidelines: 95% protection levels for freshwater aquatic ecosystems

^ANZECC 2000 - Water Quality Guidelines: 80% protection levels for freshwater aquatic ecosystems

*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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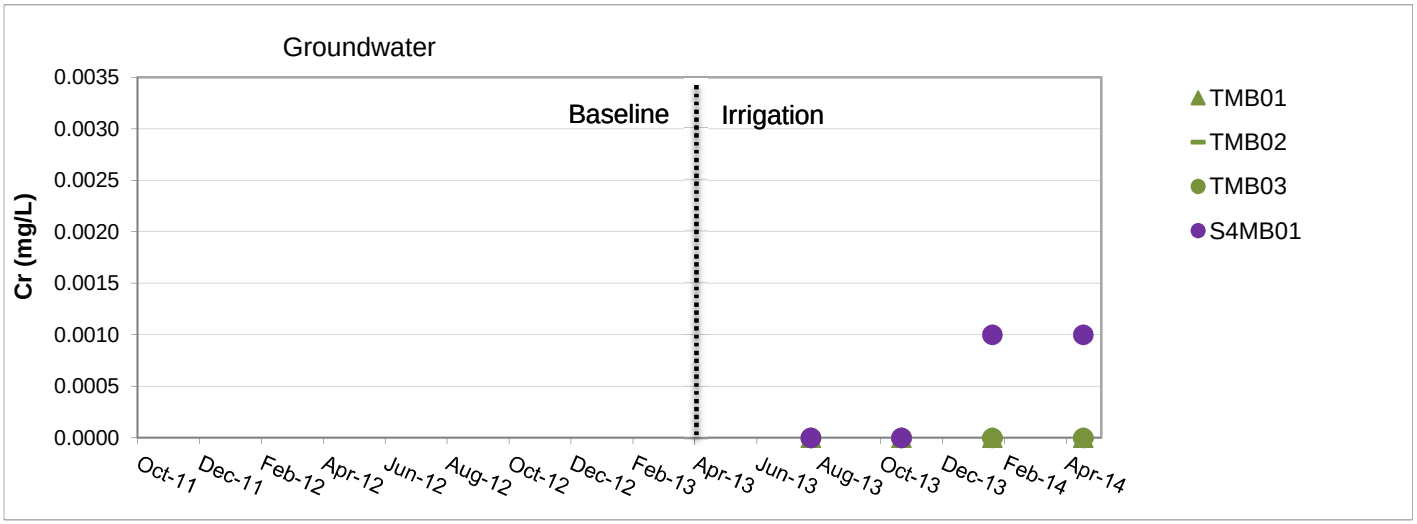
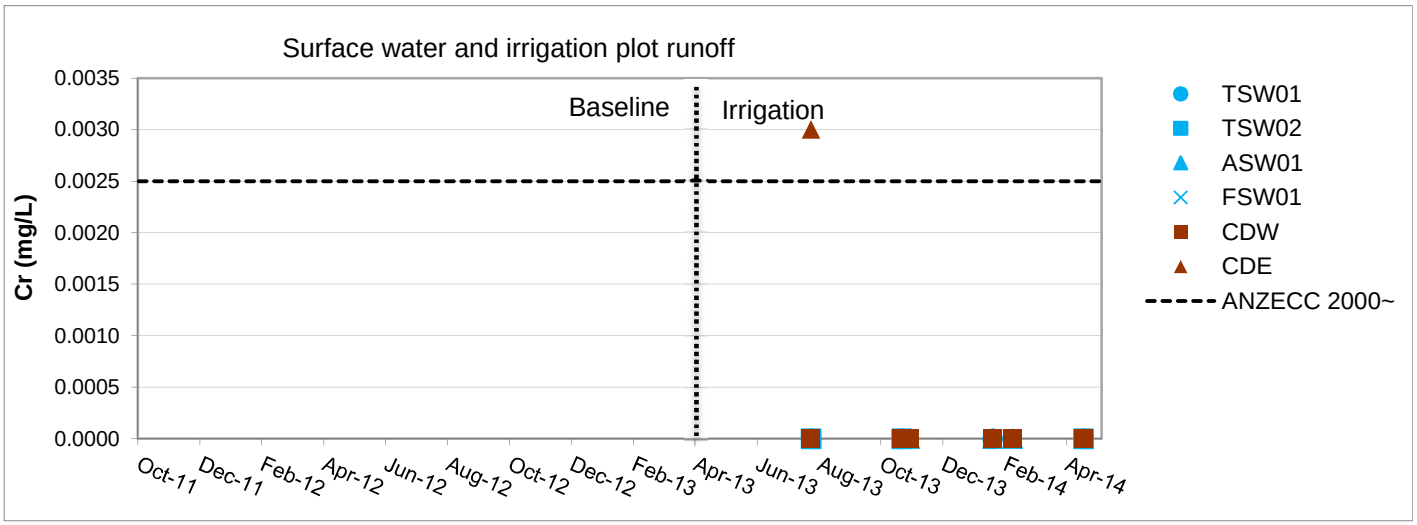
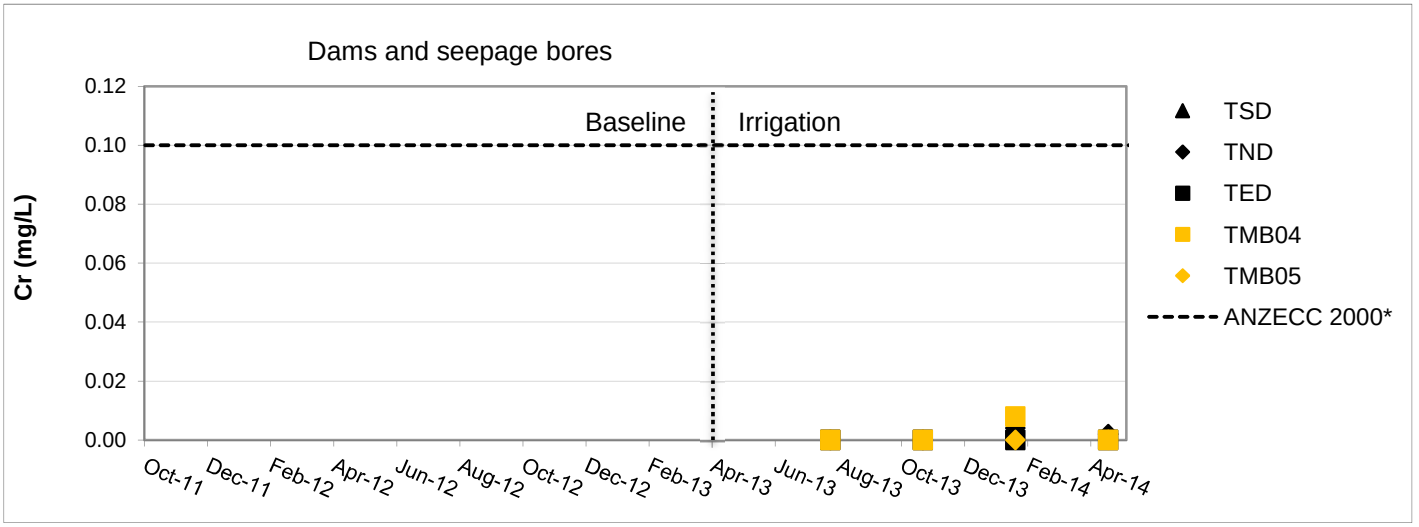
Figure B.15: Chromium concentrations







Note:
~ANZECC 2000 – Water Quality Guideline: 95% protection levels for aquatic ecosystems
*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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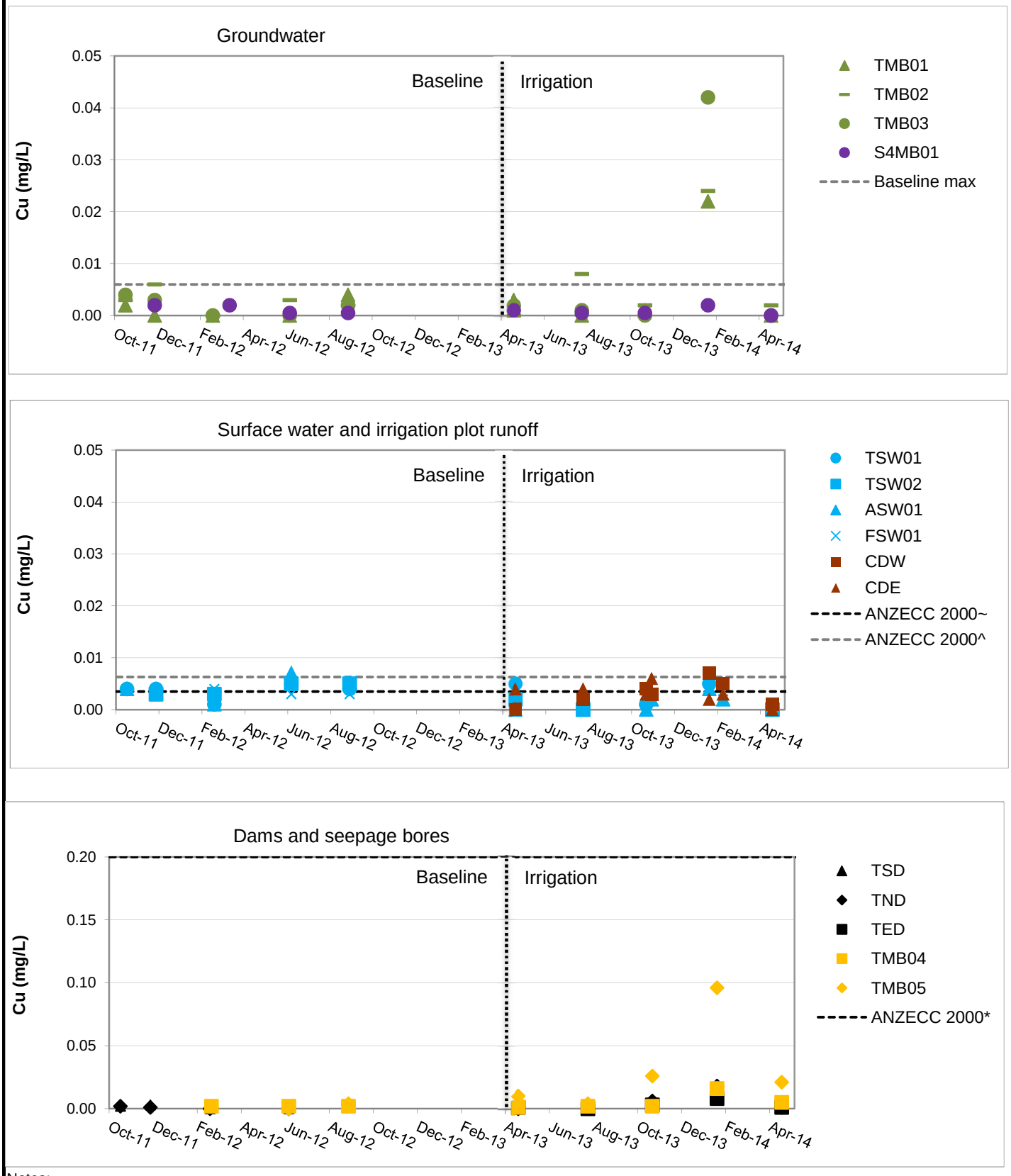
Figure B.16: Copper concentrations



Notes:

~ANZECC 2000 - Water Quality Guidelines: 95% protection levels for freshwater aquatic ecosystems

^ANZECC 2000 - Water Quality Guidelines: 80% protection levels for freshwater aquatic ecosystems

*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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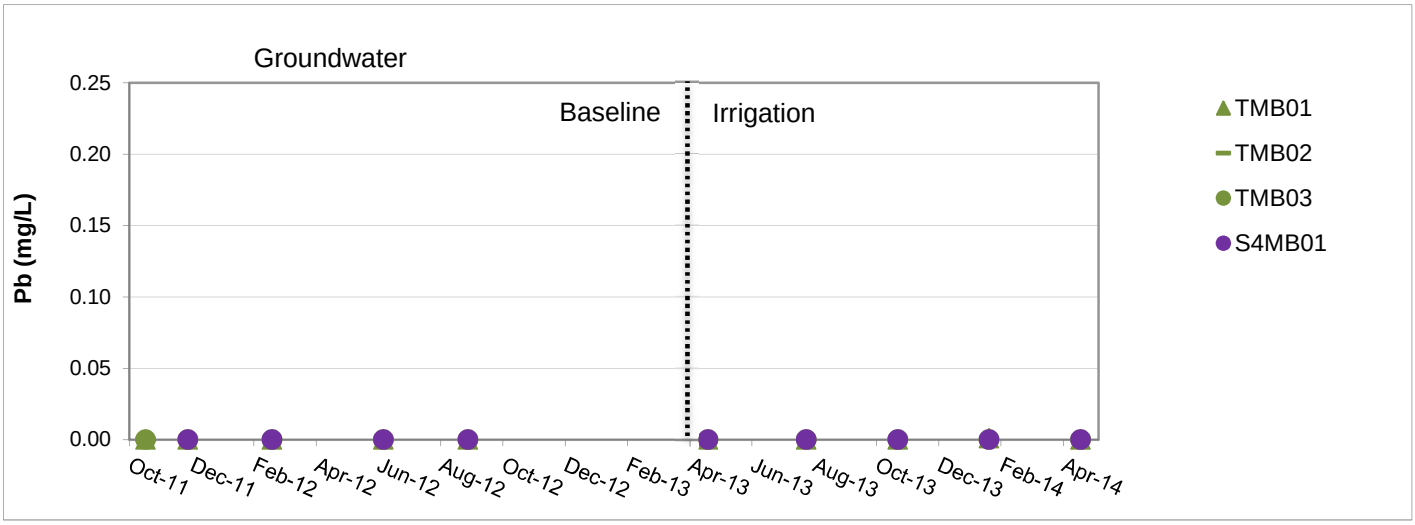
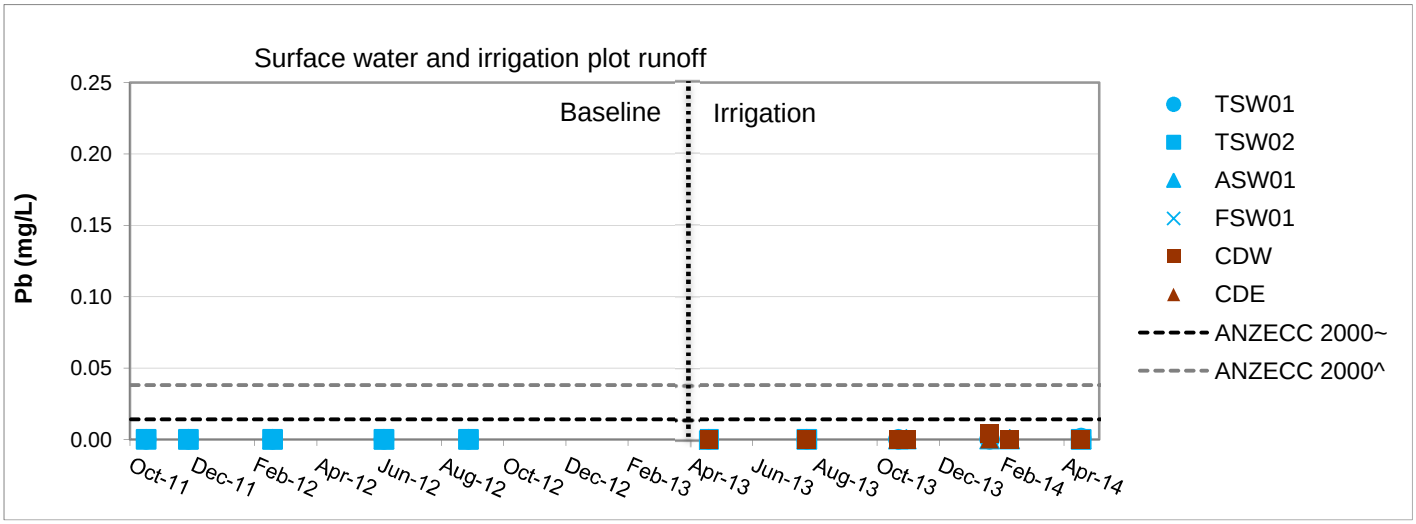
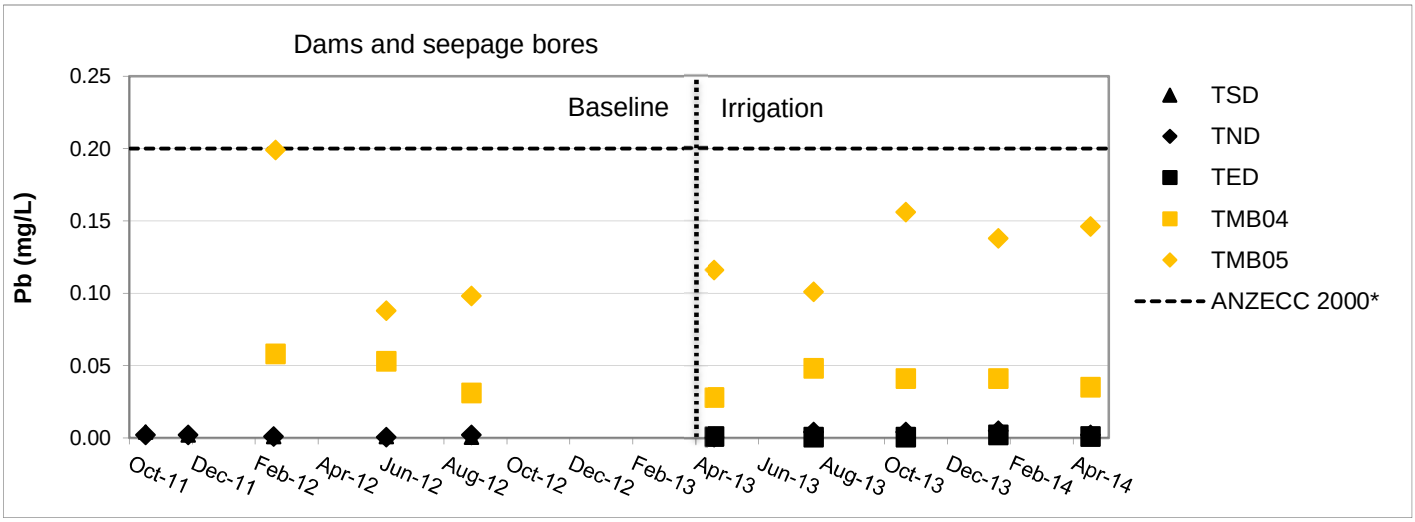
Figure B.17: Lead concentrations







