



**Rockwater**  
P R O P R I E T A R Y L I M I T E D

# **JAMES PRICE POINT MONITORING BORE COMPLETION REPORT**

**FEBRUARY 2012**

**REPORT FOR  
WOODSIDE ENERGY LTD**

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## TABLE OF CONTENTS

	PAGE
1 INTRODUCTION	1
2 HYDROGEOLOGICAL SETTING	1
2.1 Topography	1
2.2 Climate	1
2.3 Geology	2
2.4 Hydrogeology	3
3 DRILLING AND BORE CONSTRUCTION	4
4 FALLING-HEAD TESTS	7
5 HYDROCHEMISTRY	10
5.1 Groundwater sampling	10
5.2 Analytical Results	10
5.3 Isotope sampling	12
6 PASS SAMPLING	13
7 WATER LEVEL MONITORING PROGRAMME	13
8 CONCLUSIONS	14
REFERENCES	16

### Tables

Table 1: Average Rainfall at Broome	2
Table 2: Generalised Stratigraphy Beneath the Browse LNG Precinct	3
Table 3: Bore Construction Data	6
Table 4: Results of Falling-Head Tests Conducted in Watertable Bores (values of hydraulic conductivity)	8
Table 5: Results of Falling-Head Tests Conducted in Deep Monitoring Bores (values of hydraulic conductivity)	9
Table 6: Water Chemistry Results	11
Table 7: Isotope Sampling Results	12
Table 8: Summary of Laboratory Results of PASS	13

### Figures

1 Woodside BLNG Project – James Price Point Precinct General Locality Map
2 James Price Point Precinct Bore Locality Map
3 Watertable Contour Map, December 2011
4 Deep Water Level Contour Map, December 2011
5 AD-16 Composite Log
6 AD-20 Composite Log
7 AD-28 Composite Log



## TABLE OF CONTENTS

### (Continued)

#### Figures (cont.)

8	AE-10 Composite Log
9	AP-12 Composite Log
10	AP-14 Composite Log
11	AP-20 Composite Log
12	AP-24 Composite Log
13	AP-28 Composite Log
14	AP-32 Composite Log
15	AP-36 Composite Log
16	F-14 Composite Log
17	I-16 Composite Log
18	N-4 Composite Log
19	O-10 Composite Log
20	P-17 Composite Log
21	P-21 Composite Log
22	P-25 Composite Log
23	P-29 Composite Log
24	U-10 Composite Log
25	U-16 Composite Log
26	U-20 Composite Log
27	U-31 Composite Log
28	V-25 Composite Log
29	Salinity Data for Watertable Monitoring Bores, December 2011
30	Salinity Data for Deep Monitoring Bores, December 2011
31	Bore BH6X, X and X1, Hydrographs
32	Bore BH6X, X and X1, Hydrographs with Broome Tidal Data

#### Appendices

I	Department of Water Licence to Construct or Alter a Well CAW172357(1)
II	Bore Completion Data and Lithological Logs
III	Rockwater Monitoring Bore Designs
IV	Bore Schedule
V	Falling Head Tests Data Analysis
VI	Summary of Water Chemistry Results
VII	Water Chemistry Certificates of Analysis
VIII	PASS Sampling Certificates of Analysis
IX	Data Logger Installation Data
X	Water Level Data



# **1 INTRODUCTION**

In May 2011 Woodside Energy Limited (Woodside) commenced a programme of onshore geotechnical investigations including the drilling of diamond core bore holes at the Browse LNG Precinct. The precinct is located near James Price Point, approximately 60 km north of Broome on the Dampier Peninsular, Western Australia (Fig. 1). Rockwater Pty Ltd (Rockwater) was commissioned by Woodside to provide hydrogeological expertise and advice for the design and installation of a network of shallow groundwater monitoring bores to be constructed in the bore holes. The work was completed under Woodside's #68 Browse Onshore Site Investigation programme. Rockwater personnel began work on-site in July 2011, intermittently overseeing the construction of 24 monitoring bores until the completion of the programme in December 2011.

Construction of the groundwater monitoring bores was authorised by the Department of Water (DoW) under a Rights in Water and Irrigation Act 1914 Section 26D licence to construct or alter a well; CAW172357(1), a copy of which is provided in Appendix I. The licence duration is 29 October 2010 to 24 October 2012.

The monitoring bore network is intended to provide baseline hydrogeological data for the unconfined, shallow aquifer beneath the site before major onshore construction work is commenced. It comprises bores that are open at both the water table (bores designated 'shallow') and at a selected interval towards the base of the geotechnical holes (bores designated 'deep'). As a secondary objective, Rockwater personnel investigated the presence of stygofauna habitat and adjusted bore designs if favourable habitat was observed.

The bore construction programme also included groundwater sampling, permeability testing by conducting falling-head tests and installation of pressure transducers for water level monitoring; testing for the potential of acid sulphate soils was also undertaken at a small number of sites. Bore completion data for the 24 monitoring bores are presented in this report, bore locations are shown in Figure 2.

## **2 HYDROGEOLOGICAL SETTING**

### **2.1 TOPOGRAPHY**

Ground elevations across the drilling site decrease in elevation by approximately 18 m from east to west, from 29 m AHD (Australian Height Datum) to about 11 m AHD.

### **2.2 CLIMATE**

The climate of the area is hot, semi-arid and seasonally wet. The mean maximum temperatures in Broome (the nearest Bureau of Meteorology climate station) range from 29°C



in June/July to 34°C in December, March and April. Summer temperatures are generally slightly higher inland from the coast.

Average annual rainfall varies considerably over the Dampier Peninsula region, with values of 606 mm for Broome, 687 mm for Derby, 929 mm for Country Downs Station and 765 mm for Beagle Bay. Some of the differences in these values are likely to be associated with differing lengths of records for the sites.

Monsoonal rainfall predominates in the “wet season” from December to March when, on average, 85 per cent of the annual rainfall at Broome is received (Table 1). The rainfall is associated with thunderstorms and occasional tropical cyclones, and shows considerable annual variations. The “dry season” produces very low rainfall, averaging between 1 and 27 mm per month.

**Table 1: Average Rainfall at Broome**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Average Rainfall (mm)	178.5	179.1	100.8	26.7	26.4	17.8	7.3	1.7	1.4	1.4	8.9	56	606.2

(BoM data; Station No. 3003; Years 1941-2011)

Annual evapotranspiration at the site, determined from Bureau of Meteorology average areal potential evapotranspiration maps, is approximately 1900 mm. This is approximately three-times greater than the average annual rainfall and exceeds average rainfall in all months except February (Rockwater, 2010).

## 2.3 GEOLOGY

The precinct site is located on the western side of the Dampier Peninsula within the Fitzroy Trough of the Canning Basin between the west-east trending Baskerville and Barlee anticlines. The expected stratigraphy beneath the precinct area, based on Geological Survey of Western Australia mapping, is given in Table 2.

The geotechnical drilling programme targeted the superficial sediments with borehole depths penetrating to generally around 50 m bgl for those boreholes that were to be finished as monitoring bores, intersecting the Mowanjum Sand and the uppermost part of the Broome Sandstone. The Mowanjum Sand, which may colloquially be referred to as pindan, consists of red-brown, fine grained, silty sand. The Broome Sandstone is predominantly medium grained sandstone, which varies in colour from pale-grey to yellow-brown, and shows weathered and oxidised red and purple-red intervals. A weathered zone is present at the top of the Broome Sandstone.

**Table 2: Generalised Stratigraphy Beneath the Browse LNG Precinct**

Age	Formation	Thickness	Main Lithologies
Quaternary	Superficial unis, including Mowanjum Sand ("pindan")	5 – 20 m	Sand, silt, clay and minor gravel.
Tertiary to Quaternary	Superficial Laterite	0 to 2 m	Pisolitic or massive laterite.
Early Cretaceous	Broome Sandstone	Up to 280 m	Fine to coarse grained sandstone, minor gravel, some mudstone and conglomerate.
Late Cretaceous	Jarlemai Siltstone	Up to 260 m	Siltstone, claystone, minor sandstone.
Late Jurassic	Alexander Formation	Up to 50 m	Fine to coarse grained sandstone, minor mudstone.
Early to Late Jurassic	Wallal Sandstone	Up to 360 m	Fine to coarse grained sandstone, minor siltstone and conglomerate.

Note: modified after Laws (1991)

The Broome Sandstone crops out at the coast nearby to the area of the bore installations, where it comprises indurated sandstone. However, the geotechnical logs and core photographs from the drilling, supplied by Fugro (Fugro Survey Pty Ltd; Fugro Survey 2011), indicate that there are intervals of unconsolidated sand and intervals of very weakly cemented to very well cemented sandstone within the Broome Sandstone. The unconformable contact between the Mowanjum Sand and the underlying Broome Sandstone is generally very difficult to definitively locate using visual and lithological criteria. This is due to effects from weathering, other physiochemical processes and possible reworking which have resulted in a transitional zone between the formations along the contact. The geotechnical definition of the contact between the Broome Sandstone and the overlying Mowanjum Sand is outside the scope of this study; however, in general it appears that the top of the Broome Sandstone dips towards the west beneath the site.

## 2.4 HYDROGEOLOGY

The major aquifers in the Broome region are herein named after their major constituent geological units. They are, in order of increasing depth below ground the Broome, Wallal and Grant aquifers. The Broome aquifer was only intersected during the drilling programme and so the other aquifers are not discussed further.

The Broome aquifer is unconfined in the precinct area where it is expected to have a saturated thickness of about 100 to 150 m (Rockwater 2010). The results of the drilling indicate that groundwater in the Mowanjum Sand is in direct hydraulic connection with that in the Broome Sandstone and so the Mowanjum Sand is included as part of the Broome aquifer. The watertable occurs at depths between approximately 8.5 (F-14) and 25.7 m (AP-14) below ground and groundwater elevation reduces across the site from 3.43 m AHD (AP-28) in the east to 2.17 m AHD (F-14) in the west.

Groundwater contour plots of groundwater levels measured in bores slotted at the watertable (Fig. 3) and those slotted at a deeper level in the aquifer (Fig. 4) imply groundwater flow is towards the west. Although the contour plots show a small difference in hydraulic head (average 0.1 m) between these two sets of data, the difference is not significant as it is within the accuracy of the surveyed height data for the bores ( $\pm 0.1$  m; Fugro Survey 2011). There was no evidence of perched groundwater in the geotechnical holes.

### **3 DRILLING AND BORE CONSTRUCTION**

The monitoring bore construction programme was carried out in tandem with the geotechnical site investigation drilling that was conducted and managed by Fugro. Drilling and construction of the monitoring bores was carried out by Hagstrom Drilling under the conditions of CAW172357(1) (Appendix I). Drilling supervision was provided by Fugro field staff while Rockwater developed final bore designs based on the nominated bore type ('shallow' or 'deep'), the interpreted depth to the water table and lithological data.