Notes:

~ANZECC 2000 - Water Quality Guidelines: 95% protection levels for freshwater aquatic ecosystems

^ANZECC 2000 - Water Quality Guidelines: 80% protection levels for freshwater aquatic ecosystems

*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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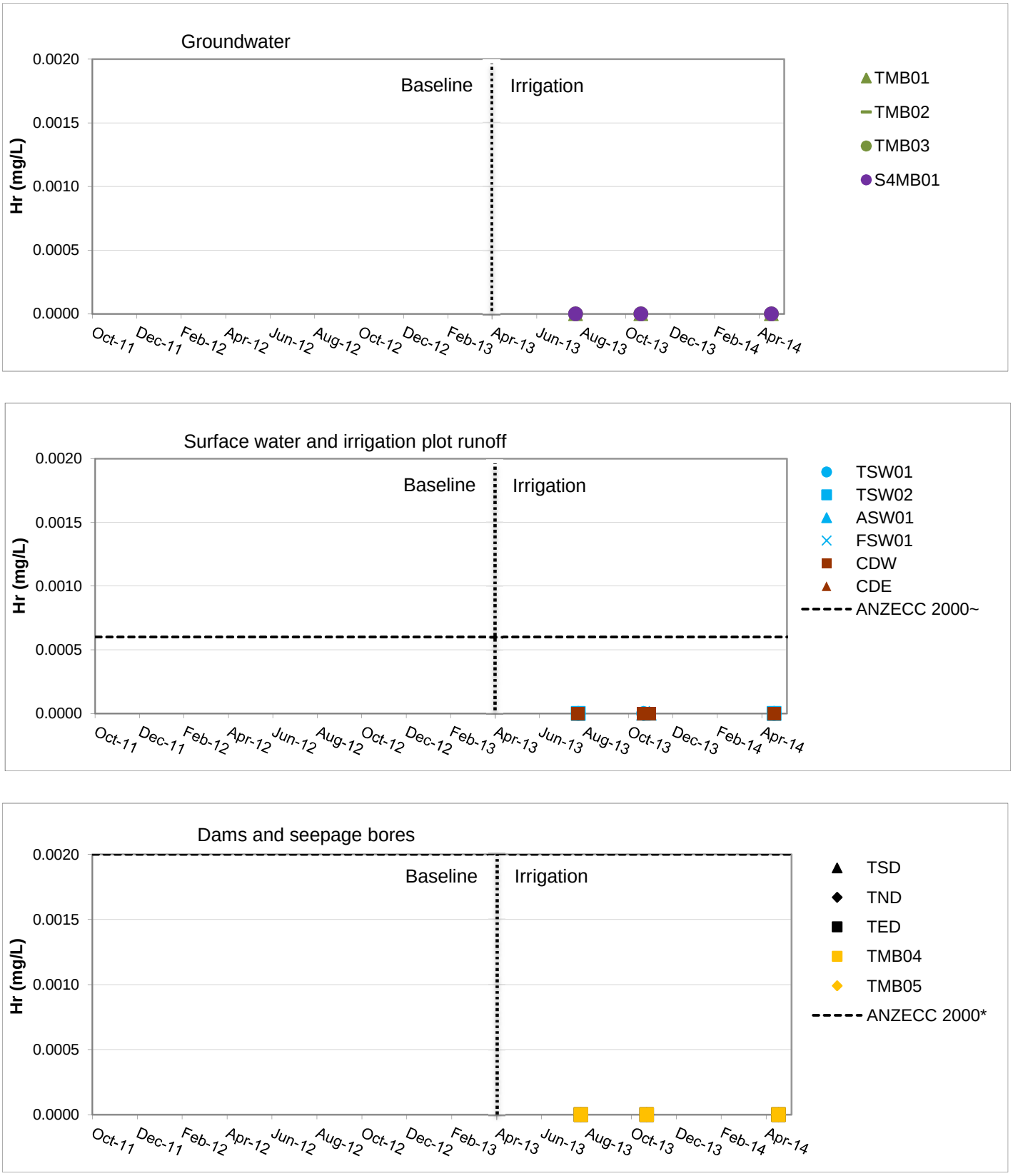
Figure B.18: Mercury concentrations



Note:
~ANZECC 2000 – Water Quality Guideline: 95% protection levels for aquatic ecosystems
*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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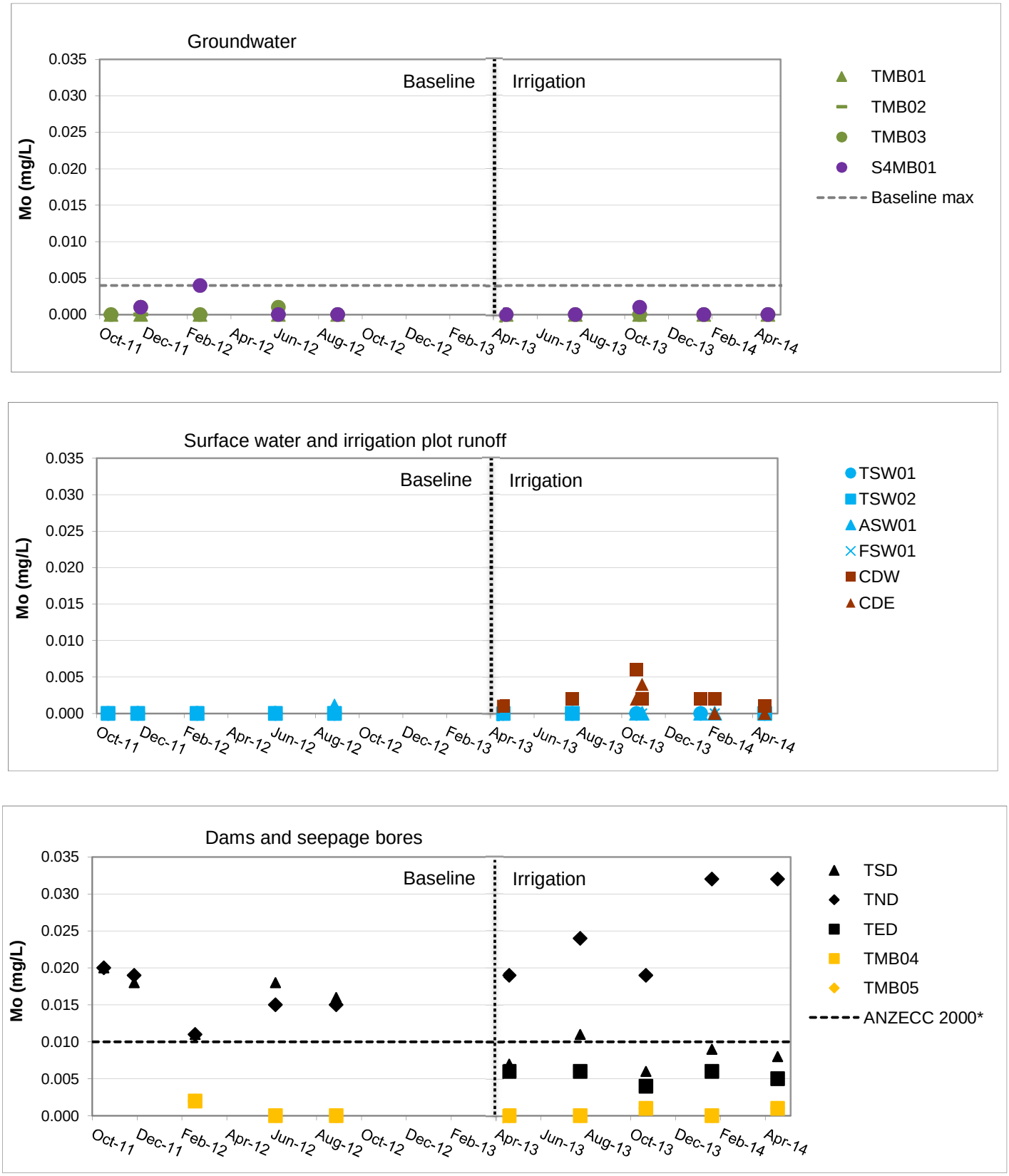
Figure B.19: Molybdenum concentrations



Note:
*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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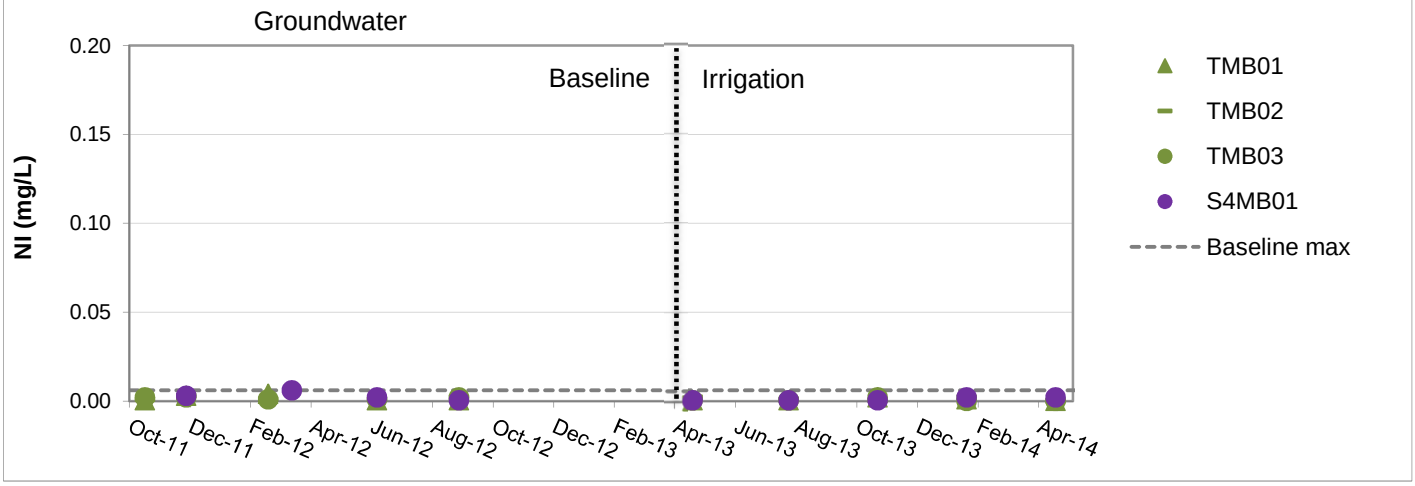
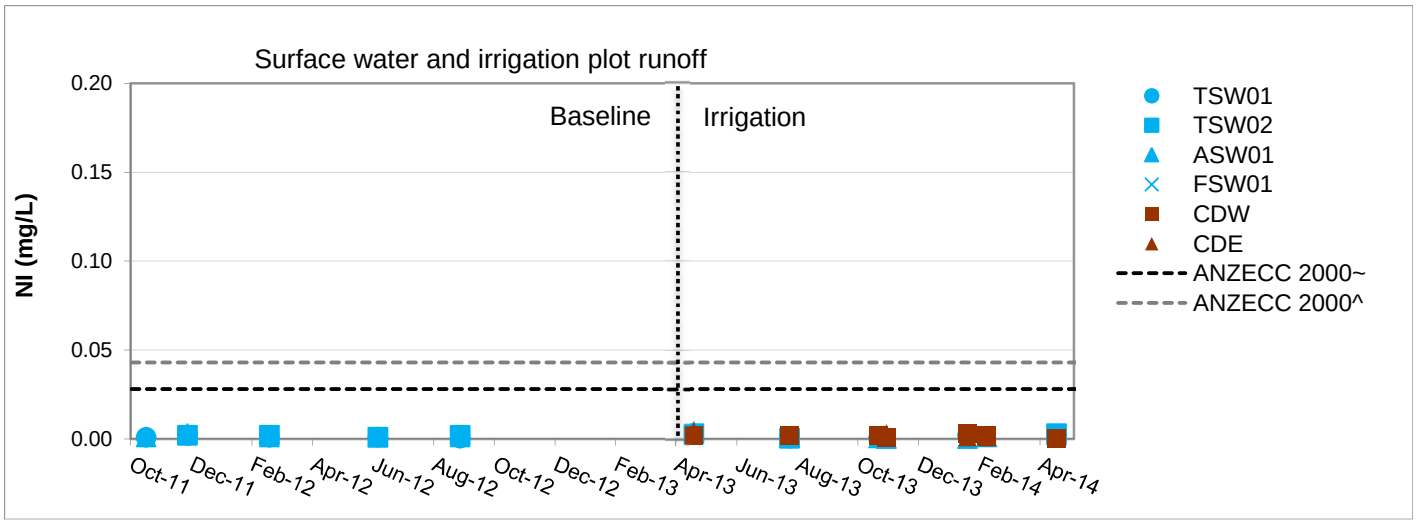
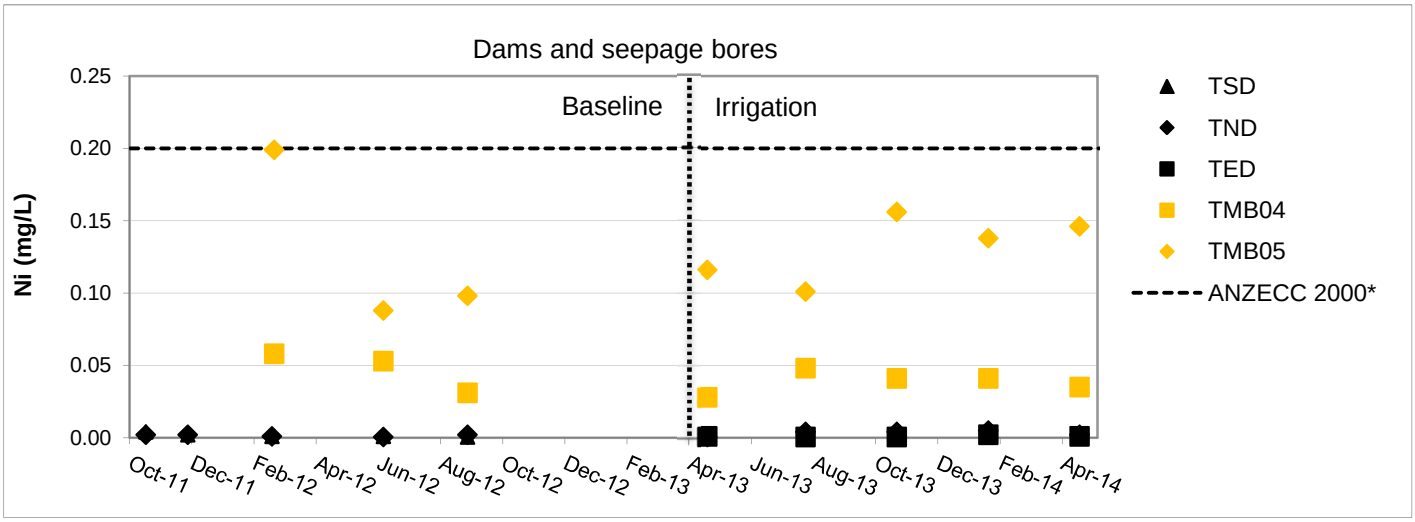
Figure B.20: Nickel concentrations