A total of 24 bores were installed. The locations of the monitoring bores were selected to provide a satisfactory spread of sites across the precinct area (Fig. 2). Eight of the bores are designated as 'deep monitoring bores' and are slotted at depth below the water table, while 16 bores are slotted at or just below the water table and are designated as 'shallow monitoring bores'. The bores are identified according to their position on a local grid that was used during the geotechnical site investigation.

Three of the monitoring bores, AD-16, U-10, and V-25, were designed and constructed for the purpose of stygofauna (subterranean fauna) sampling. These bores have slotted sections with larger slot widths (3 mm) that were installed against strata with either open cavities or fractures that indicated potential for suitable stygofauna habitat.

Hagstrom Drilling operated three rigs during the investigation using mud-rotary coring drilling methods to drill PQ3 (123 mm diameter) size boreholes to either 50 m depth or to 20 m below the top of Broome Sandstone, whichever was the deeper. The top of the Broome Sandstone was defined, for on-site geotechnical purposes, as the transition from an unconsolidated material to an indurated sandstone of variable strength. This level may not correspond to the stratigraphic top of the Broome Sandstone.

Underlying the Mowanjum Sand is pale red-brown to pale yellow, fine to medium grained sand that is weakly cemented in parts and contains minor sandstone nodules and gravel. This interval appears to be a transition zone above the sandstone of the Broome Sandstone. Broome Sandstone (sand and sandstone lithologies) extends to the total depth of the boreholes, which were drilled to between 50 and 58.5 m below ground. The Broome Sandstone consists predominantly of pale-yellow and grey, medium grained, moderately cemented sandstone with common intervals of unconsolidated sand.

Lithological logs, along with drilling and bore completion data, are included in Appendix II. The logs were prepared for hydrogeological purposes by Rockwater, and are based on the borehole logs completed by Fugro geologists (Fugro Survey 2011) and the inspection of sections of core and core photographs by Rockwater hydrogeologists. Lithological descriptions are presented for information only, please see Fugro's Factual Data Report (Fugro Survey 2011) for full geological descriptions. Rockwater was unable to inspect all section of the core as health and safety requirements prevented the hydrogeologists from attending site at all times.

Bore completion data have been provided by Fugro Survey (2011) and bore construction was completed according to designs supplied by Rockwater. Copies of the bore designs are provided in Appendix III. Composite logs for the 24 monitoring bores are shown in Figures 5 to 28.

The boreholes were backfilled with gravel (1.6 – 6.4 mm diameter) from the total drilled depth to the designed bottom of the casing. Class 18 uPVC threaded casing, with a slotted interval of 6 m placed at the base of the bore, was then inserted into the hole. The slot aperture size was either 0.5 or 0.75 mm for groundwater monitoring bores and 3 mm for the dual-purpose groundwater/stygofauna monitoring bores. Filter pack, installed into the borehole annulus around and to two metres above the slotted section, comprised either graded 1.6 – 3.2 mm diameter gravel, in the 0.5 and 0.75 mm slot-size bores, or 3.2 – 6.4 mm gravel, in the 3 mm aperture slot-size bores. A bentonite seal was installed on top of the gravel pack and the remaining annulus cement-grouted back to the ground surface. During drilling, bio-degradable rod lubricants were used on the majority of the monitoring boreholes; no glue was used in the assembly of the uPVC casing strings.

A summary of monitoring bore construction details is given in Table 3. A bore schedule is included in Appendix IV. The schedule includes details of extraction bores AD-10 and AP-10, regional monitoring bores X and X1, and monitoring bore BH6X, which was constructed during a previous geotechnical drilling programme.

Bore development was carried out by Fugro via purging and airlifting of at least three casing-volumes of water from the bores until there was no improvement in turbidity. There were considerable difficulties in developing many of the bores due to the small volumes of water that could be obtained from the comparatively narrow-diameter and shallow bores.

Reduced level height data, supplied by Fugro Survey (2011) has an accuracy of 0.1 m, which is the current best survey data available. Surveyed levels and derived data (e.g. water levels) are, consequently measured to that degree of accuracy. This could be significant for calculations of some parameters, such as groundwater gradients. It is recommended that more accurate bore levels be obtained in the future.

**Table 3: Bore Construction Data**

Bore ID	Bore Type	RL Top of Casing (m AHD)	MGA Easting (m)	MGA Northing (m)	Drill Depth (m bgl)	Casing Depth (m bgl)	Slot Size (mm)	Slotted Interval (m bgl)	Grout Interval (m bgl)	Bentonite Seal (m bgl)
AD-16	Deep / Stygo	23.9	411223	8063749	50	44.5	3.00	38.5 – 44.5	0.0 – 31.5	31.5 – 34.4
AD-20	Shallow	23.2	411220	8063554	50	25.6	0.50	19.6 – 25.6	0.0 – 15.0	15.0 – 17.0
AD-28	Deep	21.5	411221	8063164	50.5	42.9	0.50	36.9 – 42.9	0.0 – 32.0	32.0 – 35.0
AE-10	Shallow	24.7	411228	8064055	50	26.6	0.75	21.2 – 26.7	0.0 – 15.3	15.3 – 17.4
AP-12	Shallow	29.0	411824	8063949	50	32.0	0.75	26.0 – 32.0	0.0 – 22.0	22.0 – 24.0
AP-14	Deep	30.1	411823	8063850	50.5	50.0	0.50	44.0 – 50.0	0.0 – 40.0	40.0 – 42.0
AP-20	Shallow	29.0	411822	8063550	50	30.7	0.50	24.7 – 30.7	0.0 – 20.5	20.5 – 22.5
AP-24	Shallow	27.9	411822	8063350	52.5	29.6	0.50	23.6 – 29.6	0.0 – 18.0	18.0 – 21.5
AP-28	Deep	26.7	411823	8063159	50	46.7	0.50	40.7 – 46.7	0.0 – 36.0	36.0 – 38.0
AP-32	Shallow	25.4	411825	8062943	48.5	26.5	0.50	20.5 – 26.5	0.0 – 16.5	16.5 – 18.5
AP-36	Shallow	24.7	411828	8062763	58.5	26.0	0.50	20.0 – 26.0	0.0 – 16.0	16.0 – 18.0
F-14	Shallow	11.4	410027	8063852	51	14.0	0.50	8.0 – 14.0	0.0 – 3.0	3.0 – 6.0
I-16	Deep	12.6	410178	8063746	50	35.0	0.50	29.0 – 35.0	0.0 – 25.0	25.0 – 27.0
N-4	Shallow	16.0	410423	8064353	57	18.9	0.50	13.0 – 19.0	0.0 – 1.0	1.0 – 3.0
O-10	Shallow	17.1	410470	8064057	51	20.2	0.50	14.2 – 20.2	0.0 – 7.0	7.0 – 11.9
P-17	Shallow	16.1	410525	8063705	50	20.0	0.75	14.0 – 20.0	0.0 – 10.0	10.0 – 12.0
P-21	Shallow	15.3	410524	8063502	50.5	19.0	0.75	13.0 – 19.0	0.0 – 9.0	9.0 – 11.0
P-25	Deep	14.7	410526	8063307	51	35.0	0.50	29.0 – 35.0	0.0 – 24.9	24.9 – 26.6
P-29	Shallow	13.6	410528	8063097	58.5	19.5	0.75	13.5 – 19.5	0.0 – 8.5	8.5 – 10.3
U-10	Shallow / Stygo	20.4	410770	8064054	50	30.5	3.00	24.5 – 30.5	0.0 – 20.5	20.5 – 22.5
U-16	Deep	19.0	410771	8063754	50	40.5	0.75	34.5 – 40.5	0.0 – 30.0	30.0 – 32.0
U-20	Shallow	18.7	410768	8063553	54	21.2	0.75	15.2 – 21.2	0.0 – 10.8	10.8 – 12.8
U-31	Shallow	15.7	410769	8063002	51.1	18.0	0.75	12.0 – 18.0	0.0 – 8.0	8.0 – 10.0
V-25	Deep / Stygo	18.0	410819	8063300	50	39.5	3.00	33.5 – 39.5	0.0 – 28.5	28.5 – 31.0

## 4 FALLING-HEAD TESTS

Falling-head tests (slug tests) were conducted on all monitoring bores to assess aquifer hydraulic conductivity ( $k$ ). The tests, carried out after the bores were developed and pumped for groundwater sampling, were conducted by delivering a 10-litre 'slug' of water into the casing and recording the corresponding rise and fall in water level using a Solinst levellogger installed in the bore just below the water table. Time-displacement plots and derived values of hydraulic conductivity are included in Appendix V. The results are also summarised in Table 4 (watertable bores) and Table 5 (deep bores).

The data have been analysed employing the computer program AQTESOLV using the methods of Bouwer-Rice, the KGS model and Springer-Galhar for an unconfined aquifer, a partially penetrating well and a saturated thickness of 100 m. A sensitivity analysis was undertaken to determine an appropriate aquifer thickness, within the range of realistic values, to use in the analyses. It was found that there is negligible to no variation in the derived hydraulic conductivity for values of aquifer thickness of greater than 25 m. whereas the derived hydraulic conductivity increased by about 10 to 15% for smaller values of aquifer thickness, corresponding to the approximate distance from the base of the slotted interval to the water table.

The results indicate a range of hydraulic conductivity values from about 0.1 m/day up to about 4 m/day (Tables 4 and 5). One comparatively high value of 11 m/day and a very low value have been excluded from these ranges. The average value for the watertable bores is 0.9 m/day and the deep bores 1.8 m/day.

Derived values (such as hydraulic conductivity,  $k$ ) are provided for information only. Users of this report are required to independently verify the derived values based on the observed data.

**Table 4: Results of Falling-Head Tests Conducted in Watertable Bores (values of hydraulic conductivity)**

HOLE ID	BORE TYPE	SLOTTED INTERVAL	LITHOLOGY OF SLOTTED INTERVAL	Water Level	SLUG TEST RESULTS				Comments / Notes
					10 L Slug Max Displacement	Range of K Values		Average K Value	
					(m)	Minimum (m/day)	Maximum (m/day)	(m/day)	
		(m bgl)		(m btoc)					
AD-20	Shallow	19.6 - 25.6	Sand\Sandstone	20.28	0.74	1.00	3.70	1.70	Range for values for Bower-Rice, visual fitting used for early to late-time data. Early: 0 to 16 seconds - k = 1.48. Mid: k = ~1. Late: from 48 seconds on - k = 3.7 m/day.
AE-10	Shallow	21.2 - 27.2	Sand\Sandstone	22.00	0.38	0.03	0.04	0.03	Very low values, possible test failure? Increase in k value using Bouwer-Rice method for late-time data (after 800 seconds k = 0.12 m/day).
AP-12	Shallow	26.0 - 32.0	Sandstone	25.70	5.74	0.45	11.00	1.76	First 30 seconds decline possibly still effected by slug - shows rises. Significant change at 32 seconds. High (highest) displacement. Bower-Rice shows range for early to late-time data. Early: 0 to 32 seconds - k = 0.45. Late: 32 to 40 seconds - k = 11 m/day. Poor fits for KGS and Springer-Gelhar methods.
AP-20	Shallow	24.7 - 30.7	Sand\Sandstone	25.77	0.32	1.12	3.00	1.83	Oscillations recorded in first 10 seconds removed (consequence of additional of slug).
AP-24	Shallow	23.6 - 29.6	Sand	24.55	0.86	0.81	2.49	1.22	KGS method shows a poor fit. Springer-Gelhar methods fits ok with mid & late-time data (best fit). Bower-Rice method shows a range of values for early to late-time data. Early, 0 to 15 seconds - k = 0.8606. Mid, 15 to 32 seconds - k = 1.736. Late, 32 to end - k = 2.492 m/day. Mid best fit.
AP-32	Shallow	20.5 - 26.5	Silty Sand\Sand	22.09	1.32	0.24	0.31	0.27	Good match with early data (KGS and Bower-Rice methods), and all data for Springer-Gelhar method.
AP-36	Shallow	20.0 - 26.0	Silty Sand\Sand	21.37	1.06	0.39	0.67	0.51	Good fit to early-time data for Bower-Rice method. KGS method fits all time-data.
F-14	Shallow	8.0 - 14.0	Silty Sand	9.23	1.65	0.37	0.95	0.62	Good fit for KGS, higher k than all data. Springer-Gelhar method shows an average fit. Average fit for Bower-Rice method which shows a range of k values for early to late-time data. Early 0 to 25 seconds - k = 0.4, Mid 25 to 60 seconds - k = 0.24, Late 60 seconds on - k = 0.06, auto fit k = 0.4 m/day (uses early-time data).
P-17	Shallow	14.0 - 20.0	Sand	13.55	1.18	0.17	0.44	0.34	KGS method shows a good fit to late-time data. Average fit for Bower-Rice method - early and late-time data. Early, 0 to 90 seconds - k = 0.3846. Late, 90 seconds on - k = 0.1714 m/day.
P-21	Shallow	13.0 - 19.0	Silty Sand	12.93	1.17	0.61	0.84	0.75	Bower-Rice fits early-time data only. KGS method shows a good fit. Springer-Gelhar method is average to poor.
P-29	Shallow	13.5 - 19.5	Silty Sand	11.23	0.77	1.36	1.88	1.57	Bower-Rice method fits to early data only. KGS & Springer-Gelhar methods show a better fit to all time-data.
U-10	Shallow / Stygo	24.5 - 30.5	Silty Sand\Sand\Sandstone	17.94	1.85	0.61	0.85	0.71	Reasonable to good fits. Good fit for Springer-Gelhar method, good fit for early data for Bouwer-Rice & KGS methods.
U-20	Shallow	15.2 - 21.2	Silty Sand	16.23	0.99	0.47	0.60	0.52	Bower-Rice method fits early data only.
U-31	Shallow	12.0 - 18.0	Silty Sand	13.16	4.38	0.10	0.67	0.33	Visual fit used for KGS (k = 0.5538), fits ok with early & late-time data, and poorly to mid-time data. Bower-Rice methods shows a range of values for early, mid & late-time data. Early, 0 to 30 seconds - k = 0.5437. Mid, 30 to 110 seconds - k = 0.0989. Late, 110 seconds to end, k = 0.2445. Springer-Gelhar shows a range of values for early to late-time data. Early, 0 to 30 seconds, k = 0.667. Late, 100 seconds to end, k = 0.259 m/day.
N-4	Shallow	13.0 - 19.0	Sand\Silty Sand	13.83	2.10	0.50	0.66	0.57	KGS method shows a good fit.
O-10	Shallow	14.2 - 20.2	Silty Sand	14.81	1.05	0.87	1.34	1.03	Bower-Rice method shows a range of values for early and late-time data. Early, 0 to 15 seconds - k = 0.8686. Late, 20 to 40 seconds - k = 1.344 m/day. Springer-Gelhar method shows a good fit to all time data.
<b>AVERAGE VALUE FOR WATERTABLE INTERVAL - k = 0.9 m/day, range of values from 0.05 to 11 m/day</b>									

**Table 5: Results of Falling-Head Tests Conducted in Deep Monitoring Bores (values of hydraulic conductivity)**

HOLE ID	BORE TYPE	SLOTTED INTERVAL		Water Level	SLUG TEST RESULTS				
					10 L Slug	Range of K Values		Average K Value	Comments / Notes
					Max Displacement	Minimum	Maximum		
		(m bgl)		(m btoc)	(m)	(m/day)	(m/day)	(m/day)	
AD-16	Deep / Stygo	38.5 - 44.5	Sand\Sandstone	20.88 20.88	no result				Test failed- water level changes/oscillates only for 30 seconds which coincides with slug drop.
AD-28	Deep	36.9 - 42.9	Sandstone	18.56	no result				FAILED
AP-14	Deep	44.0 - 50.0	Sandstone	26.68	2.50	2.49	3.90	3.11	Very small amount of data (<10seconds) (3 to 11 seconds).
AP-28	Deep	40.7 - 46.7	Sandstone	23.27	0.48	1.90	3.05	2.54	Possible failure - 0.45 m displacement, oscillating. <20 seconds data with oscillations likely coinciding with slug drop.
P-25	Deep	29.0 - 34.9	Sand\Sandstone	12.12	1.38	1.17	1.94	1.52	Good fit for Bower-Rice and Springer-Gelhar methods.
U-16	Deep	34.5 - 40.5	Sand\Sandstone	16.41	3.80	0.12	0.15	0.13	Very slow / low gradient recovery. Good fits. Visual fit used for Bower-Rice method (rather than automatic).
V-25	Deep / Stygo	33.5 - 39.5	Sandstone	15.24	no result				FAILED
AVERAGE VALUE FOR DEEP INTERVAL - k = 1.8 m/day, range of values from 0.1 to 3.9 m/day									



The average values for the deep monitoring bores (Broome Sandstone) is comparable to the lowest hydraulic conductivity values given for the Broome Sandstone in the Broome Groundwater Management Plan (Water Authority, 1994), which reports hydraulic conductivity values ranging from 2 to >50 /day. Average hydraulic conductivity values reported by Vogwill (2003) from hydraulic tests are 1 m/day for the Mowanjum Sand and 2-4 m/day for the Broome Sandstone; however, he reports values, derived using other analysis methods, of up to 4 m/day (Mowanjum Sand) and 112 m/day (Broome Sandstone). Generally fine grained and cemented lithologies, mainly lacking in secondary porosity in the monitoring bores would suggest generally low hydraulic-conductivity values. There are no test-pumping data from the immediate locality for the Broome aquifer that are available to allow comparisons.

## **5 HYDROCHEMISTRY**

### **5.1 GROUNDWATER SAMPLING**

Groundwater samples were collected by Rockwater from all monitoring bores following bore development as well as from two extraction bores (AD-10 and AP-10) on the Browse LNG Precinct that were installed to provide water supplies for the drilling. Water samples were previously collected from BH6X, X and X1. The samples were collected in accordance with the Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC 2000). Rockwater conducted on-site analyses for pH, salinity, alkalinity and ferrous iron for the precinct bores. The samples were delivered to the NATA-accredited, ALS Laboratory Group in Perth for analysis.

Samples that were collected for laboratory analyses of several of the analytes required on-site filtration, which was carried out using syringe field filters (0.45 µm), to extend the sample holding times. Due to difficulties in obtaining timely transportation to Perth, holding times for major cations ( $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^{+}$  and  $\text{Na}^{+}$ ), reactive phosphorous and ferrous iron were exceeded for some samples. Samples that were received by the laboratory outside of the laboratory holdings times may have degraded and, consequently, the results for these analytes may not reflect the real water quality parameters of a bore. Laboratory holding times for pH are very short (6 hours) and, consequentially, sample holding times for all pH samples were exceeded. Field pH measurements were taken at the time of sampling using a calibrated water quality meter to provide more representative values for pH.

### **5.2 ANALYTICAL RESULTS**

Field results and laboratory results for selected analytes are presented in Table 6 and, for comparison, the Australian guideline limits for drinking water are included. Full tabulated laboratory results are provided in Appendix VI and laboratory certificates for the analyses are contained in Appendix VII.