Notes:

~ANZECC 2000 - Water Quality Guidelines: 95% protection levels for freshwater aquatic ecosystems

^ANZECC 2000 - Water Quality Guidelines: 80% protection levels for freshwater aquatic ecosystems

*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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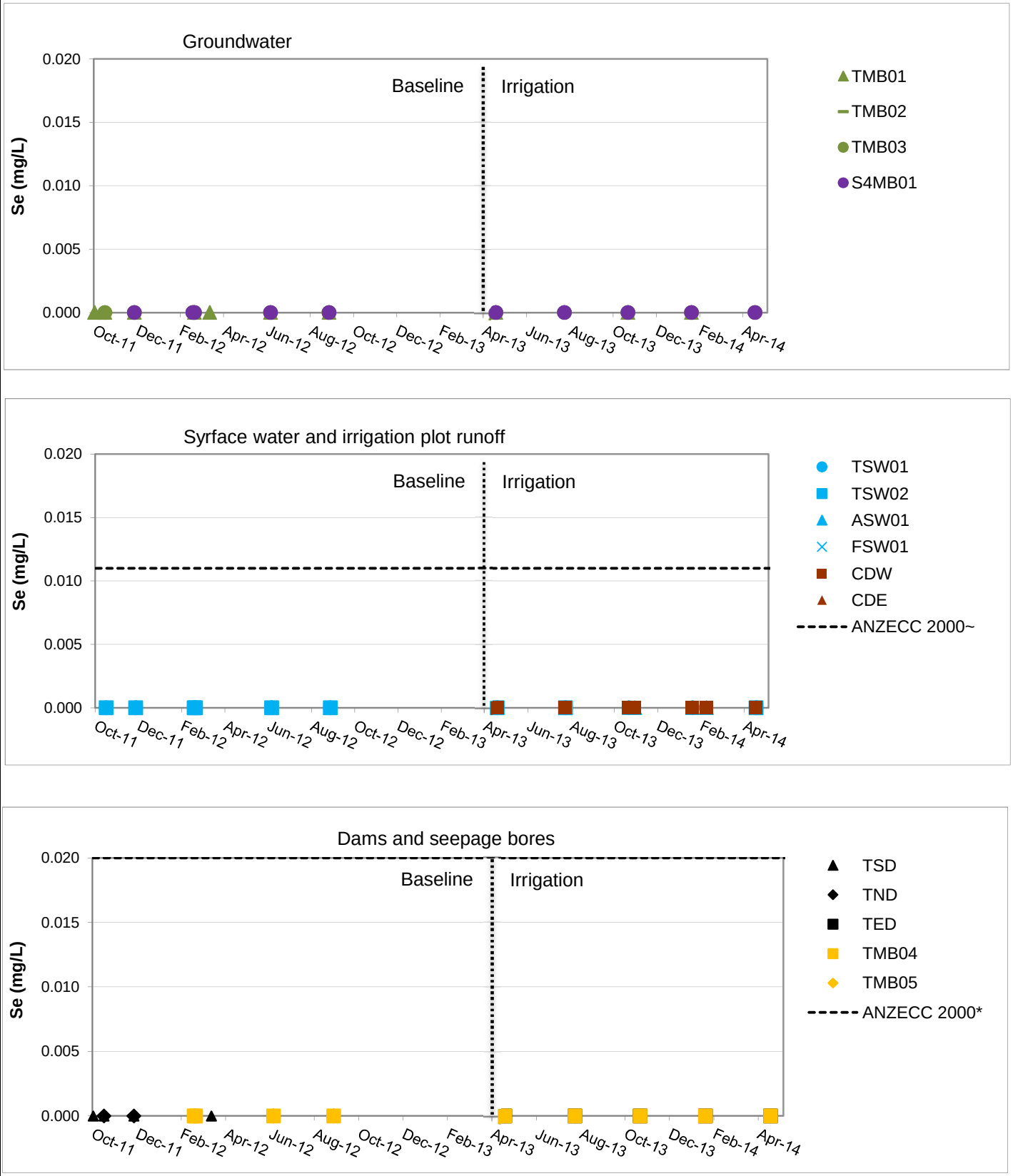
Figure B.21: Selenium concentrations



Notes:
~ANZECC 2000 - Water Quality Guidelines: 95% protection levels for freshwater aquatic ecosystems
*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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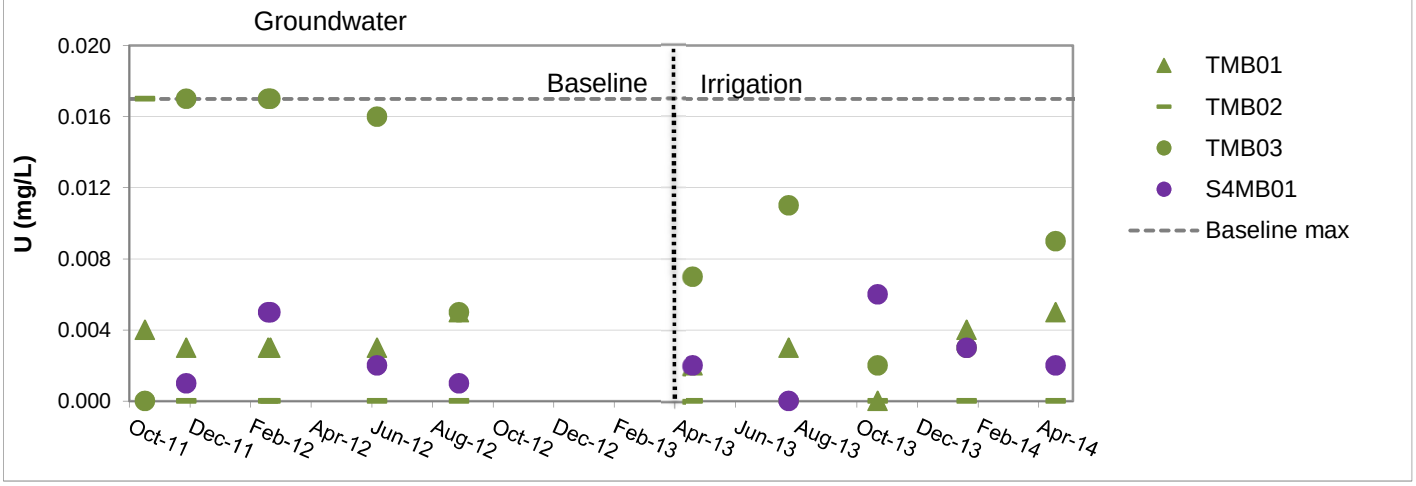
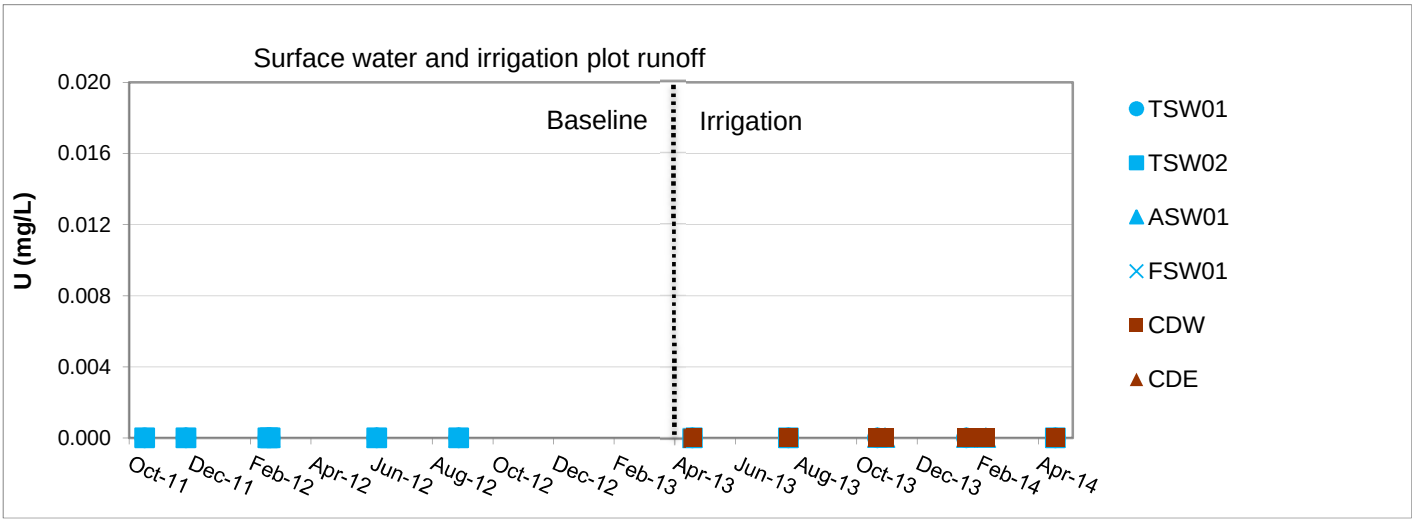
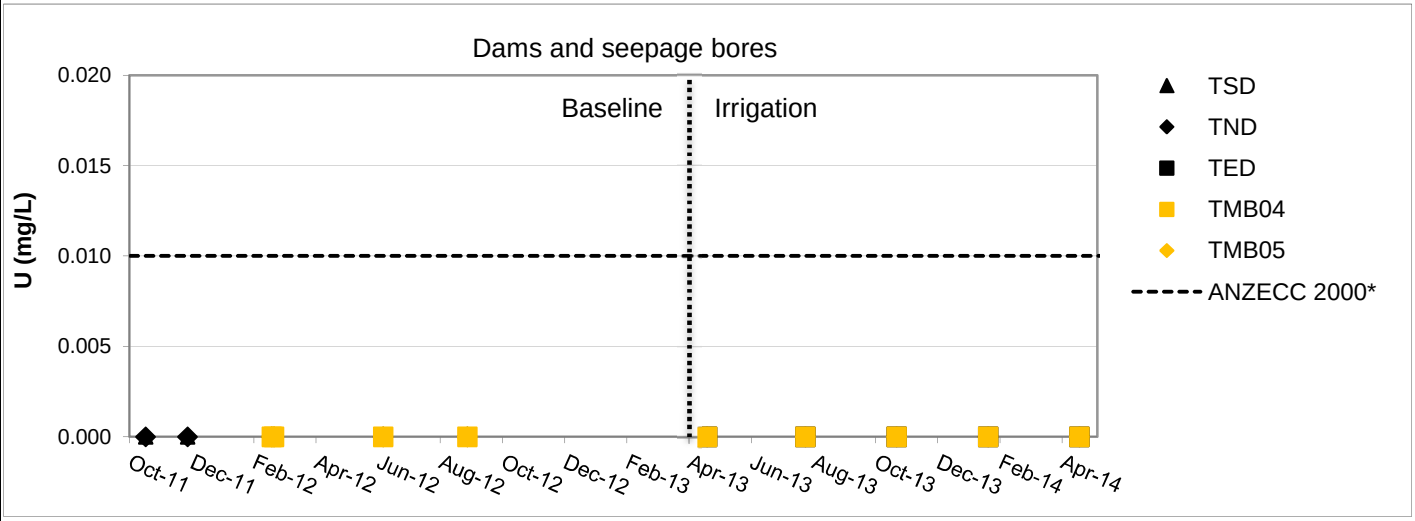
Figure B.22: Uranium concentrations





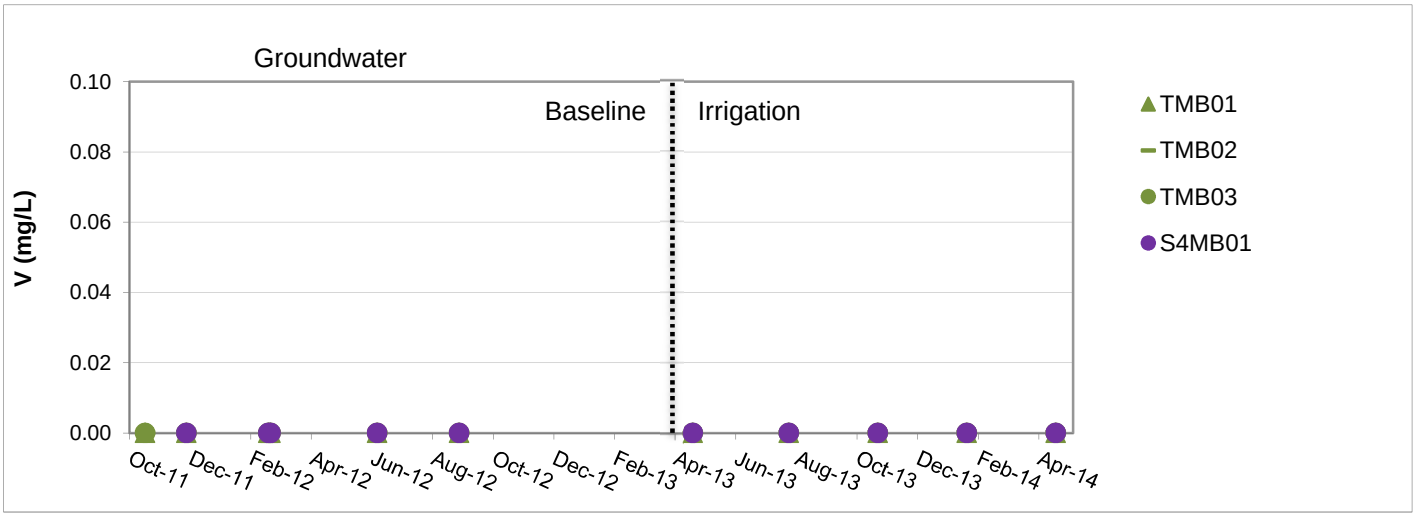


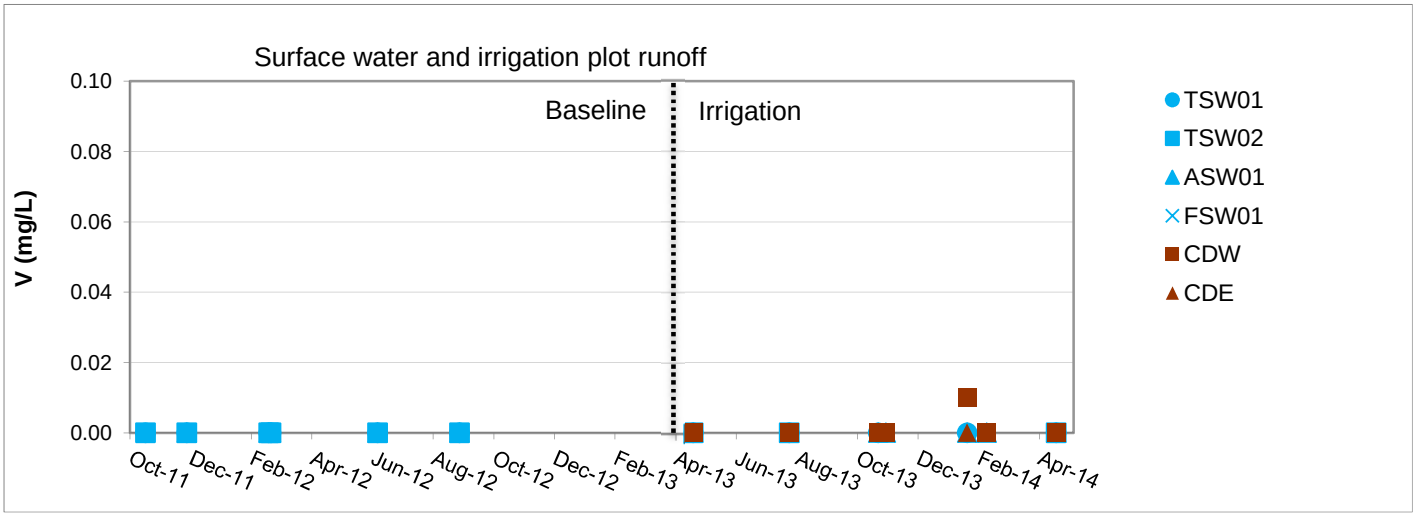
Notes:
*ANZECC 2000. Water for long term irrigation and general water use.

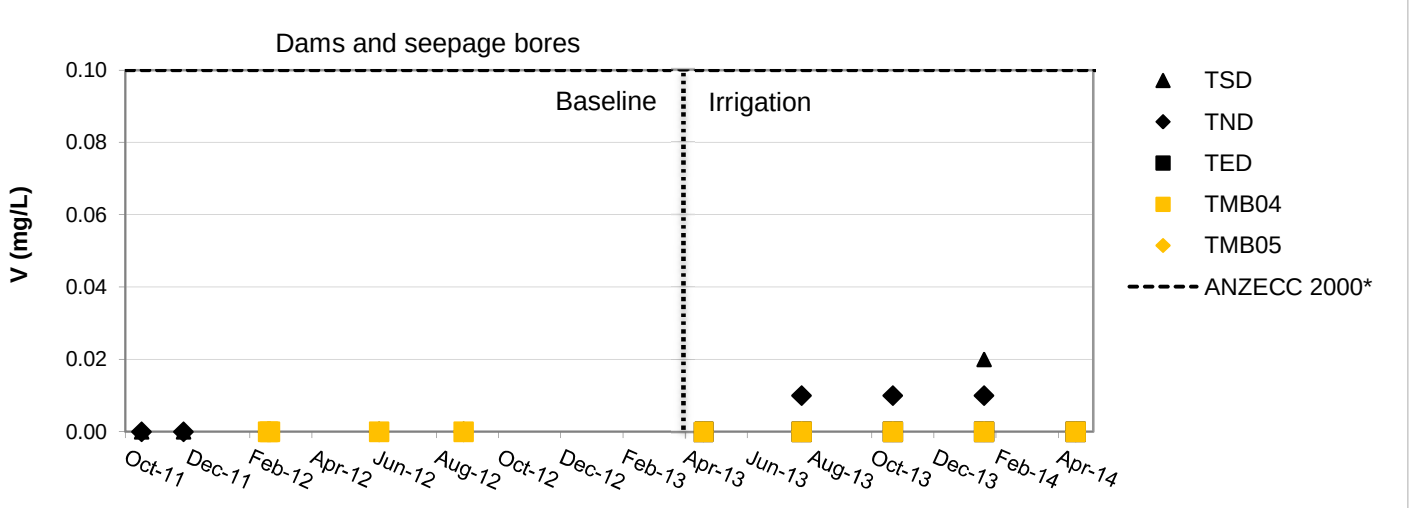
Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

PARSONS BRINCKERHOFF

Figure B.23: Vanadium concentrations







Note:
*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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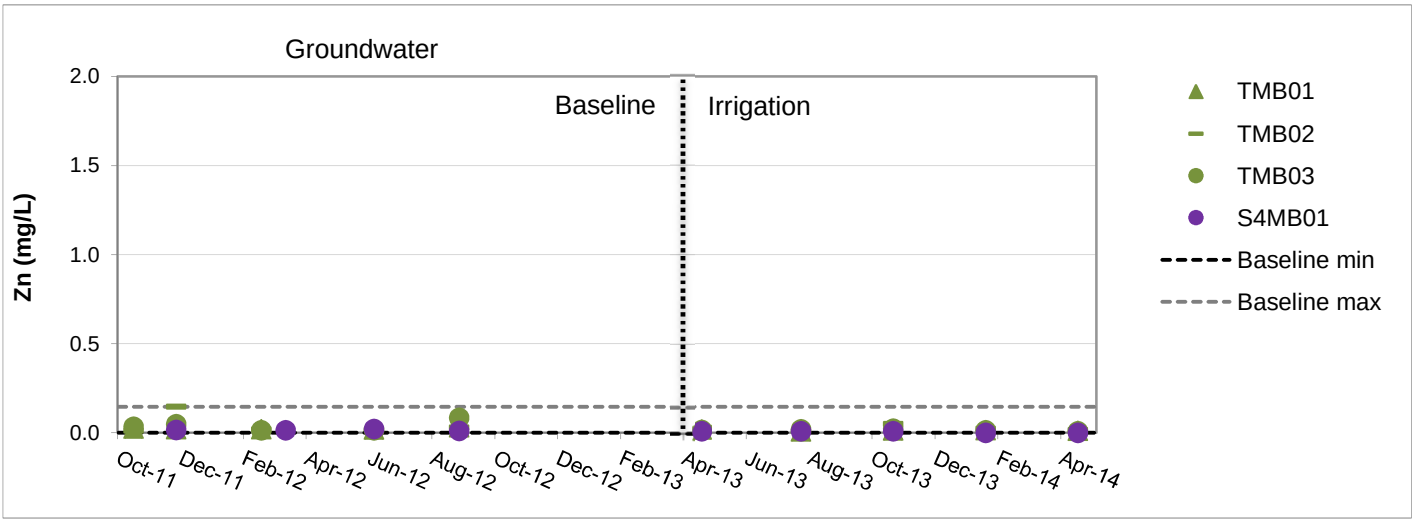
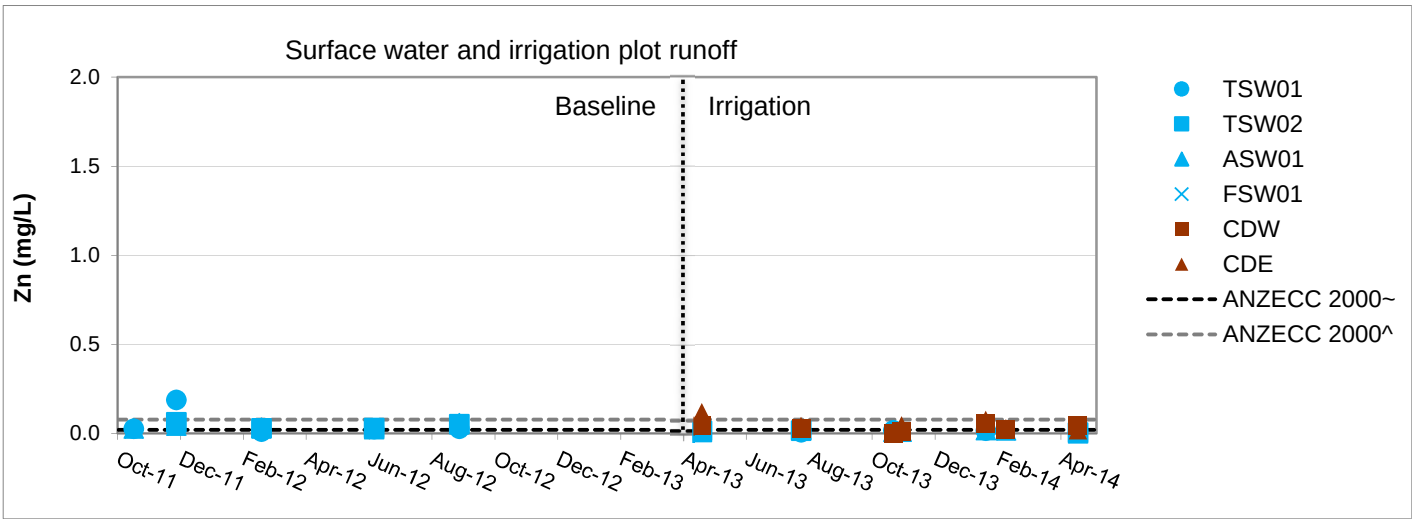
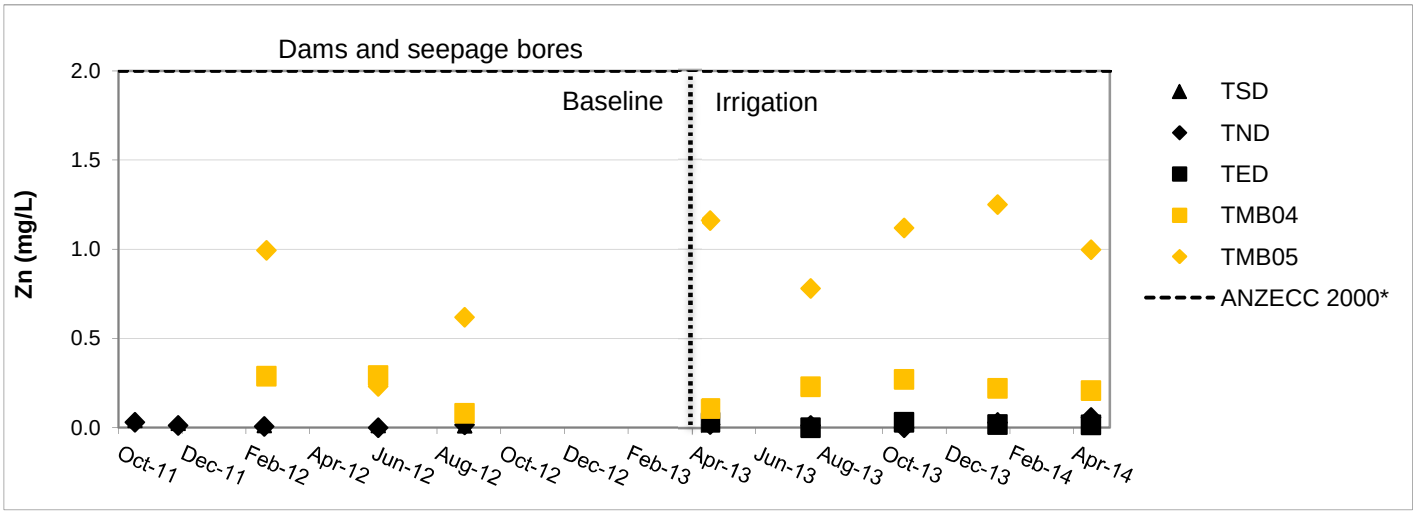
Figure B.24: Zinc concentrations







Notes:

~ANZECC 2000 - Water Quality Guidelines: 95% protection levels for freshwater aquatic ecosystems

^ANZECC 2000 - Water Quality Guidelines: 80% protection levels for freshwater aquatic ecosystems

*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester Basin, NSW

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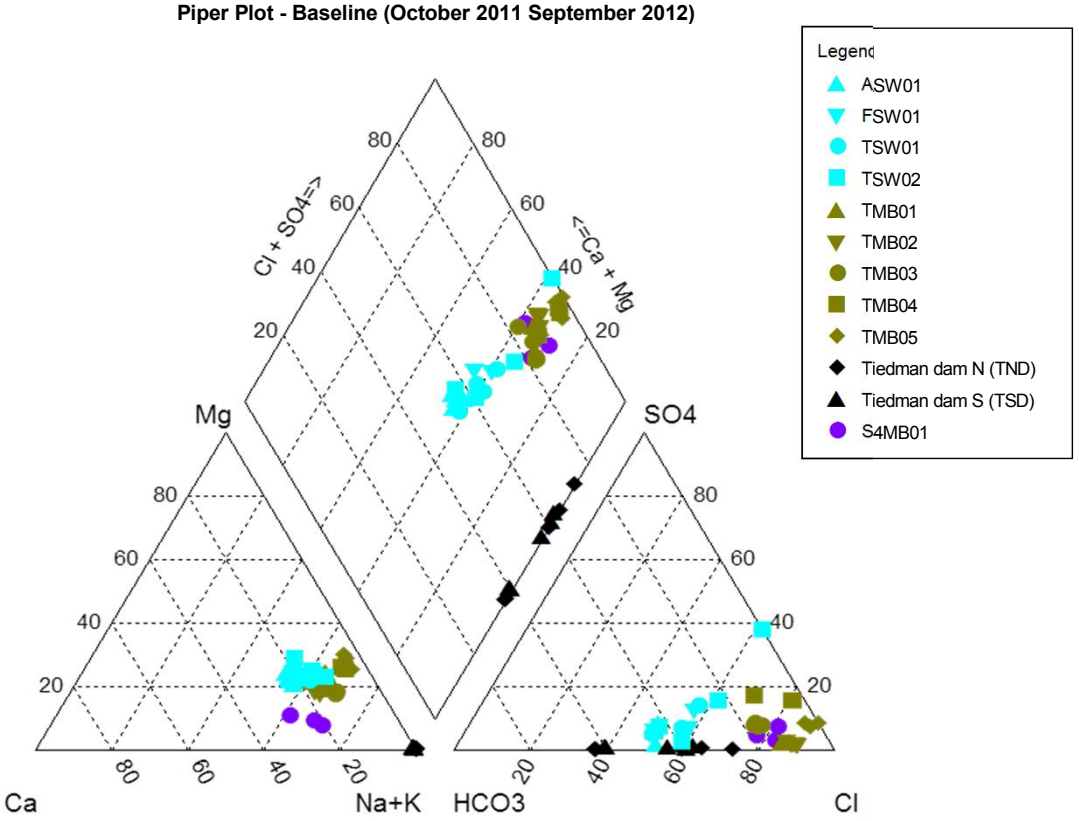
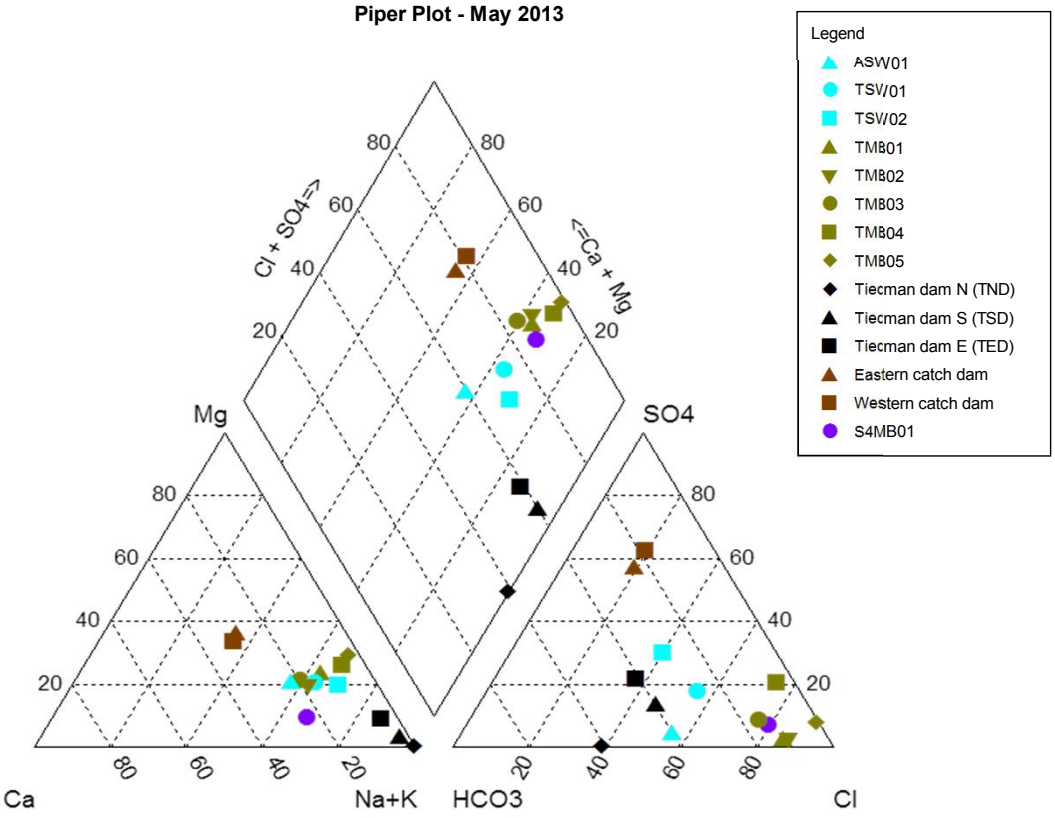
Appendix C