Table 6: Water Chemistry Results

Bore	Sample Date	Sample Depth	pH Value	Field pH	Electrical Conductivity @ 25°C	Field Electrical Conductivity	Total Dissolved Solids @ 180°C	Total Hardness as CaCO <sub>3</sub>	Total Alkalinity as CaCO <sub>3</sub>	Field Alkalinity	Sulfate as SO <sub>4</sub> - Turbidimetric	Chloride	Calcium	Magnesium	Sodium	Potassium	Aluminium	Arsenic	Manganese	Iron	Ferrous Iron	Field Ferrous Iron
Units		m bgl	pH Unit	pH Unit	µS/cm	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Guideline Value <sup>1</sup>			6.5 - 8.5	6.5 - 8.6			500	200			500 250	250			180		0.2	0.007	0.5 0.1	0.3		
AD-10 <sup>2</sup>	03/11/2011		5.57 <sup>4</sup>	-	275	-	192	24	<1	-	1	70	3	4	42	<1	<0.01	<0.001	0.008	<0.05	<0.05	-
AD-16	08/12/2011	38.5 - 44.5	7.59 <sup>4</sup>	6.55	439	444	420	45	71	1,050	4	79	13 <sup>4</sup>	3 <sup>4</sup>	65 <sup>4</sup>	1 <sup>4</sup>	0.11	0.003	0.023	<0.05	<0.05 <sup>4</sup>	1.92
AD-20	11/12/2011	19.6 - 25.6	7.49 <sup>4</sup>	6.94	464	467	321	54	81	780	14	81	15	4	65	2	0.36	0.006	0.015	0.08	<0.05	3.33
AD-28	13/12/2011	36.9 - 42.9	7.47 <sup>4</sup>	6.10	327	341	197	42	61	990	4	54	12	3	49	1	0.09	0.004	0.015	<0.05	<0.05	1.04
AE-10	04/11/2011	21.2 - 27.2	9.21 <sup>4</sup>	9.00	906	620	722	5	270	94	51	80	2	<1	209	1	0.13	0.012	0.025	0.08	<0.05	-
AP-10 <sup>2</sup>	03/11/2011		6.47 <sup>4</sup>	-	270	-	196	27	24	-	3	55	6	3	42	1	0.02	<0.001	0.212	<0.05	<0.05	-
AP-12	04/12/2011	26.0 - 32.0	6.68 <sup>4</sup>	6.20	278	294	555	16	42	780	5	54	3	2	56	1	0.52	0.001	0.143	0.37	0.25	12.63
AP-14	07/12/2011	44.0 - 50.0	7.52 <sup>4</sup>	6.58	346	329	364	38	61	960	10	51	12	2	54	1	0.35	0.004	0.020	0.12	<0.05	1.50
AP-20	11/12/2011	24.7 - 30.7	7.68 <sup>4</sup>	7.21	446	451	311	71	85	1,260	8	69	22	4	58	1	0.68	0.005	0.012	0.18	<0.05	1.30
AP-24	12/12/2011	23.6 - 29.6	7.22 <sup>4</sup>	6.77	393	400	372	22	74	1,140	3	58	4 <sup>4</sup>	3 <sup>4</sup>	76 <sup>4</sup>	<1 <sup>4</sup>	0.36	0.007	0.025	0.12	0.12	1.40
AP-28	12/12/2011	40.7 - 46.7	7.21 <sup>4</sup>	7.20	596	610	467	55	73	1,260	5	118	12 <sup>4</sup>	6 <sup>4</sup>	94 <sup>4</sup>	2 <sup>4</sup>	0.07	0.006	0.024	<0.05	<0.05	2.82
AP-32	12/12/2011	20.5 - 26.5	6.97 <sup>4</sup>	6.25	1,080	1047	714	61	70	900	33	277	8 <sup>4</sup>	10 <sup>4</sup>	208 <sup>4</sup>	2 <sup>4</sup>	0.78	<0.001	0.062	0.18	<0.05	1.27
AP-36	13/12/2011	20.0 - 26.0	7.87 <sup>4</sup>	6.96	1,020	1055	687	50	150	1,830	33	216	12	5	207	2	1.35	0.011	0.013	0.38	0.05	3.66
F-14	04/12/2011	8.0 - 14.0	6.81 <sup>4</sup>	6.05	784	804	603	40	77	750	6	218	8	5	148	<1	0.62	<0.001	0.016	0.18	<0.05	-
I-16	07/12/2011	29.0 - 35.0	7.60 <sup>4</sup>	6.96	391	378	352	42	66	960	2	64	12	3	59	1	0.46	0.005	0.035	0.10	<0.05	0.81
N-4	08/12/2011	13.0 - 19.0	7.75 <sup>4</sup>	6.91	495	498	513	32	84	990	12	77	8 <sup>4</sup>	3 <sup>4</sup>	92 <sup>4</sup>	1 <sup>4</sup>	0.05	0.011	0.016	<0.05	<0.05 <sup>4</sup>	2.05
O-10	08/12/2011	14.2 - 20.2	7.36 <sup>4</sup>	6.60	465	471	495	34	45	930	20	82	7 <sup>4</sup>	4 <sup>4</sup>	83 <sup>4</sup>	1 <sup>4</sup>	0.68	0.006	0.014	0.24	<0.05 <sup>4</sup>	2.31
P-17	04/11/2011	14.0 - 20.0	9.76 <sup>4</sup>	7.53	915	600	526	23	261	-	33	91	6	2	201	3	45.8	0.043	0.421	15.4	0.28	-
P-17 <sup>3</sup>	10/12/2011	14.0 - 20.0	7.76 <sup>4</sup>	7.44	623	657	937	23	179	1,800	<1	68	6	2	135	2	2.92	0.023	0.104	1.19	<0.05	3.08
P-21	01/11/2011	13.0 - 19.0	7.65 <sup>4</sup>	6.80	613	673	439	16	121	135	73	101	3	3	140	1	0.16	0.002	0.012	0.06	<0.05	-
P-25	10/12/2011	29.0 - 35.0	7.51 <sup>4</sup>	7.25	541	570	482	74	94	1,350	8	105	23	4	93	2	0.56	0.007	0.038	0.17	0.12	7.31
P-29	01/11/2011	13.5 - 19.5	7.24 <sup>4</sup>	6.43	912	963	599	50	82	-	36	219	7	8	192	2	0.02	<0.001	0.012	<0.05	<0.05	-
U-10	04/11/2011	24.5 - 30.5	7.57 <sup>4</sup>	7.21	630	650	458	29	144	-	17	88	5	4	132	1	0.56	0.003	0.106	0.34	0.33	-
U-16	01/12/2011	34.5 - 40.5	7.14 <sup>4</sup>	7.26	317	397	231	9	80	70	9	43	2	1	62	<1	1.25	0.003	0.018	0.47	0.23	6.55
U-20	01/11/2011	15.2 - 21.2	7.58 <sup>4</sup>	6.79	736	749	552	22	119	126	32	137	4	3	170	2	1	0.002	0.042	0.36	<0.05	-
U-31	10/12/2011	12.0 - 18.0	7.24 <sup>4</sup>	6.58	787	802	719	36	129	1,530	18	164	6	5	153	<1	0.52	<0.001	0.049	0.41	0.13	6.25
V-25	09/12/2011	33.5 - 39.5	7.54 <sup>4</sup>	7.14	491	326	451	66	78	810	7	98	20	4	81	2	0.85	0.003	0.018	0.29	0.08	1.51
BH6X	28/07/2011	-	5.95 <sup>4</sup>	-	348	-	244	33	5	-	1	94	5	5	46	<1	<0.01	<0.001	0.011	<0.05	-	-
Bore X	09/06/2011	24.50	5.92 <sup>4</sup>	5.45	361	943	251	30	6	-	4	86	4	5	41	<1	<0.01	<0.001	0.004	<0.05	-	-
Bore X1	09/06/2011	25.50	6.80 <sup>4</sup>	5.80	1,230	4,735	991	190	46	-	30	454	20	34	215	2	<0.01	<0.001	0.004	<0.05	-	-

<sup>1</sup> Maximum guideline value for drinking water (NHMRC & NRMMC 2004). Bold text indicates a health guideline limit, normal text indicates aesthetic guideline limit.

<sup>2</sup> Extraction bore.

<sup>3</sup> Bore P-17 sampled twice.

<sup>4</sup> Outside of laboratory holding time.

The analysis results show that the shallow groundwater beneath the precinct has fresh to marginal salinity ranging from 192 mg/L TDS at AD-10 to 937 mg/L TDS at P-17. Extraction bores AD-10 and AP-10 indicate salinities of about 190 mg/L TDS. Salinity data maps are provided for the shallow watertable bores (Fig. 29) and the deep bores (Fig. 30).

The groundwater has a near-neutral pH: the high pH values for P-17 (first sample) and AE-10 are likely a result of drilling mud contamination. P-17 was sampled on a second occasion due to the high pH and unusually high concentrations of aluminium, arsenic, iron and phosphorus. The results for the second sample show concentrations of these analytes are similar to those from the other sites and indicate the first sample results should be disregarded. The results for AE-10 were obtained too late in the programme to allow resampling to occur.

Aluminium concentrations range from below the limit of detection to 2.9 mg/L and are generally above the Australian Drinking Water Guideline aesthetic guideline limit of 0.2 mg/L (NHMRC & NRMCC 2004). Arsenic concentrations are above the health limit for drinking water (0.007 mg/L) in bores AE-10, AP-36 and P-17 (NHMRC & NRMCC 2004).

Manganese concentrations exceed the aesthetic guideline limit of 0.1 mg/L in bores AP-12, AP-36, P-17 and U-10, but are below the health guideline limit of 0.5 mg/L. Iron concentrations range from below the limit of detection to about 1 mg/L, slightly higher than the aesthetic guideline limit of 0.3 mg/L. All remaining metal concentrations are below drinking water guideline limits.

Monitoring bores P-17 (first sample) and AE-10 returned results that are not comparable to the other bores (high values for pH and some metals). Subsequent re-purging and sampling of bore P-17 returned water quality results similar to the other bores. This suggests that the bores were likely under-developed and still contained drilling mud at the times that samples were collected from P-17 (first sample) and from AE-10.

### 5.3 ISOTOPE SAMPLING

Isotopic sampling was carried out on eight of the monitoring bores. Groundwater samples were sent Natural Isotopes (Edith Cowan University Laboratory) for analysis of  $^2\text{H}$  and  $^{18}\text{O}$ . The results are summarised in Table 7 and included in Appendix VI.

**Table 7: Isotope Sampling Results**

Sampled Date	Sampled Interval (m bgl)	d2H Reportable Value (permil)	d18O Reportable Value (permil)
02/11/2011	21.2 - 272	-48.4	-7.30
01/11/2011	15.2 - 21.2	-48.0	-7.19
04/12/2011	26.0 - 32.0	-48.5	-7.24
07/12/2011	44.0 - 50.0	-48.3	-7.20
04/12/2011	8.0 - 14.0	-49.2	-7.33
10/12/2011	14.0 - 20.0	-49.0	-7.31
01/12/2011	34.5 - 40.5	-49.5	-7.36

## 6 PASS SAMPLING

Potential acid sulphate soil (PASS) sampling and analyses was carried out on several boreholes located in areas of the precinct where Rockwater had been advised that the deepest site excavations are likely to take place. Portions of core underwent field testing for pH and pH<sub>fox</sub> (field peroxide test); however, due to contamination of the core sample by the unknown quantities of alkaline (9.0 to 10 pH) drilling mud, the results of the tests are considered to provide false assessments of PASS.

The depth of expected excavation over most of the precinct is unlikely to extend to or beyond the depth of the water table, which during the bore construction programme was determined to be between about 9 and 27 metres below ground.

In addition to field testing, core samples were taken from five sites located around positions of possible deeper excavations at the precinct. These samples, which potentially contained drilling mud, were frozen and delivered, to ALS Laboratory Group in Perth and were analysed for SPOCAS suite and the chromium suite. Laboratory certificates and guideline values are included in Appendix VIII, and the results are summarised in Table 8. All the core samples analysed contained less than 2 mol H<sup>+</sup>/tonne of acidity, below the Western Australian Acid Sulphate Guidelines action criteria limit for a total potential acidity level of 18 mol H<sup>+</sup>/tonne. Oxidisable sulphur levels are less than 0.005 %, which is below the guideline limit of 0.03% (Department of Environment and Conservation 2009).

**Table 8: Summary of Laboratory Results of PASS**

Borehole	Sampled Date	Sampled Interval (m bgl)	pH <sub>KCL</sub>	pH <sub>OX</sub>	TSA (mole H <sup>+</sup> / tonne)	S <sub>POS</sub> (%S)
AD-16	06/11/2011	20.2 - 20.35	7.0	6.7	<2	<0.005
AD-20	12/11/2011	16.25 - 16.40	6.3	6.1	<2	<0.005
AE-10	31/08/2011	23.75 - 24.25	5.9	6.1	<2	<0.005
U-16	07/11/2011	19.5 - 19.6	6.4	6.1	<2	<0.005

S<sub>pos</sub> = Peroxide oxidisable sulphur

TSA= Titratable sulfidic acidity

## 7 WATER LEVEL MONITORING PROGRAMME

Monitoring of groundwater levels across the precinct site is currently underway. At the completion of bore construction a Solinst levellogger was installed into each monitoring bore. The loggers are programmed to sample water levels, presently at 15 minute intervals, to establish baseline groundwater level data for the site. A summary of logger installation data is included in Appendix IX. No data have been collected from these loggers due to the short time that they had been installed before Rockwater left site. Manual water level data

collected from these bores during the bore installation programme are presented in Appendix X.