Piper diagrams

Piper Plot - Baseline (October 2011 September 2012)



Piper Plot - May 2013

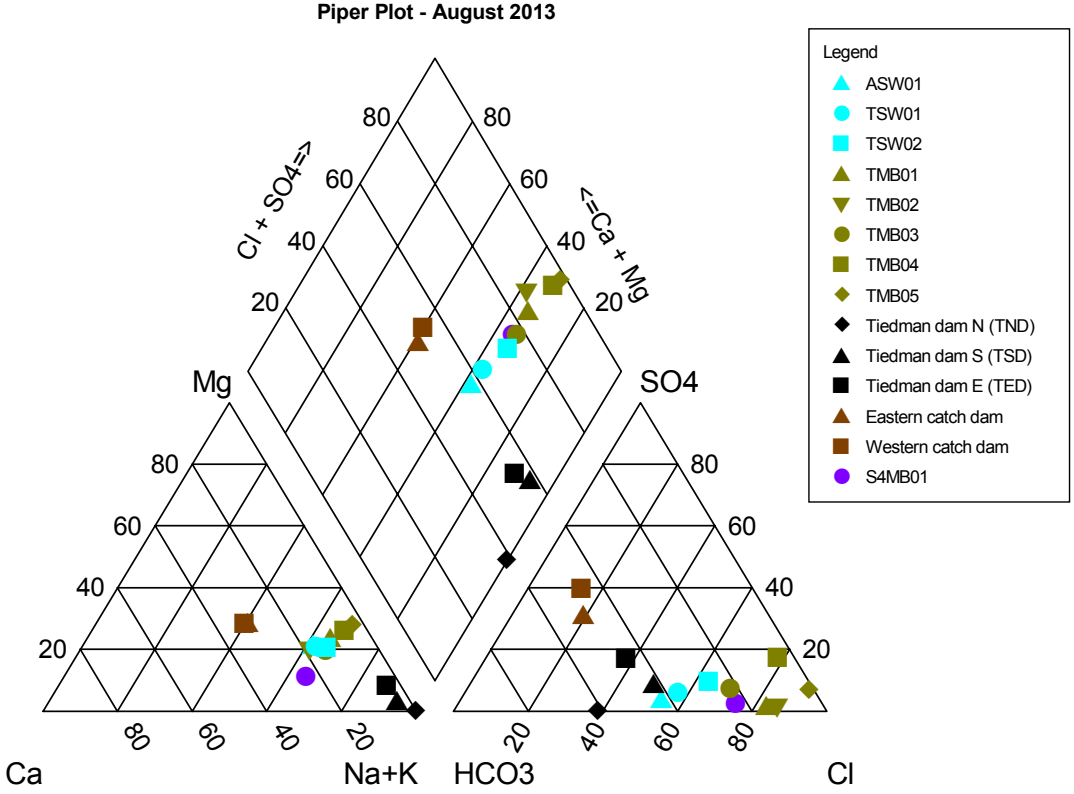


Note: Blue - surface water; Olive - shallow groundwater; Black - storage dams; Brown - irrigation plot runoff; and Purple - interburden unit

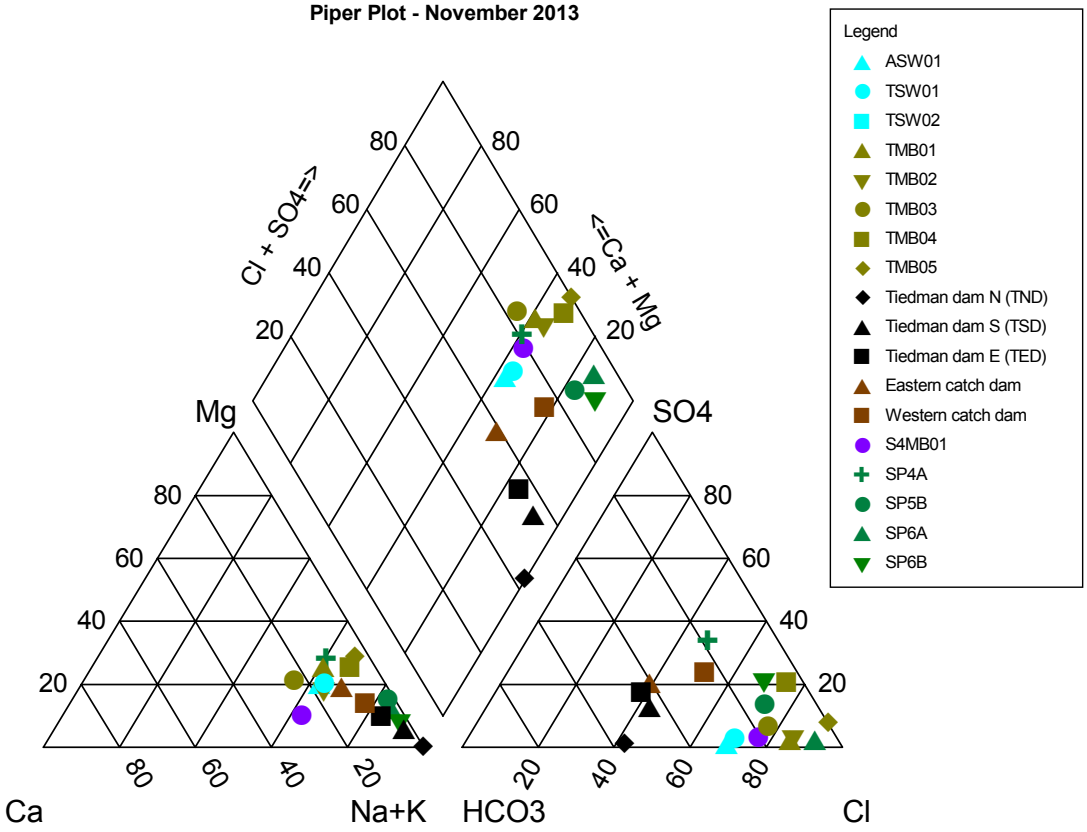
Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester, NSW

PARSONS BRINCKERHOFF

Piper Plot - August 2013



Piper Plot - November 2013

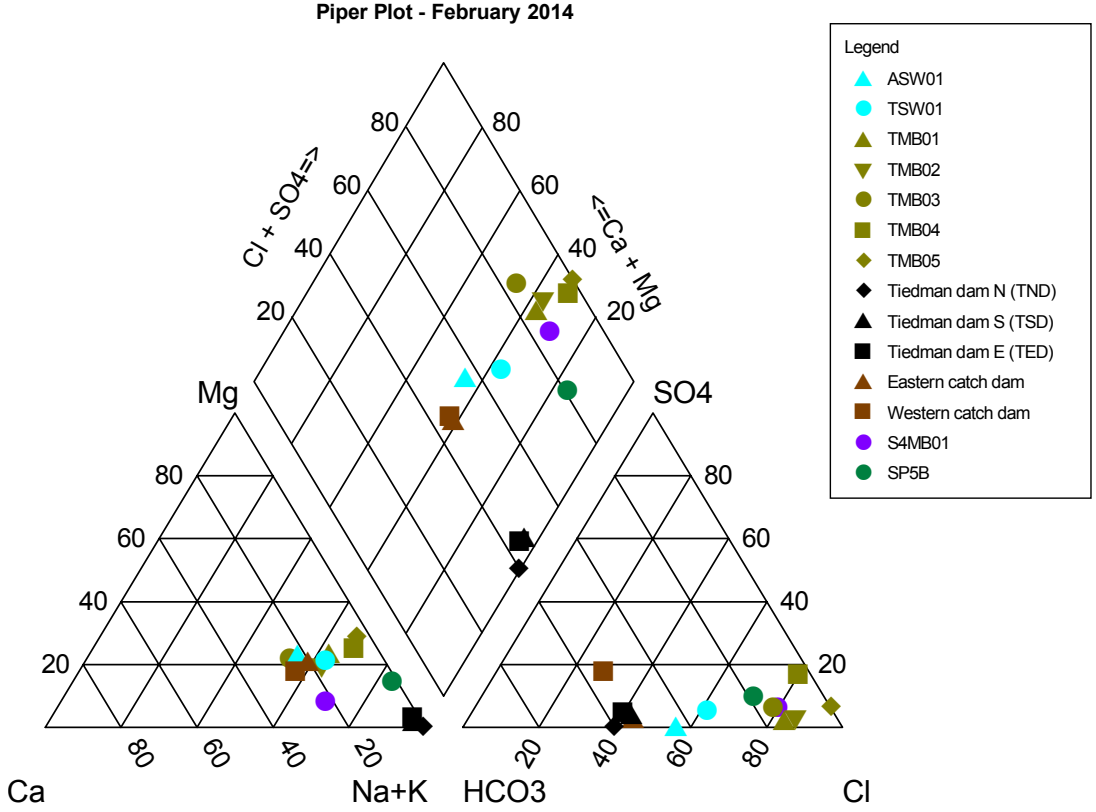


Note: Blue - surface water; Olive - shallow groundwater; Black - storage dams; Brown - irrigation plot runoff; Purple - interburden unit and Green - perched groundwater on irrigation plot

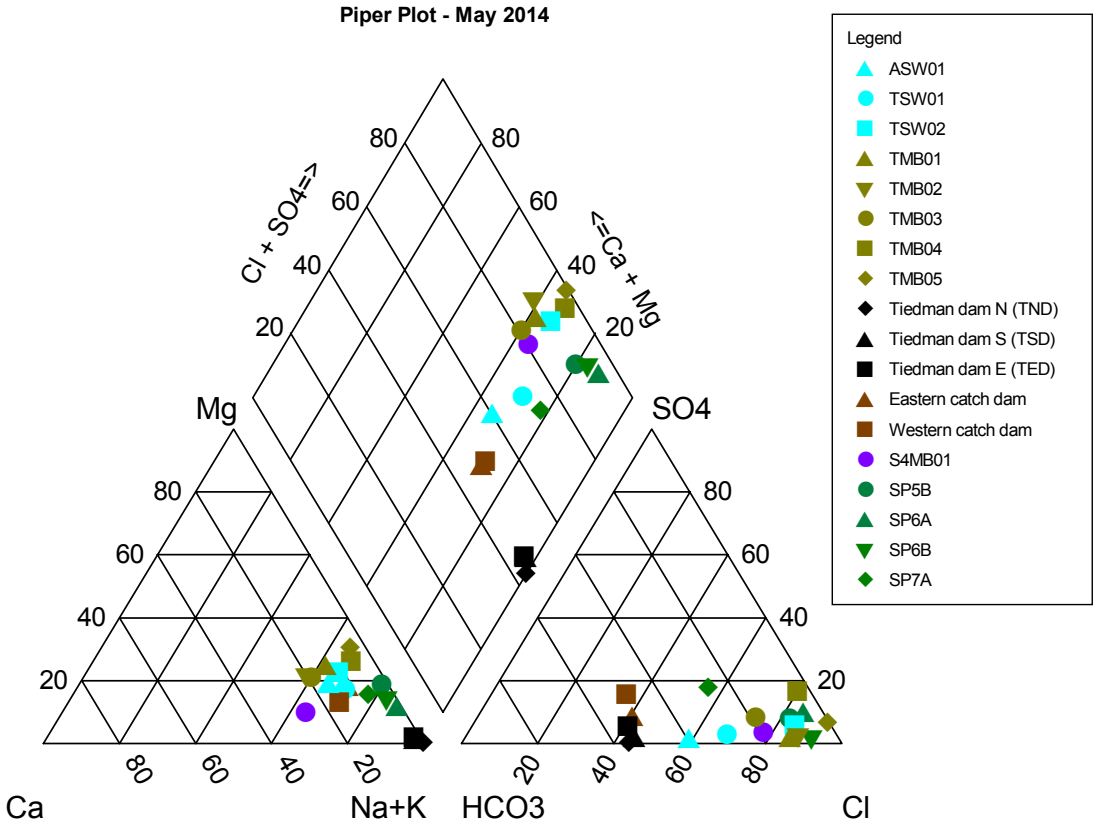
Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester, NSW

PARSONS BRINCKERHOFF

Piper Plot - February 2014



Piper Plot - May 2014



Note: Blue - surface water; Olive - shallow groundwater; Black - storage dams; Brown - irrigation plot runoff; Purple - interburden unit and Green - perched groundwater on irrigation plot

Client: AGL Upstream Investment Pty Ltd
Project: Tiedman Irrigation Program - Gloucester Gas Project
Location: Gloucester, NSW

PARSONS BRINCKERHOFF

Appendix D

Laboratory reports

CERTIFICATE OF ANALYSIS

Work Order	: **ES1402862**	Page	: 1 of 11
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: MR JAMES DUGGLEBY	Contact	: Client Services
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jduggleby@pb.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 9272 5100	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 9272 5101	Facsimile	: +61-2-8784 8500
Project	: 2162406F	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 12-FEB-2014
Sampler	: CR	Issue Date	: 19-FEB-2014
Site	: ----		
		No. of samples received	: 14
Quote number	: EN/008/13	No. of samples analysed	: 14

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Shobhna Chandra	Metals Coordinator	Sydney Inorganics

General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

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

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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

- **EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.**
- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **EP035G:LOR raised for Phenol analysis on various samples due to sample matrix.**
- **Ionic Balance out of acceptable limits for sample 14 due to analytes not quantified in this report.**
- **TDS by method EA-015 may bias high for few samples due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TED	TSD	TND	WCD	ECD
				Client sampling date / time	11-FEB-2014 09:40	11-FEB-2014 09:00	11-FEB-2014 09:00	11-FEB-2014 11:00	11-FEB-2014 12:30
					ES1402862-001	ES1402862-002	ES1402862-003	ES1402862-004	ES1402862-005
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		9.88	9.66	9.78	7.69	8.83
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		2000	1540	5670	283	783
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L		1200	978	3280	376	622
EA016: Non Marine - Estimated TDS Salinity									
Total Dissolved Solids (Calc.)	----	1	mg/L		1300	1000	3680	184	509
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		167	32	63	39	198
EA045: Turbidity									
Turbidity	----	0.1	NTU		130	103	45.2	166	190
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		44	27	18	60	156
EA071: Langeliers Index									
Langelier Index	----	0.10	-		----	1.51	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		391	204	990	<1	29
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		121	165	529	68	164
Total Alkalinity as CaCO3	----	1	mg/L		512	369	1520	68	193
ED040F: Dissolved Major Anions									
Sulfur as S	63705-05-5	1	mg/L		----	8	----	----	----
Silicon as SiO2	14464-46-1	0.1	mg/L		18.4	11.8	33.8	14.3	3.4
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		42	26	<1	22	9
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		262	207	711	26	111
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		6	6	4	14	31
Magnesium	7439-95-4	1	mg/L		7	3	2	6	19
Sodium	7440-23-5	1	mg/L		413	262	1060	28	86
Potassium	7440-09-7	1	mg/L		33	92	325	15	28
EG020F: Dissolved Metals by ICP-MS									

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TED	TSD	TND	WCD	ECD
				Client sampling date / time	11-FEB-2014 09:40	11-FEB-2014 09:00	11-FEB-2014 09:00	11-FEB-2014 11:00	11-FEB-2014 12:30
					ES1402862-001	ES1402862-002	ES1402862-003	ES1402862-004	ES1402862-005
EG020F: Dissolved Metals by ICP-MS - Continued									
Aluminium	7429-90-5	0.01	mg/L		**0.75**	**9.42**	**0.52**	**0.63**	**0.07**
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	**0.003**	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L		**0.005**	**0.008**	**0.013**	**0.005**	**0.010**
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Barium	7440-39-3	0.001	mg/L		**0.228**	**0.151**	**0.308**	**0.091**	**0.071**
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	**0.005**	**0.004**	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L		<0.001	**0.002**	**0.001**	**0.002**	**0.002**
Copper	7440-50-8	0.001	mg/L		**0.008**	**0.014**	**0.018**	**0.007**	**0.002**
Lead	7439-92-1	0.001	mg/L		<0.001	**0.004**	<0.001	**0.004**	<0.001
Manganese	7439-96-5	0.001	mg/L		**0.046**	**0.049**	**0.098**	**0.207**	**0.964**
Molybdenum	7439-98-7	0.001	mg/L		**0.006**	**0.009**	**0.032**	**0.002**	**0.002**
Nickel	7440-02-0	0.001	mg/L		**0.002**	**0.004**	**0.005**	**0.003**	**0.001**
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	7440-24-6	0.001	mg/L		**0.459**	**0.150**	**0.479**	**0.130**	**0.263**
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	7440-62-2	0.01	mg/L		<0.01	**0.02**	**0.01**	**0.01**	<0.01
Zinc	7440-66-6	0.005	mg/L		**0.017**	**0.043**	**0.029**	**0.057**	**0.075**
Boron	7440-42-8	0.05	mg/L		**0.56**	**0.25**	**0.77**	<0.05	**0.07**
Iron	7439-89-6	0.05	mg/L		**0.60**	**5.38**	**0.54**	**4.10**	**0.66**
Bromine	7726-95-6	0.1	mg/L		**0.5**	**0.6**	**1.9**	**0.1**	**0.3**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.6**	**0.8**	**0.9**	**0.6**	**0.4**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.05**	**0.05**	<0.01	**1.36**	**0.05**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.02**	<0.01	**0.01**	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.02**	<0.01	**0.01**	<0.01	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**9.8**	**3.1**	**5.4**	**3.3**	**10.9**

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TED	TSD	TND	WCD	ECD
				Client sampling date / time	11-FEB-2014 09:40	11-FEB-2014 09:00	11-FEB-2014 09:00	11-FEB-2014 11:00	11-FEB-2014 12:30
					ES1402862-001	ES1402862-002	ES1402862-003	ES1402862-004	ES1402862-005
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**1.33**	**1.61**	**1.72**	**2.16**	**2.21**
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	**0.63**	<0.01	**0.84**	**0.24**
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**18.5**	**13.8**	**50.4**	**2.55**	----
Total Anions	----	0.01	meq/L		----	----	----	----	**7.27**
Total Cations	----	0.01	meq/L		**19.7**	**14.3**	**54.8**	**2.79**	**7.57**
Ionic Balance	----	0.01	%		**3.07**	**1.91**	**4.11**	----	----
Ionic Balance	----	0.01	%		----	----	----	----	**2.02**
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		**99**	**35**	**57**	**36**	**104**
EP026ST: Chemical Oxygen Demand (Sealed Tube)									
Chemical Oxygen Demand	----	5	mg/L		**400**	**145**	**248**	**125**	**490**
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		<0.10	<0.05	<0.05	<0.10	<0.10

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TSW01	ASW01	S4MB01	TMB01	TMB02
				Client sampling date / time	11-FEB-2014 10:30	11-FEB-2014 00:00	10-FEB-2014 16:00	10-FEB-2014 15:15	10-FEB-2014 14:50
					ES1402862-006	ES1402862-007	ES1402862-008	ES1402862-009	ES1402862-010
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		7.55	7.61	7.64	7.13	6.78
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		582	465	4920	8920	4330
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L		314	262	2740	4940	2400
EA016: Non Marine - Estimated TDS Salinity									
Total Dissolved Solids (Calc.)	----	1	mg/L		378	302	3200	5800	2810
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		<5	9	13	316	<5
EA045: Turbidity									
Turbidity	----	0.1	NTU		5.1	9.4	6.9	227	3.2
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		100	97	715	1670	716
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		83	86	295	584	182
Total Alkalinity as CaCO3	----	1	mg/L		83	86	295	584	182
ED040F: Dissolved Major Anions									
Silicon as SiO2	14464-46-1	0.1	mg/L		14.3	15.1	26.1	39.1	36.6
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		13	<1	121	82	50
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		111	80	1180	2450	1040
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		17	19	212	245	135
Magnesium	7439-95-4	1	mg/L		14	12	45	258	92
Sodium	7440-23-5	1	mg/L		75	51	751	1310	566
Potassium	7440-09-7	1	mg/L		6	6	9	3	4
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.05	0.14	0.06	0.22	0.01
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L		0.003	0.003	0.001	0.001	0.003

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TSW01	ASW01	S4MB01	TMB01	TMB02
				Client sampling date / time	11-FEB-2014 10:30	11-FEB-2014 00:00	10-FEB-2014 16:00	10-FEB-2014 15:15	10-FEB-2014 14:50
					ES1402862-006	ES1402862-007	ES1402862-008	ES1402862-009	ES1402862-010
EG020F: Dissolved Metals by ICP-MS - Continued									
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Barium	7440-39-3	0.001	mg/L		**0.074**	**0.074**	**0.985**	**0.296**	**0.724**
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	**0.001**	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L		**0.003**	<0.001	<0.001	<0.001	**0.003**
Copper	7440-50-8	0.001	mg/L		**0.005**	**0.004**	**0.002**	**0.022**	**0.024**
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	**0.001**	<0.001
Manganese	7439-96-5	0.001	mg/L		**0.920**	**0.693**	**0.241**	**1.04**	**1.71**
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L		**0.002**	<0.001	**0.002**	**0.001**	**0.002**
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	7440-24-6	0.001	mg/L		**0.398**	**0.417**	**18.3**	**9.73**	**4.26**
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	**0.003**	**0.004**	<0.001
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L		**0.016**	**0.017**	<0.005	**0.014**	**0.022**
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	**0.17**	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		**2.14**	**2.38**	**0.07**	**2.48**	**4.34**
Bromine	7726-95-6	0.1	mg/L		**0.2**	**0.1**	**2.6**	**4.1**	**2.2**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.1**	**0.1**	**0.4**	**0.2**	<0.1
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.12**	**0.01**	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	**0.02**	<0.01	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	**0.02**	<0.01	<0.01	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**1.0**	**0.9**	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.18**	**0.09**	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TSW01	ASW01	S4MB01	TMB01	TMB02
				Client sampling date / time	11-FEB-2014 10:30	11-FEB-2014 00:00	10-FEB-2014 16:00	10-FEB-2014 15:15	10-FEB-2014 14:50
Compound	CAS Number	LOR	Unit		ES1402862-006	ES1402862-007	ES1402862-008	ES1402862-009	ES1402862-010
EK071G: Reactive Phosphorus as P by discrete analyser - Continued									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		**0.10**	**0.02**	**0.03**	<0.01	<0.01
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**5.43**	**4.37**	**42.5**	**82.5**	**35.0**
Total Cations	----	0.01	meq/L		**5.42**	**4.31**	**47.2**	**90.5**	**39.0**
Ionic Balance	----	0.01	%		**0.14**	**0.75**	**5.27**	**4.63**	**5.45**
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		**16**	**14**	----	----	----
EP026ST: Chemical Oxygen Demand (Sealed Tube)									
Chemical Oxygen Demand	----	5	mg/L		**53**	**53**	----	----	----
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		<0.05	<0.05	----	----	----

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TMB03	TMB04	TMB05	SP5B	----
				Client sampling date / time	10-FEB-2014 14:20	10-FEB-2014 08:30	11-FEB-2014 10:00	11-FEB-2014 11:30	----
					ES1402862-011	ES1402862-012	ES1402862-013	ES1402862-014	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		6.97	6.43	4.77	7.60	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		6300	7320	7500	4200	----
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L		3980	3590	3030	2600	----
EA016: Non Marine - Estimated TDS Salinity									
Total Dissolved Solids (Calc.)	----	1	mg/L		4100	4760	4880	2730	----
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		14	184	101	888	----
EA045: Turbidity									
Turbidity	----	0.1	NTU		16.6	107	103	1060	----
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		1460	1190	1220	337	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		431	110	<1	326	----
Total Alkalinity as CaCO3	----	1	mg/L		431	110	<1	326	----
ED040F: Dissolved Major Anions									
Silicon as SiO2	14464-46-1	0.1	mg/L		34.2	59.5	72.2	24.4	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		163	548	203	158	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		1560	1970	2250	879	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		311	92	55	13	----
Magnesium	7439-95-4	1	mg/L		167	233	264	74	----
Sodium	7440-23-5	1	mg/L		767	1200	1160	803	----
Potassium	7440-09-7	1	mg/L		4	27	20	5	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.02	0.10	0.30	0.02	----
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Arsenic	7440-38-2	0.001	mg/L		0.004	<0.001	<0.001	0.005	----

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TMB03	TMB04	TMB05	SP5B	----
				Client sampling date / time	10-FEB-2014 14:20	10-FEB-2014 08:30	11-FEB-2014 10:00	11-FEB-2014 11:30	----
					ES1402862-011	ES1402862-012	ES1402862-013	ES1402862-014	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	**0.005**	<0.001	----
Barium	7440-39-3	0.001	mg/L		**0.360**	**0.356**	**0.130**	**0.108**	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	**0.0006**	**0.0022**	<0.0001	----
Chromium	7440-47-3	0.001	mg/L		<0.001	**0.008**	<0.001	<0.001	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	**0.082**	**0.282**	**0.006**	----
Copper	7440-50-8	0.001	mg/L		**0.042**	**0.016**	**0.096**	**0.006**	----
Lead	7439-92-1	0.001	mg/L		<0.001	**0.001**	**0.007**	<0.001	----
Manganese	7439-96-5	0.001	mg/L		**1.66**	**9.57**	**19.1**	**0.229**	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	<0.001	**0.118**	----
Nickel	7440-02-0	0.001	mg/L		<0.001	**0.041**	**0.138**	**0.093**	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
Strontium	7440-24-6	0.001	mg/L		**7.20**	**1.22**	**0.822**	**0.716**	----
Uranium	7440-61-1	0.001	mg/L		**0.003**	<0.001	<0.001	**0.007**	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
Zinc	7440-66-6	0.005	mg/L		**0.014**	**0.220**	**1.25**	**0.034**	----
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	**0.10**	----
Iron	7439-89-6	0.05	mg/L		**5.68**	**6.86**	**14.5**	**1.27**	----
Bromine	7726-95-6	0.1	mg/L		**3.3**	**3.5**	**2.0**	**2.6**	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.5**	<0.1	**0.7**	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		----	**0.12**	**0.29**	**0.14**	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	<0.01	<0.01	**0.02**	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	**0.06**	**0.11**	**0.25**	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	**0.06**	**0.11**	**0.27**	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		----	**0.2**	**0.4**	**17.7**	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		----	**0.07**	**0.02**	**6.03**	----
EK071G: Reactive Phosphorus as P by discrete analyser									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TMB03	TMB04	TMB05	SP5B	----
				Client sampling date / time	10-FEB-2014 14:20	10-FEB-2014 08:30	11-FEB-2014 10:00	11-FEB-2014 11:30	----
Compound	CAS Number	LOR	Unit		ES1402862-011	ES1402862-012	ES1402862-013	ES1402862-014	----
EK071G: Reactive Phosphorus as P by discrete analyser - Continued									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	<0.01	<0.01	**0.34**	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**56.9**	**69.2**	**69.6**	**36.5**	----
Total Cations	----	0.01	meq/L		**62.7**	**76.6**	**75.4**	**41.8**	----
Ionic Balance	----	0.01	%		**4.86**	**5.11**	**4.03**	**6.73**	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		----	**5**	**5**	**40**	----
EP026ST: Chemical Oxygen Demand (Sealed Tube)									
Chemical Oxygen Demand	----	5	mg/L		----	**44**	**56**	**961**	----
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		----	<0.05	<0.05	<0.10	----

CERTIFICATE OF ANALYSIS

Work Order	: **ES1405026**	Page	: 1 of 5
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: MR JAMES DUGGLEBY	Contact	: Client Services
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jduggleby@pb.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 9272 5100	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 9272 5101	Facsimile	: +61-2-8784 8500
Project	: 2162406F	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 07-MAR-2014
Sampler	: CR/AL	Issue Date	: 14-MAR-2014
Site	: ----		
		No. of samples received	: 4
Quote number	: EN/008/13	No. of samples analysed	: 4

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Shobhna Chandra	Metals Coordinator	Sydney Inorganics

General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

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

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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

- **EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.**
- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **TDS by method EA-015 may bias high for samples 3 and 4 due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	FSW01	ASW01	CDW	CDE	----
				Client sampling date / time	03-MAR-2014 14:20	03-MAR-2014 15:45	03-MAR-2014 16:10	03-MAR-2014 16:40	----
					ES1405026-001	ES1405026-002	ES1405026-003	ES1405026-004	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		7.41	7.41	7.55	7.36	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		481	426	303	145	----
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L		284	254	529	180	----
EA016: Non Marine - Estimated TDS Salinity									
Total Dissolved Solids (Calc.)	----	1	mg/L		313	277	197	94	----
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		22	8	120	56	----
EA045: Turbidity									
Turbidity	----	0.1	NTU		32.1	35.8	447	133	----
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		78	76	38	16	----
EA071: Langeliers Index									
Langelier Index	----	0.10	-		-1.04	-1.02	-1.20	-1.97	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		74	69	74	45	----
Total Alkalinity as CaCO3	----	1	mg/L		74	69	74	45	----
ED040F: Dissolved Major Anions									
Sulfur as S	63705-05-5	1	mg/L		4	7	7	2	----
Silicon as SiO2	14464-46-1	0.1	mg/L		14.2	19.9	16.6	14.9	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		8	22	20	<1	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		91	66	26	9	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		13	14	7	3	----
Magnesium	7439-95-4	1	mg/L		11	10	5	2	----
Sodium	7440-23-5	1	mg/L		56	49	38	16	----
Potassium	7440-09-7	1	mg/L		8	6	17	11	----
EG020F: Dissolved Metals by ICP-MS									