Similar data loggers were installed, in mid-2011, in bores BH6X, which is located at the southwestern corner of the precinct (Fig. 2), and bores X and X1, which are located adjacent to Manari Road approximately 4 km north and 18 km south of the precinct area, respectively. Location and construction data for these bores are included in Appendix IV. Barometric data loggers are installed in bore AD-16 and bore BH6X to collect data to enable the logger water level data to be compensated for changes in atmospheric pressure. The water level data are presented as time-series plots in Figure 31. The final month of data (14-November to 14-December 2011) is presented with tidal data for Broome in Figure 32. The electronic record of water level data is held by Woodside (WEL DRIMS#7860857).

## 8 CONCLUSIONS

This report presents bore completion data for 24 groundwater monitoring bores installed across the Browse LNG precinct during a geotechnical site investigation in August to December 2011. It includes all data that were collected during the drilling, construction and testing of the bores. Additional geotechnical data are presented separately by Furgo Survey (2011). The bore completion data include:

- bore construction details;
- lithological logs;
- water levels;
- hydraulic conductivity determinations; and
- hydrochemistry.

PASS sampling was also undertaken; however, the core samples were affected by alkaline drilling mud and the results of the field pH and  $\text{pH}_{\text{fox}}$  tests are considered to provide false assessments of PASS. Laboratory analysis results (SPOCAS and chromium suite) indicate a very low potential for producing acid sulphate soils.

The bores were constructed to gain baseline groundwater level and hydrochemistry data, and have been fitted with data loggers for on-going water level monitoring. Each bore is constructed with class 18 uPVC to depths of between 14 and 50 metres below ground. Eight ‘deep’ monitoring bores are slotted below the water table and 16 ‘shallow’ monitoring bores are slotted at or just below the watertable. Three of the bores, where habitat potentially suitable for stygofauna was recognised, were constructed with 3 mm aperture slotted intervals to make them more suited for stygofauna sampling.

The surficial sediments consist of red-brown silty sand (Mowanjum Sand). The Mowanjum Sand rests unconformably on the Broome Sandstone; however, the position of the contact has not been able to be defined because it is masked due to the presence of a zone of weathered sand/sandstone at the top of the Broome Sandstone and similar lithologies, colours and textures in samples from the two formations. This zone overlies medium grained, moderately cemented sandstone of the Broome Sandstone. The Mowanjum Sand and Broome Sandstone are in hydraulic connection and comprise the Broome aquifer. The watertable occurs at depths of between approximately 8.5 (F-14) and 25.7 m (AP-14) below ground and groundwater elevations reduce across the site from 3.43 m AHD (AP-28 in the east) to 2.17 m AHD (F-14 in west).

Values of hydraulic conductivity were derived from analyses of falling-head tests that were conducted on the bores. The results indicate a range of hydraulic conductivity values from about 0.1 m/day to about 4 m/day, and average values 0.9 m/day for the watertable bores and 1.8 m/day for the deep bores. The general lithologies and lack of secondary porosity in the strata intersected by the drilling also suggest comparatively low hydraulic conductivity values.

Groundwater samples collected from the bores indicate fresh to marginal salinity across the site with an average of about 500 mg/L TDS. Analysis results for two of the samples (P-17 first sample and AE-10) appear anomalous and it is suggested that bore development was incomplete at the times that the samples were collected. It is recommended that an additional set of samples be collected and analysed from all bores before any major construction work commences at the site.

**Dated: 16 February 2012**

**Rockwater Pty Ltd**



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**Project Hydrogeologist**



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**Principal Hydrogeologist**

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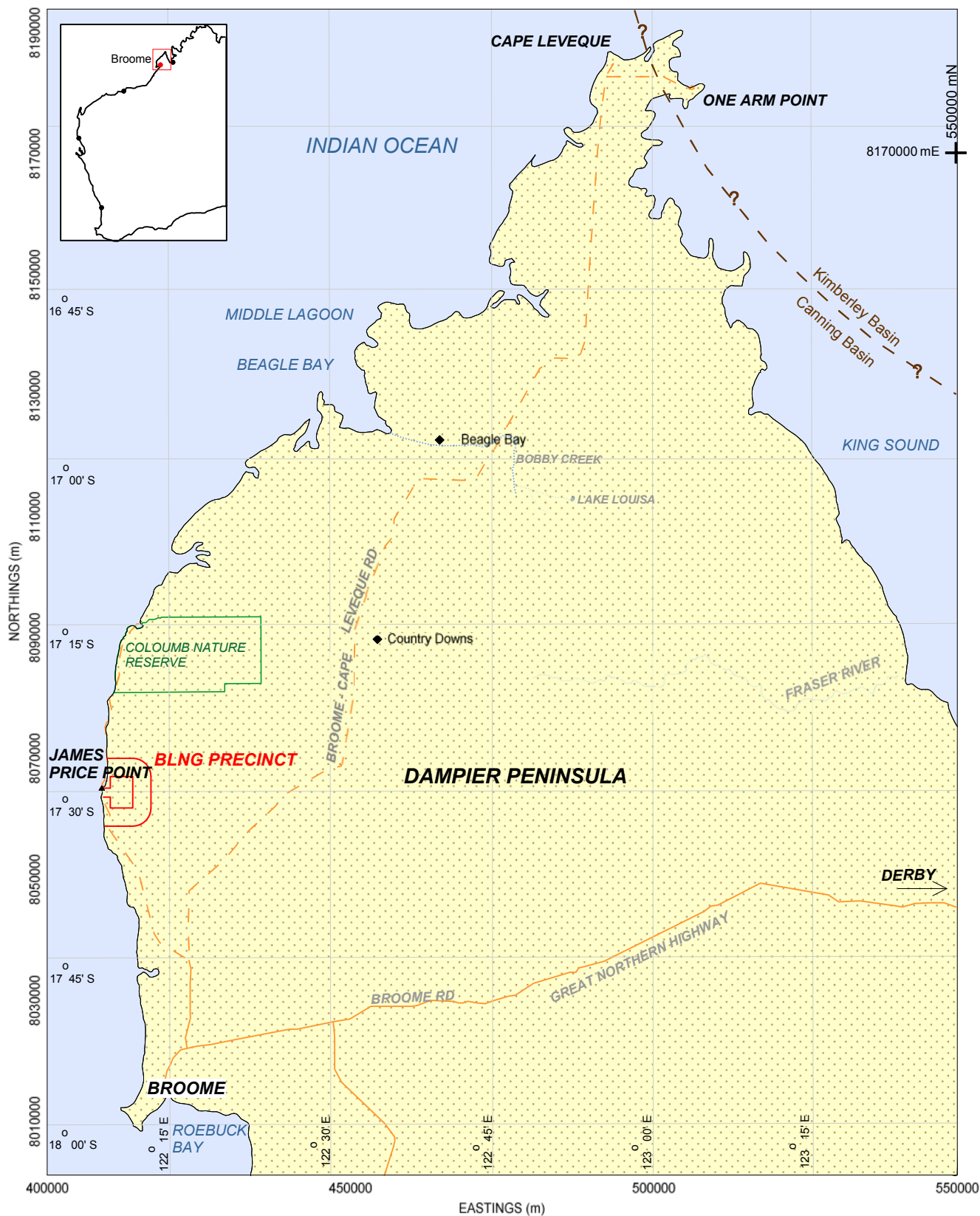
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## FIGURES





FIGURE 1



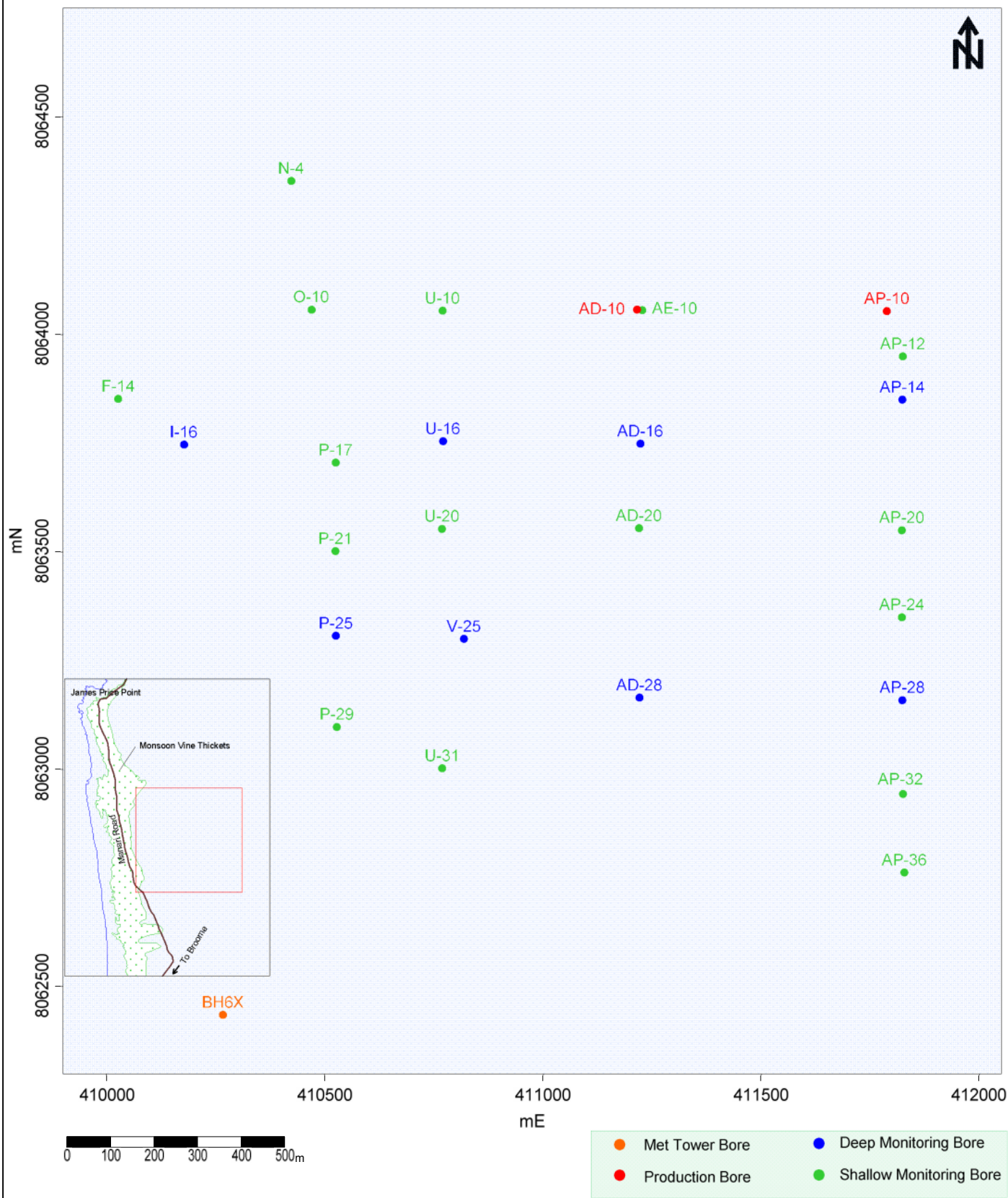
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CLIENT: Woodside Energy Ltd  
PROJECT: James Price Point  
Monitoring Bore Completion Report  
DATE: February 2012  
Dwg. No: 368.0.2A/12/1-1