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	FSW01	ASW01	CDW	CDE	----
				Client sampling date / time	03-MAR-2014 14:20	03-MAR-2014 15:45	03-MAR-2014 16:10	03-MAR-2014 16:40	----
					ES1405026-001	ES1405026-002	ES1405026-003	ES1405026-004	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Aluminium	7429-90-5	0.01	mg/L		**0.04**	**0.03**	**0.82**	**0.68**	----
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Arsenic	7440-38-2	0.001	mg/L		**0.002**	**0.001**	**0.002**	**0.003**	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Barium	7440-39-3	0.001	mg/L		**0.060**	**0.071**	**0.031**	**0.024**	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	**0.001**	<0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L		**0.002**	**0.002**	**0.005**	**0.003**	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Manganese	7439-96-5	0.001	mg/L		**0.521**	**0.221**	**0.013**	**0.078**	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	**0.002**	<0.001	----
Nickel	7440-02-0	0.001	mg/L		**0.001**	**0.001**	**0.002**	**0.001**	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
Strontium	7440-24-6	0.001	mg/L		**0.228**	**0.249**	**0.063**	**0.029**	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
Zinc	7440-66-6	0.005	mg/L		**0.014**	**0.016**	**0.023**	**0.029**	----
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	----
Iron	7439-89-6	0.05	mg/L		**1.34**	**0.89**	**0.84**	**0.50**	----
Bromine	7726-95-6	0.1	mg/L		**0.2**	**0.1**	<0.1	<0.1	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.1**	**0.1**	**0.2**	**0.1**	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.17**	**0.19**	**0.19**	**0.06**	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	**0.01**	**0.02**	<0.01	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.07**	**0.12**	**0.05**	**0.06**	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.07**	**0.13**	**0.07**	**0.06**	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**1.8**	**1.3**	**4.1**	**2.7**	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	FSW01	ASW01	CDW	CDE	----
			Client sampling date / time	03-MAR-2014 14:20	03-MAR-2014 15:45	03-MAR-2014 16:10	03-MAR-2014 16:40	----
Compound	CAS Number	LOR	Unit	ES1405026-001	ES1405026-002	ES1405026-003	ES1405026-004	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.28	0.21	1.76	1.08	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	0.10	0.09	1.24	0.67	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	4.21	3.70	2.63	1.15	----
Total Cations	----	0.01	meq/L	4.19	3.81	2.85	1.29	----
Ionic Balance	----	0.01	%	0.22	1.43	----	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	19	13	19	13	----
EP026ST: Chemical Oxygen Demand (Sealed Tube)								
Chemical Oxygen Demand	----	5	mg/L	52	42	112	75	----
EP035G: Total Phenol by Discrete Analyser								
Phenols (Total)	----	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	----

CERTIFICATE OF ANALYSIS

Work Order	: **ES1410640**	Page	: 1 of 23
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: MR JAMES DUGGLEBY	Contact	: Client Services
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jduggleby@pb.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 9272 5100	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 9272 5101	Facsimile	: +61-2-8784 8500
Project	: 2162406F	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 14-MAY-2014
Sampler	: CR/CS	Issue Date	: 22-MAY-2014
Site	: ----		
		No. of samples received	: 20
Quote number	: EN/008/13	No. of samples analysed	: 20

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

General Comments

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

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

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

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

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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

- **Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.**
- **EA016: Calculated TDS is determined from Electrical conductivity using a conversion factor of 0.65.**
- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **EP026SP: LOR raised for COD on various samples due to matrix interference.**
- **EP035G: Spike failed for Total Phenol analysis due to matrix interferences, confirmed via re-analysis.**
- **It has been noted that Nitrite is greater than NOx for sample ID (TSD), however this difference is within the limits of experimental variation.**
- **TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**

Signatories

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

Signatories	Position	Accreditation Category
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Hoa Nguyen	Senior Inorganic Chemist	Sydney Inorganics
Phalak Inthaksone	Laboratory Manager - Organics	Sydney Organics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Shobhna Chandra	Metals Coordinator	Sydney Inorganics

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TED	TSD	TND	WCD	ECD
				Client sampling date / time	13-MAY-2014 16:30	13-MAY-2014 08:30	13-MAY-2014 09:00	13-MAY-2014 12:00	13-MAY-2014 09:45
					ES1410640-001	ES1410640-002	ES1410640-003	ES1410640-004	ES1410640-005
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		9.78	9.27	9.70	9.16	7.84
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		1150	1470	5100	210	141
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L		884	905	2970	180	109
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		108	27	58	98	58
EA045: Turbidity									
Turbidity	----	0.1	NTU		120	71.5	46.2	60.0	39.6
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		16	18	5	27	20
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		176	115	767	14	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		123	257	557	36	35
Total Alkalinity as CaCO3	----	1	mg/L		299	372	1320	50	35
ED040F: Dissolved Major Anions									
Sulfur as S	63705-05-5	1	mg/L		----	4	----	----	----
Silicon as SiO2	14464-46-1	0.1	mg/L		12.2	13.2	27.4	0.6	6.0
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		27	12	<1	15	6
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		164	219	731	26	21
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		3	4	2	6	3
Magnesium	7439-95-4	1	mg/L		2	2	<1	3	3
Sodium	7440-23-5	1	mg/L		214	240	924	23	16
Potassium	7440-09-7	1	mg/L		18	88	262	15	11
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.35	1.91	0.22	0.07	0.27
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	0.002	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L		0.004	0.006	0.010	<0.001	0.002
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TED	TSD	TND	WCD	ECD
				Client sampling date / time	13-MAY-2014 16:30	13-MAY-2014 08:30	13-MAY-2014 09:00	13-MAY-2014 12:00	13-MAY-2014 09:45
					ES1410640-001	ES1410640-002	ES1410640-003	ES1410640-004	ES1410640-005
EG020F: Dissolved Metals by ICP-MS - Continued									
Barium	7440-39-3	0.001	mg/L		**0.097**	**0.143**	**0.440**	**0.028**	**0.016**
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	**0.001**	**0.002**	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L		**0.001**	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		**0.001**	**0.001**	**0.001**	**0.001**	<0.001
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L		**0.064**	**0.014**	**0.006**	**0.006**	**0.024**
Molybdenum	7439-98-7	0.001	mg/L		**0.005**	**0.008**	**0.032**	**0.001**	<0.001
Nickel	7440-02-0	0.001	mg/L		**0.001**	**0.002**	**0.002**	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	7440-24-6	0.001	mg/L		**0.176**	**0.167**	**0.430**	**0.080**	**0.040**
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L		**0.016**	**0.007**	**0.058**	**0.047**	**0.018**
Boron	7440-42-8	0.05	mg/L		**0.25**	**0.18**	**0.54**	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		**0.25**	**0.57**	**0.16**	**0.08**	**0.27**
Bromine	7726-95-6	0.1	mg/L		**0.3**	**0.6**	**1.9**	<0.1	<0.1
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.3**	**0.5**	**0.9**	**0.2**	**0.1**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		<0.01	**0.45**	**0.07**	**0.01**	<0.01
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	**0.01**	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**7.5**	**4.3**	**5.6**	**4.5**	**3.9**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.80**	**0.83**	**1.37**	**0.65**	**0.75**

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TED	TSD	TND	WCD	ECD
				Client sampling date / time	13-MAY-2014 16:30	13-MAY-2014 08:30	13-MAY-2014 09:00	13-MAY-2014 12:00	13-MAY-2014 09:45
					ES1410640-001	ES1410640-002	ES1410640-003	ES1410640-004	ES1410640-005
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	**0.32**	<0.01	<0.01	**0.03**
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		**51**	**28**	**53**	**28**	**12**
EP026SP: Chemical Oxygen Demand (Spectrophotometric)									
Chemical Oxygen Demand	----	10	mg/L		**250**	**107**	**211**	**135**	**98**
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L		<10	<10	<10	----	----
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		<1.0	<1.0	<1.0	----	----
2-Chlorophenol	95-57-8	1.0	µg/L		<1.0	<1.0	<1.0	----	----
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	<1.0	<1.0	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	<2.0	<2.0	----	----
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	<1.0	<1.0	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	<1.0	<1.0	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	<1.0	<1.0	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	<1.0	<1.0	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	<1.0	<1.0	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	<1.0	<1.0	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	<2.0	<2.0	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	<1.0	----	----

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TED	TSD	TND	WCD	ECD
				Client sampling date / time	13-MAY-2014 16:30	13-MAY-2014 08:30	13-MAY-2014 09:00	13-MAY-2014 12:00	13-MAY-2014 09:45
					ES1410640-001	ES1410640-002	ES1410640-003	ES1410640-004	ES1410640-005
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	<1.0	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L		<0.5	<0.5	<0.5	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L		<0.5	<0.5	<0.5	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	----	----
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	----	----
C15 - C28 Fraction	----	100	µg/L		**290**	<100	**150**	----	----
C29 - C36 Fraction	----	50	µg/L		**70**	<50	<50	----	----
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		**360**	<50	**150**	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	<20	<20	----	----
>C10 - C16 Fraction	>C10_C16	100	µg/L		<100	<100	<100	----	----
>C16 - C34 Fraction	----	100	µg/L		**340**	<100	**140**	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	----	----
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		**340**	<100	**140**	----	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	<100	<100	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	----	----
Toluene	108-88-3	2	µg/L		<2	<2	<2	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	----	----
^ **Total Xylenes**	1330-20-7	2	µg/L		<2	<2	<2	----	----
^ **Sum of BTEX**	----	1	µg/L		<1	<1	<1	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	----	----
EP075(SIM)S: Phenolic Compound Surrogates									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TED	TSD	TND	WCD	ECD
				Client sampling date / time	13-MAY-2014 16:30	13-MAY-2014 08:30	13-MAY-2014 09:00	13-MAY-2014 12:00	13-MAY-2014 09:45
Compound	CAS Number	LOR	Unit		ES1410640-001	ES1410640-002	ES1410640-003	ES1410640-004	ES1410640-005
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
Phenol-d6	13127-88-3	0.1	%		27.2	28.3	25.4	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%		56.4	53.7	48.6	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%		67.9	66.4	60.0	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		72.3	63.4	66.5	----	----
Anthracene-d10	1719-06-8	0.1	%		89.2	70.0	92.1	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		73.7	72.4	76.4	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		81.0	82.6	74.2	----	----
Toluene-D8	2037-26-5	0.1	%		103	112	95.4	----	----
4-Bromofluorobenzene	460-00-4	0.1	%		121	128	125	----	----

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TSW01	TSW02	ASW01	S4MB01	TMB01
				Client sampling date / time	13-MAY-2014 15:00	13-MAY-2014 15:30	14-MAY-2014 10:30	13-MAY-2014 10:00	13-MAY-2014 14:15
					ES1410640-006	ES1410640-007	ES1410640-008	ES1410640-009	ES1410640-010
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		7.54	7.56	7.46	7.67	7.20
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		555	1690	446	4820	9050
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L		303	940	267	2450	5480
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		6	20	10	23	224
EA045: Turbidity									
Turbidity	----	0.1	NTU		6.0	40.8	6.3	8.5	143
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		71	245	67	791	1730
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		72	69	81	390	576
Total Alkalinity as CaCO3	----	1	mg/L		72	69	81	390	576
ED040F: Dissolved Major Anions									
Silicon as SiO2	14464-46-1	0.1	mg/L		16.3	4.1	17.6	28.4	40.4
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		7	41	3	69	77
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		123	454	88	1130	2770
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		12	32	12	231	242
Magnesium	7439-95-4	1	mg/L		10	40	9	52	273
Sodium	7440-23-5	1	mg/L		75	214	55	640	1290
Potassium	7440-09-7	1	mg/L		7	16	6	8	4
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.07	0.24	0.08	<0.01	0.07
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L		0.002	0.001	0.002	<0.001	0.002
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Barium	7440-39-3	0.001	mg/L		0.072	0.096	0.065	1.00	0.287

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TSW01	TSW02	ASW01	S4MB01	TMB01
				Client sampling date / time	13-MAY-2014 15:00	13-MAY-2014 15:30	14-MAY-2014 10:30	13-MAY-2014 10:00	13-MAY-2014 14:15
					ES1410640-006	ES1410640-007	ES1410640-008	ES1410640-009	ES1410640-010
EG020F: Dissolved Metals by ICP-MS - Continued									
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	**0.001**	<0.001
Cobalt	7440-48-4	0.001	mg/L		<0.001	**0.005**	**0.001**	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L		**0.001**	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L		**0.294**	**2.08**	**0.740**	**0.245**	**1.02**
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L		**0.001**	**0.003**	**0.002**	**0.002**	<0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	7440-24-6	0.001	mg/L		**0.431**	**0.695**	**0.268**	**21.2**	**7.76**
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	**0.002**	**0.005**
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L		**0.008**	**0.005**	<0.005	<0.005	**0.010**
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	**0.12**	<0.05
Iron	7439-89-6	0.05	mg/L		**1.28**	**0.26**	**1.36**	**0.07**	**2.47**
Bromine	7726-95-6	0.1	mg/L		**0.3**	**0.6**	**0.2**	**2.5**	**4.5**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.1**	**0.1**	**0.1**	**0.5**	**0.3**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.13**	**0.02**	**0.16**	**1.88**	**0.20**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		**0.02**	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.05**	<0.01	<0.01	**0.07**	**0.03**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.07**	<0.01	<0.01	**0.07**	**0.03**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**1.0**	**1.3**	**0.9**	**1.9**	**0.4**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.09**	**0.05**	**0.09**	**0.06**	**0.06**
EK071G: Reactive Phosphorus as P by discrete analyser									

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TSW01	TSW02	ASW01	S4MB01	TMB01
				Client sampling date / time	13-MAY-2014 15:00	13-MAY-2014 15:30	14-MAY-2014 10:30	13-MAY-2014 10:00	13-MAY-2014 14:15
					ES1410640-006	ES1410640-007	ES1410640-008	ES1410640-009	ES1410640-010
EK071G: Reactive Phosphorus as P by discrete analyser - Continued									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		**0.04**	<0.01	**0.02**	**0.02**	<0.01
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		**13**	**20**	**12**	**19**	**3**
EP026SP: Chemical Oxygen Demand (Spectrophotometric)									
Chemical Oxygen Demand	----	10	mg/L		**41**	**60**	**37**	**90**	<50
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L		<10	**20**	**15**	**1320**	**11**
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2-Chlorophenol	95-57-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID: TSW01	TSW02	ASW01	S4MB01	TMB01
				Client sampling date / time: 13-MAY-2014 15:00	13-MAY-2014 15:30	14-MAY-2014 10:30	13-MAY-2014 10:00	13-MAY-2014 14:15
				ES1410640-006	ES1410640-007	ES1410640-008	ES1410640-009	ES1410640-010
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Benzo(b+j)fluoranthene	205-99-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50
^ **C10 - C36 Fraction (sum)**	----	50	µg/L	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	µg/L	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L	<100	<100	<100	<100	<100
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L	<100	<100	<100	<100	<100
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2
^ **Total Xylenes**	1330-20-7	2	µg/L	<2	<2	<2	<2	<2
^ **Sum of BTEX**	----	1	µg/L	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5
EP075(SIM)S: Phenolic Compound Surrogates								

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TSW01	TSW02	ASW01	S4MB01	TMB01
				Client sampling date / time	13-MAY-2014 15:00	13-MAY-2014 15:30	14-MAY-2014 10:30	13-MAY-2014 10:00	13-MAY-2014 14:15
Compound	CAS Number	LOR	Unit		ES1410640-006	ES1410640-007	ES1410640-008	ES1410640-009	ES1410640-010
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
Phenol-d6	13127-88-3	0.1	%		32.2	30.6	30.7	30.0	32.4
2-Chlorophenol-D4	93951-73-6	0.1	%		65.4	69.8	68.9	61.6	61.3
2.4.6-Tribromophenol	118-79-6	0.1	%		72.3	70.6	77.2	75.1	60.7
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		71.8	77.6	75.5	69.6	67.3
Anthracene-d10	1719-06-8	0.1	%		74.3	80.2	81.6	73.8	71.5
4-Terphenyl-d14	1718-51-0	0.1	%		73.7	78.6	83.0	74.7	72.2
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		77.0	92.1	85.2	75.7	84.5
Toluene-D8	2037-26-5	0.1	%		97.6	93.4	97.3	97.5	110
4-Bromofluorobenzene	460-00-4	0.1	%		110	97.3	114	105	108