WOODSIDE BLNG PROJECT  
JAMES PRICE POINT PRECINCT  
GENERAL LOCALITY MAP



FIGURE 2



I:368-0-2A/Surfer/12-01/F2 Bore Locality.srf

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

DATE: February 2012

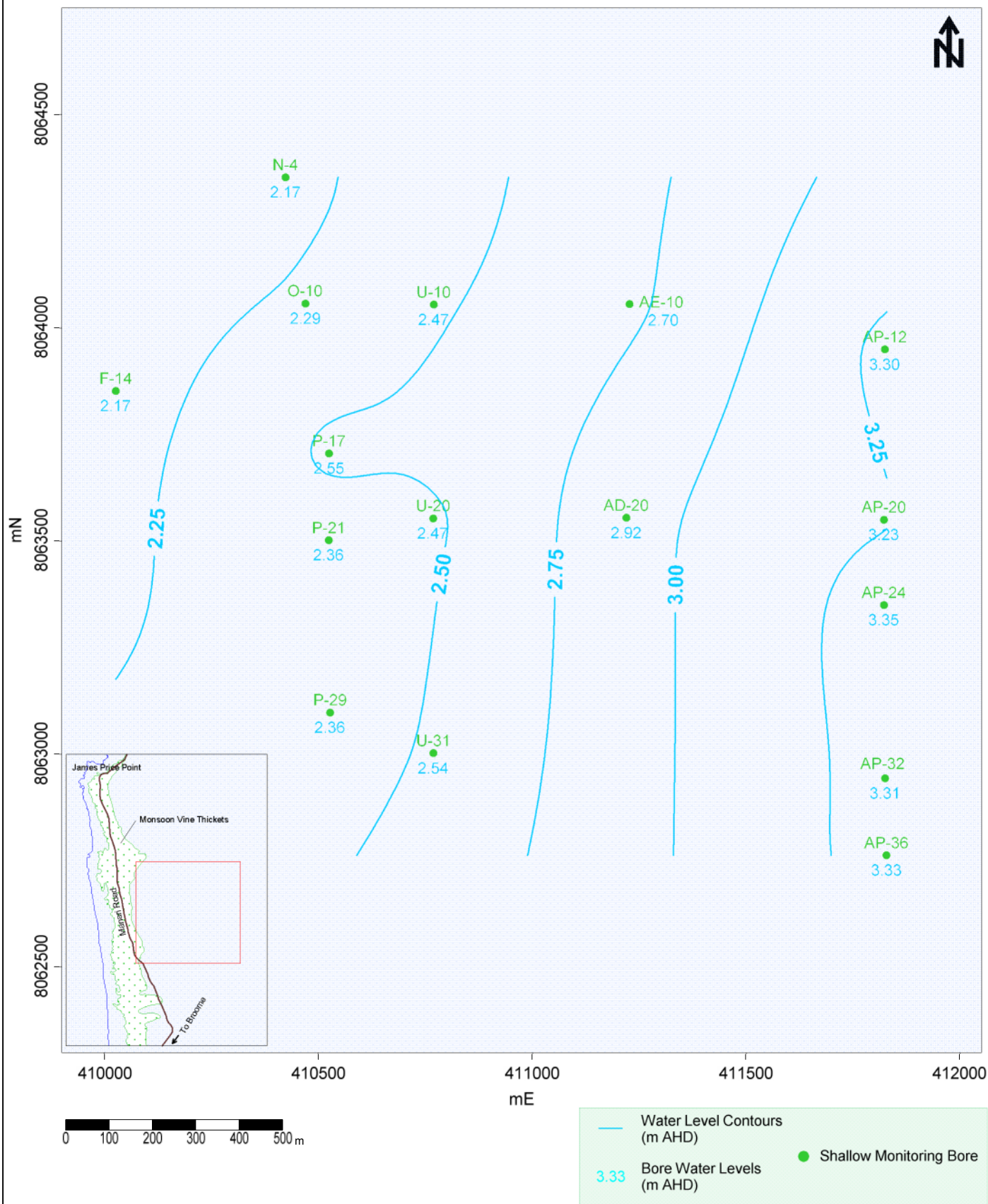
Dwg. No: 368.0.2A/12/1-2

JAMES PRICE POINT PRECINCT  
BORE LOCALITY MAP





FIGURE 3



I:368-0-2A/Surfer/12-01/F3 Water Levels Shallow.srf

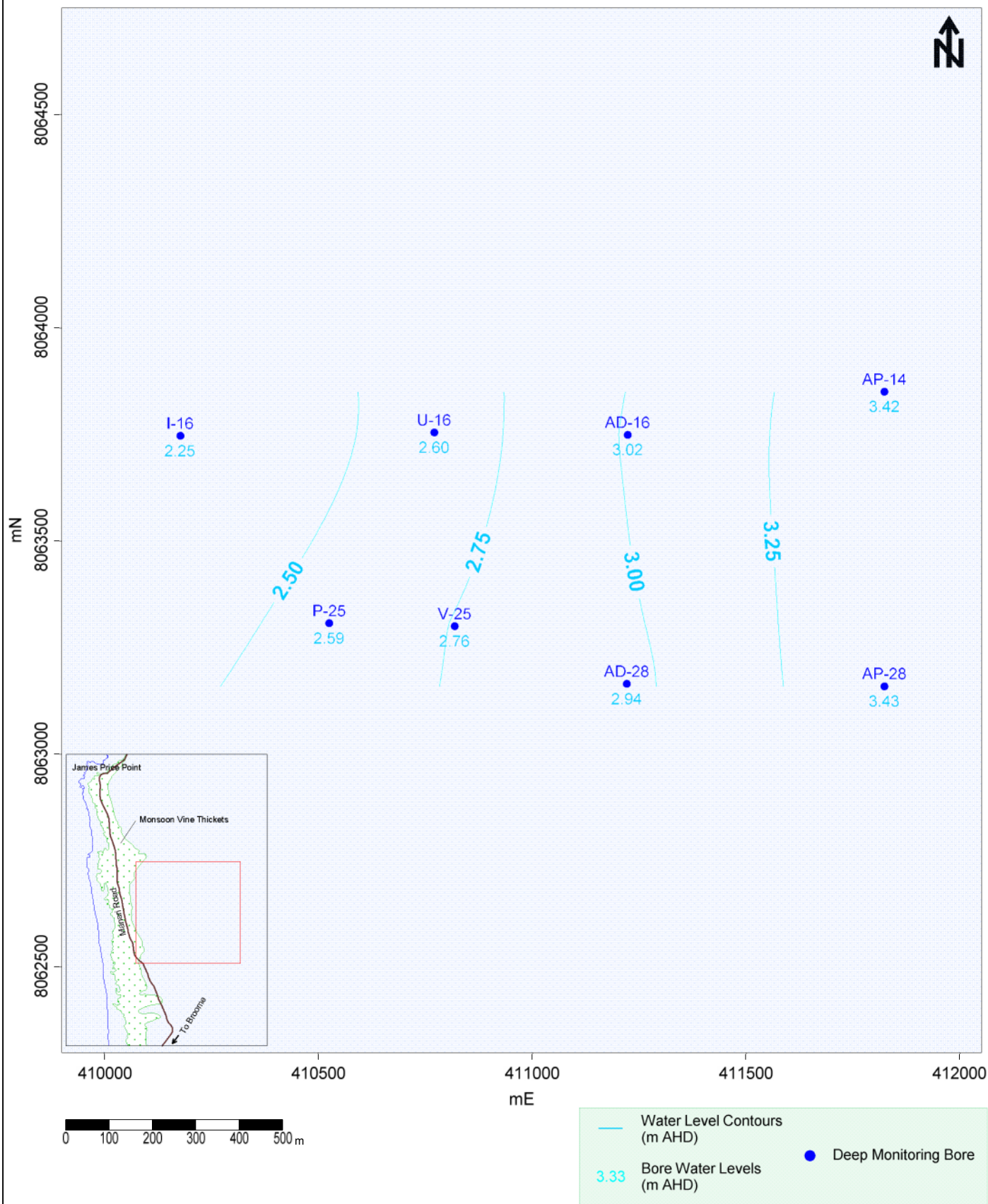
CLIENT: Woodside Energy Ltd  
PROJECT: James Price Point  
Monitoring Bore Completion Report  
DATE: February 2012  
Dwg. No: 368.0.2A/12/1-3

## WATERTABLE CONTOUR MAP DECEMBER 2011





FIGURE 4



I:368-0-2A/Surfer/12-01/F4 Water Levels Deep.srf

CLIENT: Woodside Energy Ltd  
PROJECT: James Price Point  
Monitoring Bore Completion Report  
DATE: February 2012  
Dwg. No: 368.0.2A/12/1-4

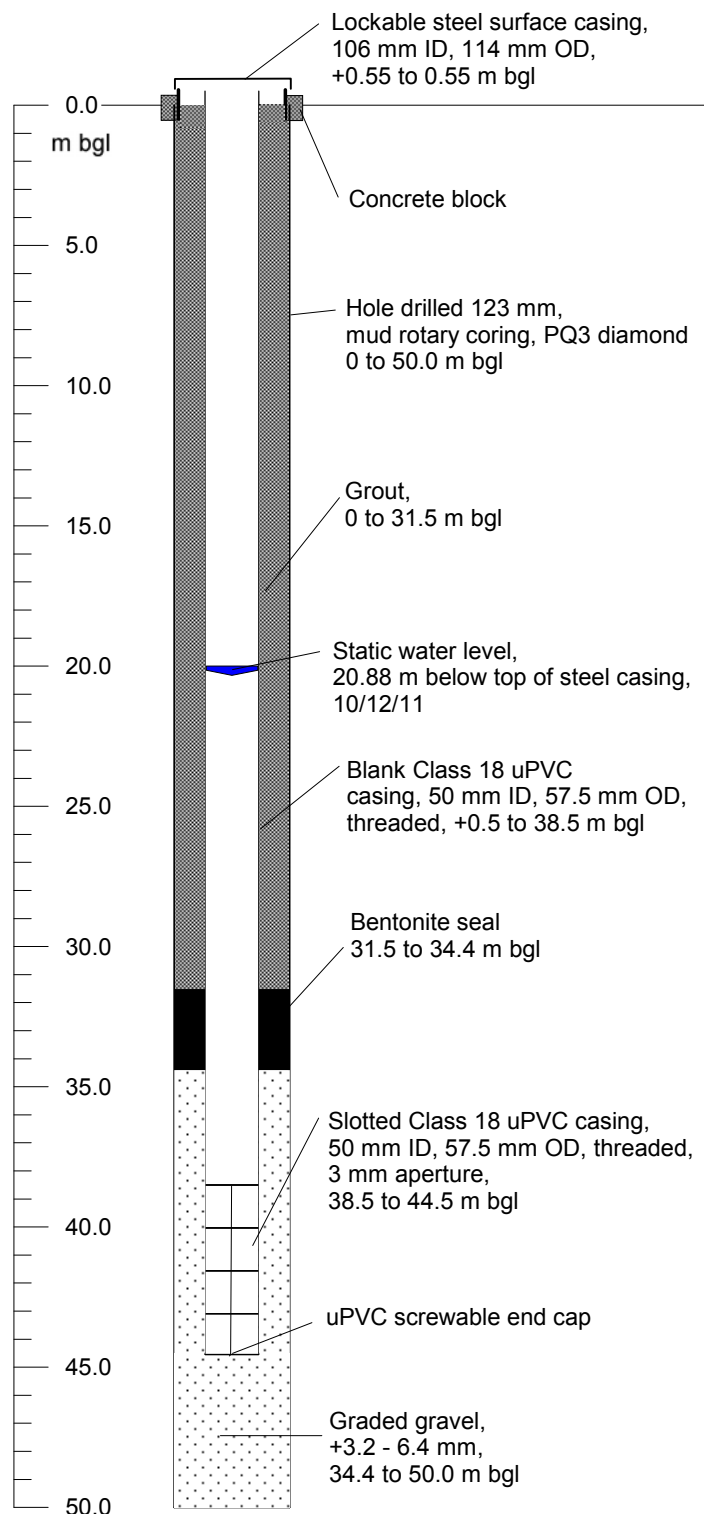
## DEEP WATER LEVEL CONTOUR MAP DECEMBER 2011



FIGURE 5

LITHOLOGY

SILTY SAND	Red, red-brown, very fine to medium grained, sub-rounded to sub-angular, moderately to poorly sorted, silty. Pockets of yellow sand with traces of clay. Traces of red and yellow-black, rounded gravel from 17 to 19.6 m.
SAND	Pale red-brown, dark-yellow brown, fine to medium grained, sub-rounded to sub-angular, poorly sorted, minor rounded gravel. Unconsolidated with minor cemented fragments.
SAND/SANDSTONE	Pale white-grey, light brown, yellow-brown, fine to coarse grained, sub-angular to sub-rounded, poorly sorted. Bedded, weakly to moderately cemented, with minor silicified bands and fracturing. Unconsolidated in parts. Note top of rock logged at 27.16 m.
	As above, increased cementation and gravel from 45 m.



I:\368-0-2A\Strater\Geotech Monitoring Bores.str

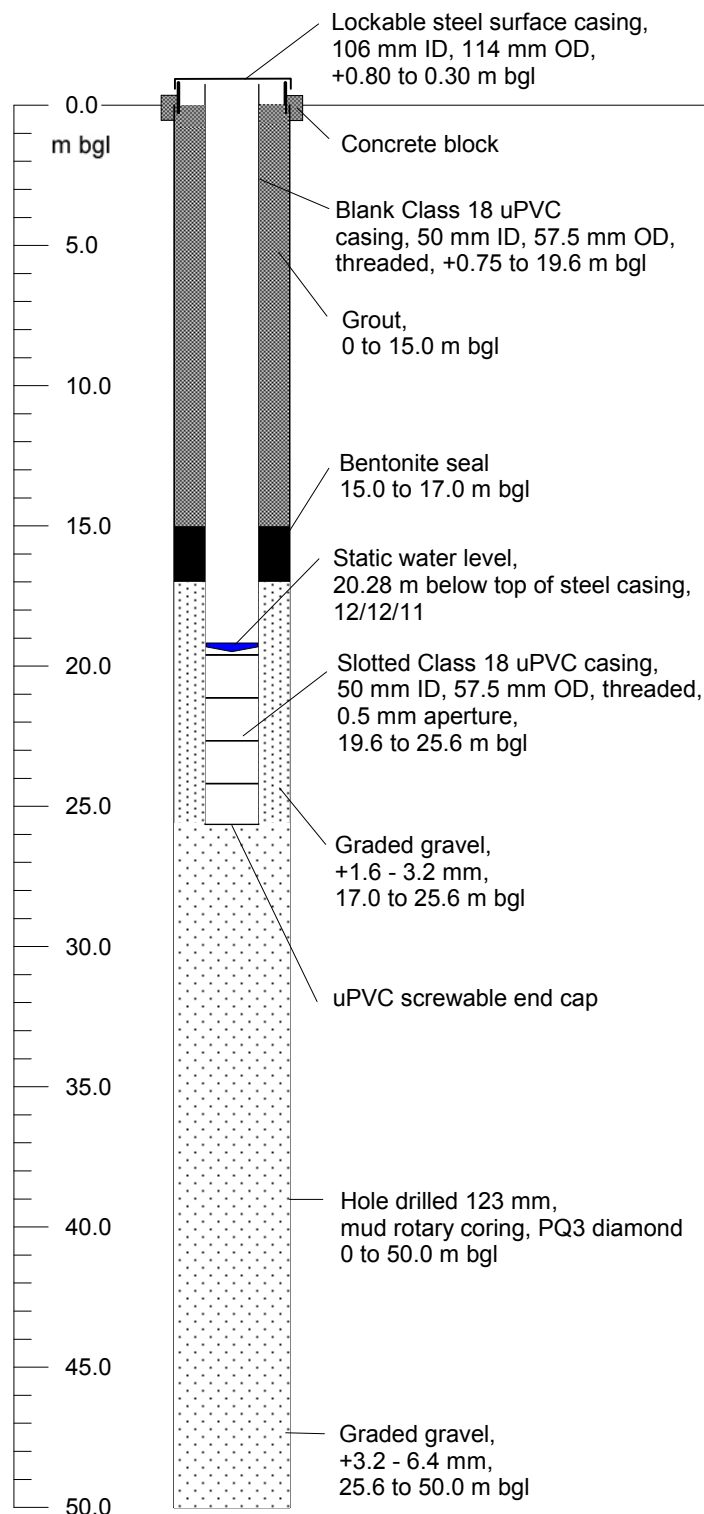
CLIENT: Woodside Energy Ltd  
 PROJECT: JPP - Monitoring Bore Completion Report  
 DATE: February 2012  
 DWG NO.: 368.0.2A/12/1-5

AD-16 COMPOSITE LOG

FIGURE 6

LITHOLOGY

SILTY SAND	Red-brown, very fine to medium grained, sub-rounded to sub-angular, moderately to poorly sorted, silty. Pockets of white and yellow silty sand.
SAND	As above with minor iron oxide concentrations and gravel at 17.5 m.  Red-brown, pale brown, pale yellow-brown, fine to coarse grained, sub-angular to sub-rounded, poorly sorted. Very weakly to weakly cemented (trace sandstone), mostly unconsolidated. Trace gravel. Minor cavities at 20.7 m.
SAND/SANDSTONE	As above, bedded. Silty in parts with some white silicified layers.
SANDSTONE	Pale red, light brown, yellow-brown, fine to medium grained (trace gravel), sub-rounded, moderately to poorly sorted. Layered, with light grey silty sand, moderately to well cemented, some fracturing and minor cavities. Minor dark purple-brown layers at 29.5 and 35 and 42 m. Minor unconsolidated sand throughout.

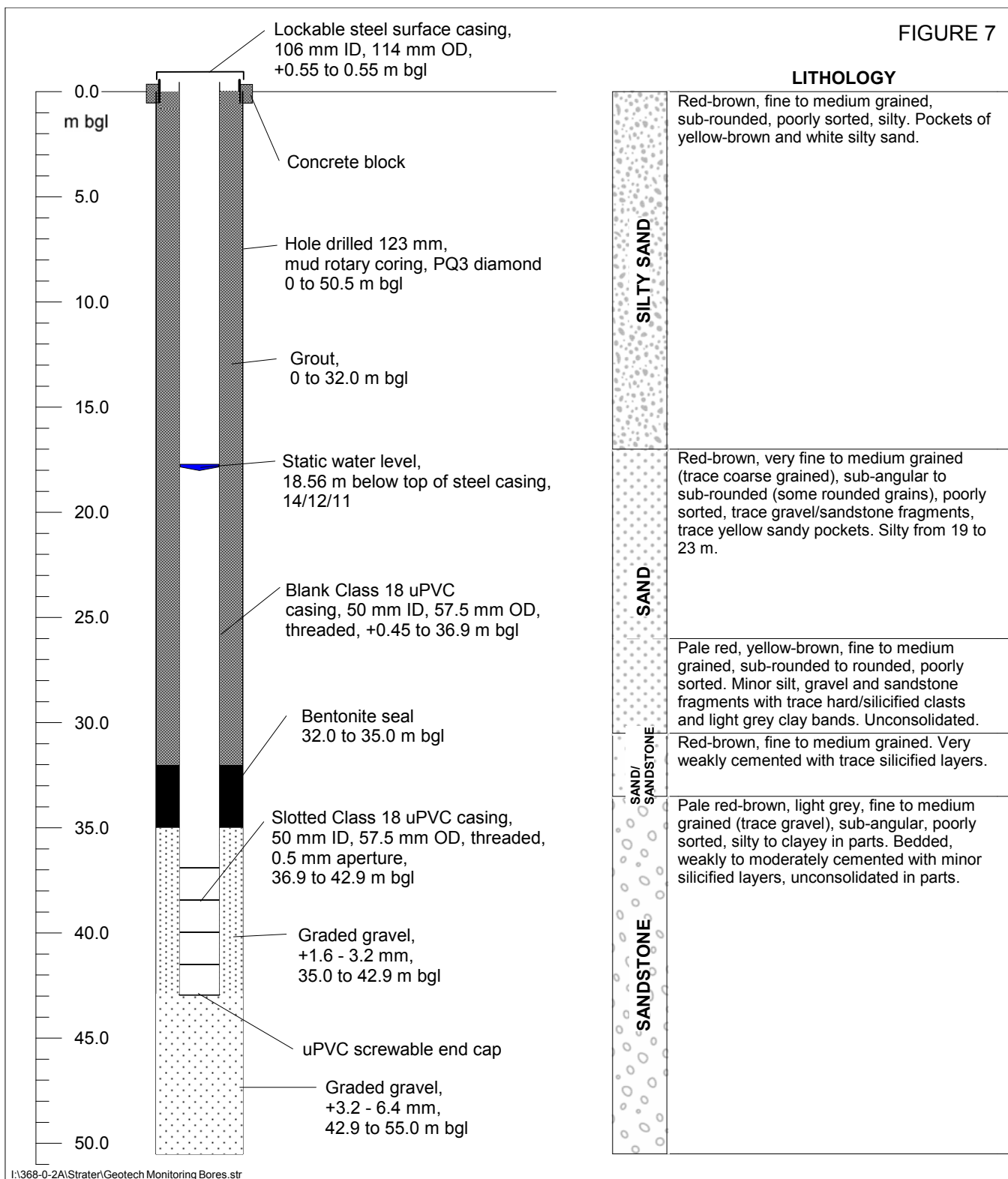


I:\368-0-2A\Strater\Geotech Monitoring Bores.str

CLIENT: Woodside Energy Ltd  
 PROJECT: JPP - Monitoring Bore Completion Report  
 DATE: February 2012  
 DWG NO.: 368.0.2A/12/1-6