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TMB02	TMB03	TMB04	TMB05	SP5B
				Client sampling date / time	14-MAY-2014 08:45	13-MAY-2014 15:10	13-MAY-2014 17:00	13-MAY-2014 16:15	13-MAY-2014 11:15
					ES1410640-011	ES1410640-012	ES1410640-013	ES1410640-014	ES1410640-015
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		6.86	7.15	6.55	5.69	7.05
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		3790	5800	7150	7290	5460
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L		2330	3280	4430	4170	2610
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		18	16	119	111	5260
EA045: Turbidity									
Turbidity	----	0.1	NTU		18.7	13.2	58.1	58.7	3160
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		701	1130	1140	1200	527
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		160	472	106	24	223
Total Alkalinity as CaCO3	----	1	mg/L		160	472	106	24	223
ED040F: Dissolved Major Anions									
Silicon as SiO2	14464-46-1	0.1	mg/L		38.0	35.1	63.9	67.2	30.7
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		33	199	493	221	173
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		970	1310	1800	2370	1320
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		134	217	86	58	18
Magnesium	7439-95-4	1	mg/L		89	144	224	256	117
Sodium	7440-23-5	1	mg/L		452	777	1100	1030	941
Potassium	7440-09-7	1	mg/L		4	3	29	21	4
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	0.01	0.08	1.37	0.01
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L		0.003	0.003	0.001	<0.001	0.012
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	0.007	<0.001
Barium	7440-39-3	0.001	mg/L		0.798	0.204	0.068	0.085	0.122

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID: TMB02	TMB03	TMB04	TMB05	SP5B
				Client sampling date / time: 14-MAY-2014 08:45	13-MAY-2014 15:10	13-MAY-2014 17:00	13-MAY-2014 16:15	13-MAY-2014 11:15
				ES1410640-011	ES1410640-012	ES1410640-013	ES1410640-014	ES1410640-015
EG020F: Dissolved Metals by ICP-MS - Continued								
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	**0.0008**	**0.0024**	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	**0.002**	**0.002**	**0.082**	**0.297**	**0.002**
Copper	7440-50-8	0.001	mg/L	**0.002**	<0.001	**0.005**	**0.021**	**0.001**
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	**0.006**	<0.001
Manganese	7439-96-5	0.001	mg/L	**1.48**	**1.62**	**12.1**	**21.7**	**0.224**
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	**0.001**	**0.001**	**0.030**
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	**0.035**	**0.146**	**0.024**
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	7440-24-6	0.001	mg/L	**3.72**	**5.96**	**0.979**	**0.870**	**1.15**
Uranium	7440-61-1	0.001	mg/L	<0.001	**0.009**	<0.001	<0.001	**0.002**
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	**0.015**	**0.008**	**0.208**	**0.998**	**0.027**
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L	**6.44**	**2.28**	**2.08**	**10.0**	**2.26**
Bromine	7726-95-6	0.1	mg/L	**2.1**	**2.7**	**3.1**	**1.7**	**2.9**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.1**	**0.3**	**0.9**	**0.7**	**0.5**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.32**	**0.15**	**0.10**	**0.32**	**0.03**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	**0.04**	**0.15**	**0.04**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	**0.04**	**0.15**	**0.04**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.4**	**0.2**	**0.3**	**0.6**	**7.4**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.04**	**0.06**	**0.08**	<0.01	**1.39**
EK071G: Reactive Phosphorus as P by discrete analyser								

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TMB02	TMB03	TMB04	TMB05	SP5B
				Client sampling date / time	14-MAY-2014 08:45	13-MAY-2014 15:10	13-MAY-2014 17:00	13-MAY-2014 16:15	13-MAY-2014 11:15
					ES1410640-011	ES1410640-012	ES1410640-013	ES1410640-014	ES1410640-015
EK071G: Reactive Phosphorus as P by discrete analyser - Continued									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		**1**	**2**	**10**	**5**	**29**
EP026SP: Chemical Oxygen Demand (Spectrophotometric)									
Chemical Oxygen Demand	----	10	mg/L		**14**	**21**	**55**	<50	**219**
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L		<10	<10	----	----	----
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		<1.0	<1.0	----	----	----
2-Chlorophenol	95-57-8	1.0	µg/L		<1.0	<1.0	----	----	----
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	<1.0	----	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	<2.0	----	----	----
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	<1.0	----	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	<1.0	----	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	<1.0	----	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	<1.0	----	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	<1.0	----	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	<1.0	----	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	<1.0	----	----	----
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	<2.0	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	----	----	----

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	TMB02	TMB03	TMB04	TMB05	SP5B
				Client sampling date / time	14-MAY-2014 08:45	13-MAY-2014 15:10	13-MAY-2014 17:00	13-MAY-2014 16:15	13-MAY-2014 11:15
					ES1410640-011	ES1410640-012	ES1410640-013	ES1410640-014	ES1410640-015
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	----	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L		<0.5	<0.5	----	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L		<0.5	<0.5	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L		<50	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L		<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L		<50	<50	----	----	----
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	----	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	<20	----	----	----
>C10 - C16 Fraction	>C10_C16	100	µg/L		<100	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	----	----	----
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	<100	----	----	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	<100	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	----	----	----
Toluene	108-88-3	2	µg/L		<2	<2	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	----	----	----
^ **Total Xylenes**	1330-20-7	2	µg/L		<2	<2	----	----	----
^ **Sum of BTEX**	----	1	µg/L		<1	<1	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TMB02	TMB03	TMB04	TMB05	SP5B
				Client sampling date / time	14-MAY-2014 08:45	13-MAY-2014 15:10	13-MAY-2014 17:00	13-MAY-2014 16:15	13-MAY-2014 11:15
Compound	CAS Number	LOR	Unit		ES1410640-011	ES1410640-012	ES1410640-013	ES1410640-014	ES1410640-015
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
Phenol-d6	13127-88-3	0.1	%		33.1	33.5	----	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%		66.7	61.7	----	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%		64.7	66.3	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		67.4	64.3	----	----	----
Anthracene-d10	1719-06-8	0.1	%		74.2	82.8	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		76.2	83.9	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		76.2	92.7	----	----	----
Toluene-D8	2037-26-5	0.1	%		104	116	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%		101	119	----	----	----

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	SP6A	SP6B	SP7A	SP8A	QA1
				Client sampling date / time	13-MAY-2014 11:30	13-MAY-2014 11:30	14-MAY-2014 09:10	14-MAY-2014 09:15	13-MAY-2014 15:00
					ES1410640-016	ES1410640-017	ES1410640-018	ES1410640-019	ES1410640-020
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		7.35	7.08	7.63	7.26	6.85
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		4490	4630	1860	1660	3790
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L		2400	2200	1170	778	2290
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		48	5700	197	4960	18
EA045: Turbidity									
Turbidity	----	0.1	NTU		47.6	3700	172	2300	19.3
EA065: Total Hardness as CaCO3									
Total Hardness as CaCO3	----	1	mg/L		256	356	188	145	711
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		91	126	225	132	160
Total Alkalinity as CaCO3	----	1	mg/L		91	126	225	132	160
ED040F: Dissolved Major Anions									
Silicon as SiO2	14464-46-1	0.1	mg/L		27.8	16.2	12.2	11.9	38.5
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		172	34	144	111	33
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		1100	1210	339	361	976
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		10	22	24	17	138
Magnesium	7439-95-4	1	mg/L		56	73	31	25	89
Sodium	7440-23-5	1	mg/L		803	806	283	258	459
Potassium	7440-09-7	1	mg/L		<1	3	29	20	4
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.02	0.04	0.06	0.30	0.02
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L		0.003	0.003	0.004	0.002	0.003
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Barium	7440-39-3	0.001	mg/L		0.071	0.510	0.148	0.169	0.792

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	SP6A	SP6B	SP7A	SP8A	QA1
				Client sampling date / time	13-MAY-2014 11:30	13-MAY-2014 11:30	14-MAY-2014 09:10	14-MAY-2014 09:15	13-MAY-2014 15:00
					ES1410640-016	ES1410640-017	ES1410640-018	ES1410640-019	ES1410640-020
EG020F: Dissolved Metals by ICP-MS - Continued									
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	**0.002**	<0.001	**0.005**	<0.001
Cobalt	7440-48-4	0.001	mg/L		**0.004**	**0.009**	**0.003**	**0.004**	**0.003**
Copper	7440-50-8	0.001	mg/L		**0.002**	**0.003**	**0.005**	**0.002**	**0.002**
Lead	7439-92-1	0.001	mg/L		**0.001**	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L		**0.092**	**0.499**	**0.072**	**0.136**	**1.58**
Molybdenum	7439-98-7	0.001	mg/L		**0.002**	**0.077**	**0.008**	**0.022**	<0.001
Nickel	7440-02-0	0.001	mg/L		**0.008**	**0.258**	**0.006**	**0.178**	**0.001**
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	7440-24-6	0.001	mg/L		**0.614**	**0.966**	**0.386**	**0.263**	**3.74**
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	**0.002**	**0.001**	<0.001
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L		**0.028**	**0.024**	**0.023**	**0.172**	**0.012**
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	**0.12**	**0.14**	<0.05
Iron	7439-89-6	0.05	mg/L		**1.50**	**2.03**	**0.71**	**0.49**	**5.95**
Bromine	7726-95-6	0.1	mg/L		**1.9**	**1.9**	**0.8**	**0.8**	**2.1**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.3**	**0.5**	**0.5**	**0.3**	**0.1**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.02**	**0.13**	**0.63**	**0.07**	**0.29**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	<0.01	**0.36**	**0.02**	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.05**	**0.08**	**11.2**	**2.04**	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.05**	**0.08**	**11.6**	**2.06**	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.5**	**1.0**	**20.9**	**13.0**	**0.3**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.06**	**0.17**	**3.65**	**2.30**	**0.04**
EK071G: Reactive Phosphorus as P by discrete analyser									

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	SP6A	SP6B	SP7A	SP8A	QA1
				Client sampling date / time	13-MAY-2014 11:30	13-MAY-2014 11:30	14-MAY-2014 09:10	14-MAY-2014 09:15	13-MAY-2014 15:00
					ES1410640-016	ES1410640-017	ES1410640-018	ES1410640-019	ES1410640-020
EK071G: Reactive Phosphorus as P by discrete analyser - Continued									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	<0.01	**0.25**	<0.01	<0.01
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		**16**	**9**	**54**	**39**	**1**
EP026SP: Chemical Oxygen Demand (Spectrophotometric)									
Chemical Oxygen Demand	----	10	mg/L		**48**	**37**	**528**	**389**	**13**
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L		----	----	----	----	<10
EP035G: Total Phenol by Discrete Analyser									
Phenols (Total)	----	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		----	----	----	----	<1.0
2-Chlorophenol	95-57-8	1.0	µg/L		----	----	----	----	<1.0
2-Methylphenol	95-48-7	1.0	µg/L		----	----	----	----	<1.0
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		----	----	----	----	<2.0
2-Nitrophenol	88-75-5	1.0	µg/L		----	----	----	----	<1.0
2.4-Dimethylphenol	105-67-9	1.0	µg/L		----	----	----	----	<1.0
2.4-Dichlorophenol	120-83-2	1.0	µg/L		----	----	----	----	<1.0
2.6-Dichlorophenol	87-65-0	1.0	µg/L		----	----	----	----	<1.0
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		----	----	----	----	<1.0
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		----	----	----	----	<1.0
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		----	----	----	----	<1.0
Pentachlorophenol	87-86-5	2.0	µg/L		----	----	----	----	<2.0
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		----	----	----	----	<1.0
Acenaphthylene	208-96-8	1.0	µg/L		----	----	----	----	<1.0
Acenaphthene	83-32-9	1.0	µg/L		----	----	----	----	<1.0
Fluorene	86-73-7	1.0	µg/L		----	----	----	----	<1.0
Phenanthrene	85-01-8	1.0	µg/L		----	----	----	----	<1.0
Anthracene	120-12-7	1.0	µg/L		----	----	----	----	<1.0
Fluoranthene	206-44-0	1.0	µg/L		----	----	----	----	<1.0
Pyrene	129-00-0	1.0	µg/L		----	----	----	----	<1.0
Benz(a)anthracene	56-55-3	1.0	µg/L		----	----	----	----	<1.0
Chrysene	218-01-9	1.0	µg/L		----	----	----	----	<1.0

Analytical Results

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

Compound	CAS Number	LOR	Unit	Client sample ID	SP6A	SP6B	SP7A	SP8A	QA1
				Client sampling date / time	13-MAY-2014 11:30	13-MAY-2014 11:30	14-MAY-2014 09:10	14-MAY-2014 09:15	13-MAY-2014 15:00
					ES1410640-016	ES1410640-017	ES1410640-018	ES1410640-019	ES1410640-020
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2	1.0	µg/L		----	----	----	----	<1.0
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		----	----	----	----	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L		----	----	----	----	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		----	----	----	----	<1.0
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		----	----	----	----	<1.0
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		----	----	----	----	<1.0
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L		----	----	----	----	<0.5
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L		----	----	----	----	<0.5
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		----	----	----	----	<20
C10 - C14 Fraction	----	50	µg/L		----	----	----	----	<50
C15 - C28 Fraction	----	100	µg/L		----	----	----	----	<100
C29 - C36 Fraction	----	50	µg/L		----	----	----	----	<50
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		----	----	----	----	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	20	µg/L		----	----	----	----	<20
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		----	----	----	----	<20
>C10 - C16 Fraction	>C10_C16	100	µg/L		----	----	----	----	<100
>C16 - C34 Fraction	----	100	µg/L		----	----	----	----	<100
>C34 - C40 Fraction	----	100	µg/L		----	----	----	----	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		----	----	----	----	<100
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		----	----	----	----	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		----	----	----	----	<1
Toluene	108-88-3	2	µg/L		----	----	----	----	<2
Ethylbenzene	100-41-4	2	µg/L		----	----	----	----	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		----	----	----	----	<2
ortho-Xylene	95-47-6	2	µg/L		----	----	----	----	<2
^ **Total Xylenes**	1330-20-7	2	µg/L		----	----	----	----	<2
^ **Sum of BTEX**	----	1	µg/L		----	----	----	----	<1
Naphthalene	91-20-3	5	µg/L		----	----	----	----	<5
EP075(SIM)S: Phenolic Compound Surrogates									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SP6A	SP6B	SP7A	SP8A	QA1
				Client sampling date / time	13-MAY-2014 11:30	13-MAY-2014 11:30	14-MAY-2014 09:10	14-MAY-2014 09:15	13-MAY-2014 15:00
Compound	CAS Number	LOR	Unit		ES1410640-016	ES1410640-017	ES1410640-018	ES1410640-019	ES1410640-020
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
Phenol-d6	13127-88-3	0.1	%		----	----	----	----	32.6
2-Chlorophenol-D4	93951-73-6	0.1	%		----	----	----	----	70.1
2.4.6-Tribromophenol	118-79-6	0.1	%		----	----	----	----	63.0
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		----	----	----	----	66.1
Anthracene-d10	1719-06-8	0.1	%		----	----	----	----	84.7
4-Terphenyl-d14	1718-51-0	0.1	%		----	----	----	----	85.5
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		----	----	----	----	97.5
Toluene-D8	2037-26-5	0.1	%		----	----	----	----	125
4-Bromofluorobenzene	460-00-4	0.1	%		----	----	----	----	121

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27.4	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128