AD-20 COMPOSITE LOG

FIGURE 7



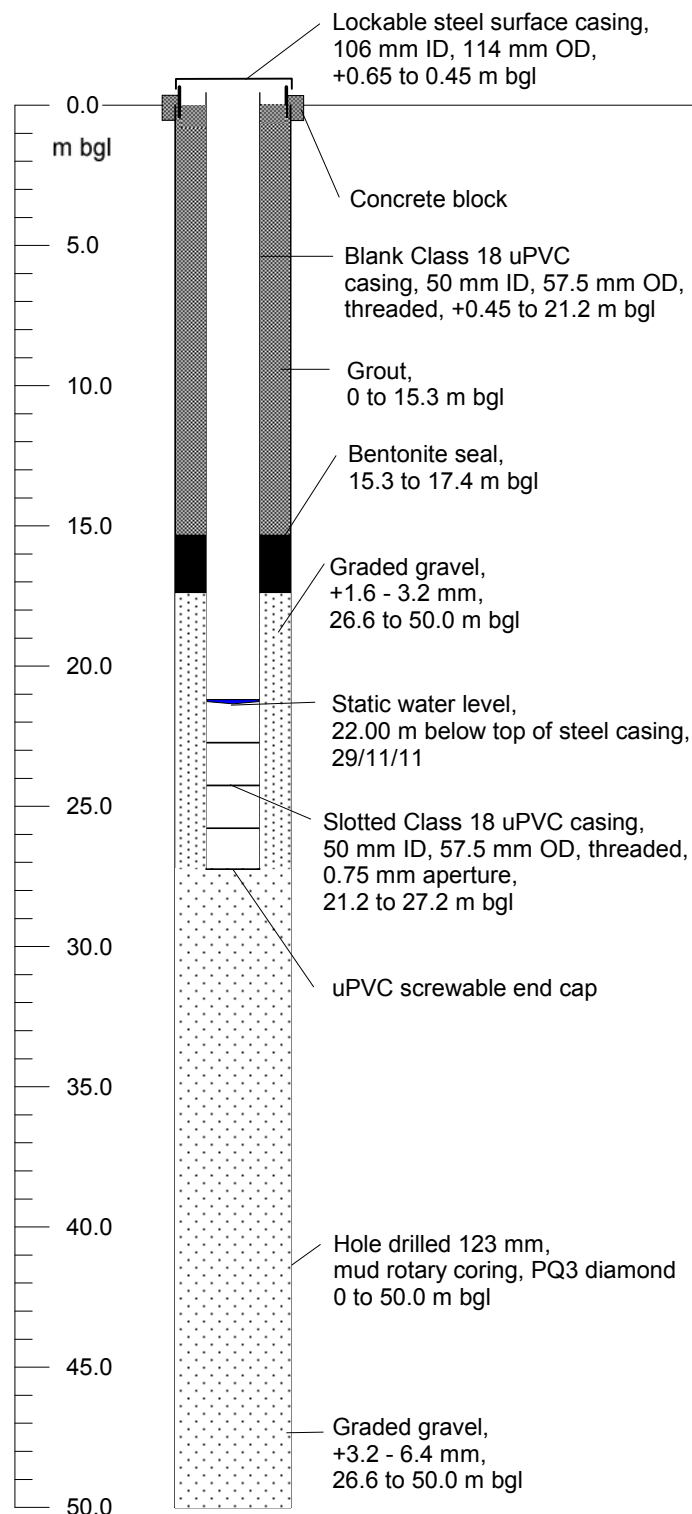
CLIENT: Woodside Energy Ltd  
 PROJECT: JPP - Monitoring Bore Completion Report  
 DATE: February 2012  
 DWG NO.: 368.0.2A/12/1-7

## AD-28 COMPOSITE LOG



FIGURE 8

LITHOLOGY



SILTY SAND	Red brown, dark red brown, fine to coarse grained, sub-rounded to sub-angular, poorly sorted, silty. Pockets of yellow and pale grey-yellow sand and minor mottling.
SAND/SANDSTONE	Orange, cream, pale grey, mottled, fine to medium grained with some silt, minor red sand and gravel. Weakly cemented to unconsolidated.
	Pale grey, yellow, red, fine to coarse grained, sub-angular to sub-rounded, moderately to well sorted, decreasing silt content. Very weakly to weakly cemented with white silty, cemented bands.
	Pale grey brown, white, very fine to coarse grained, sub-round to rounded, moderately to poorly sorted. Minor yellow, yellow-grey pockets. Moderately consolidated/weakly cemented.
SANDSTONE	White, cream, fine to medium grained, sub-rounded, moderately sorted, some bedding. Dark brown silt at 28.5m.
	Pale grey-yellow, cream, medium grained, moderately to well sorted, sub-rounded to rounded, weakly to well cemented, minor white silt in parts, trace black very fine grains. Minor yellow-grey unconsolidated sand.
SANDSTONE/SAND	As above, bedded. Unconsolidated in parts. Yellow staining, and minor dark red brown iron oxide layers.

I:\368-0-2A\Strater\Geotech Monitoring Bores.str

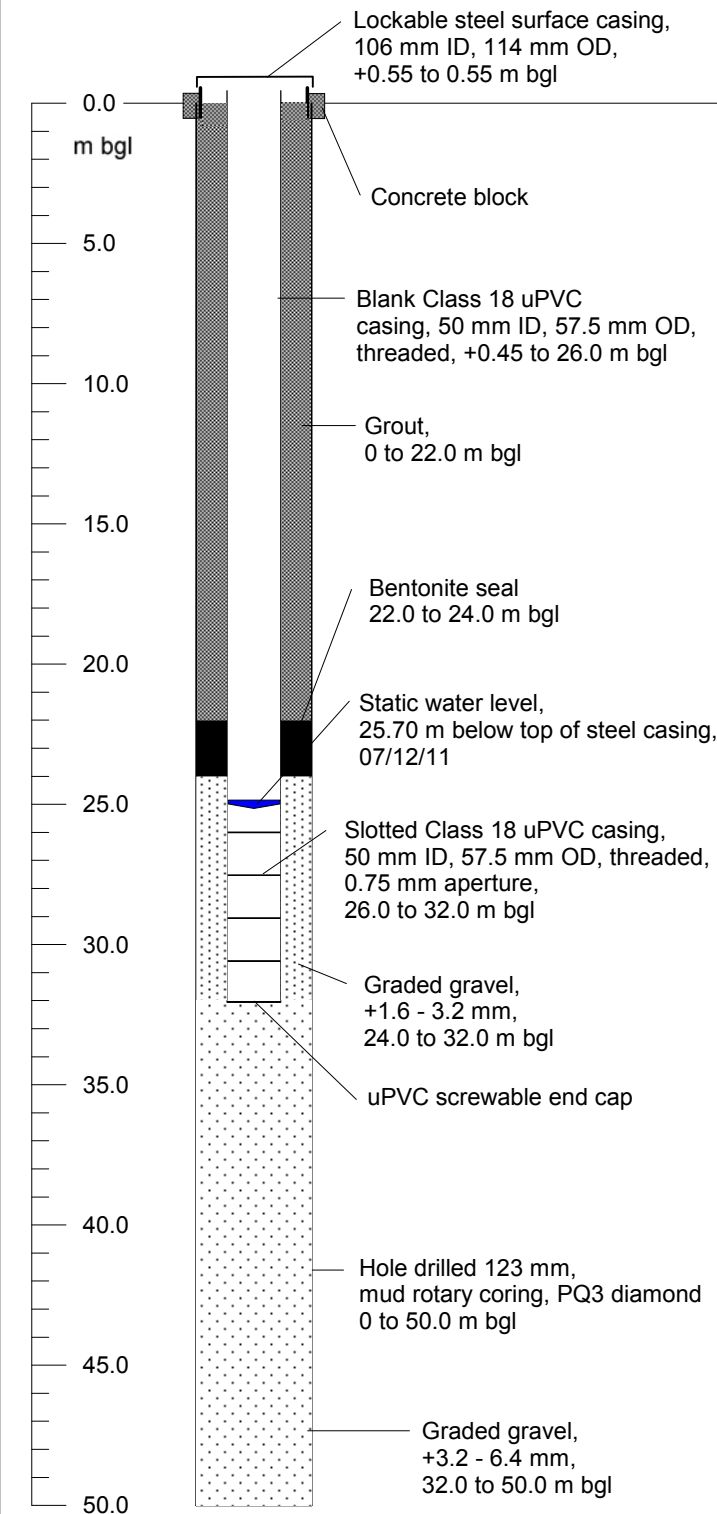
CLIENT: Woodside Energy Ltd  
 PROJECT: JPP - Monitoring Bore Completion Report  
 DATE: February 2012  
 DWG NO.: 368.0.2A/12/1-8

AE-10 COMPOSITE LOG



FIGURE 9

LITHOLOGY



I:\368-0-2A\Strater\Geotech Monitoring Bores.str

SILTY SAND	Red-brown, dark red-brown, fine to medium grained, sub-rounded to sub-angular, poorly sorted, silty. Pockets of yellow sand.
SAND	Red-brown, fine coarse grained, sub-angular to sub-rounded (some rounded grains), poorly sorted, trace silt, trace yellow sandy pockets. Yellow-brown, red-brown, minor grey mottling, fine to coarse grained, sub-rounded to sub-angular, poorly sorted. Trace sandstone nodules, and weakly cemented layers.
SANDSTONE	Pale grey, pale red-brown, minor pale red mottling, fine to coarse grained, sub-angular, poorly sorted. Layered, weakly to moderately cemented with minor pale grey, silicified layers. Pale grey, pale brown, minor red, red-blue staining, fine to coarse grained, moderately to well cemented. Mostly well consolidated. Minor red and white (silty) laminations at 32 and from 40 m. Increased grainsize (to predominantly medium) from 42 m.

CLIENT: Woodside Energy Ltd

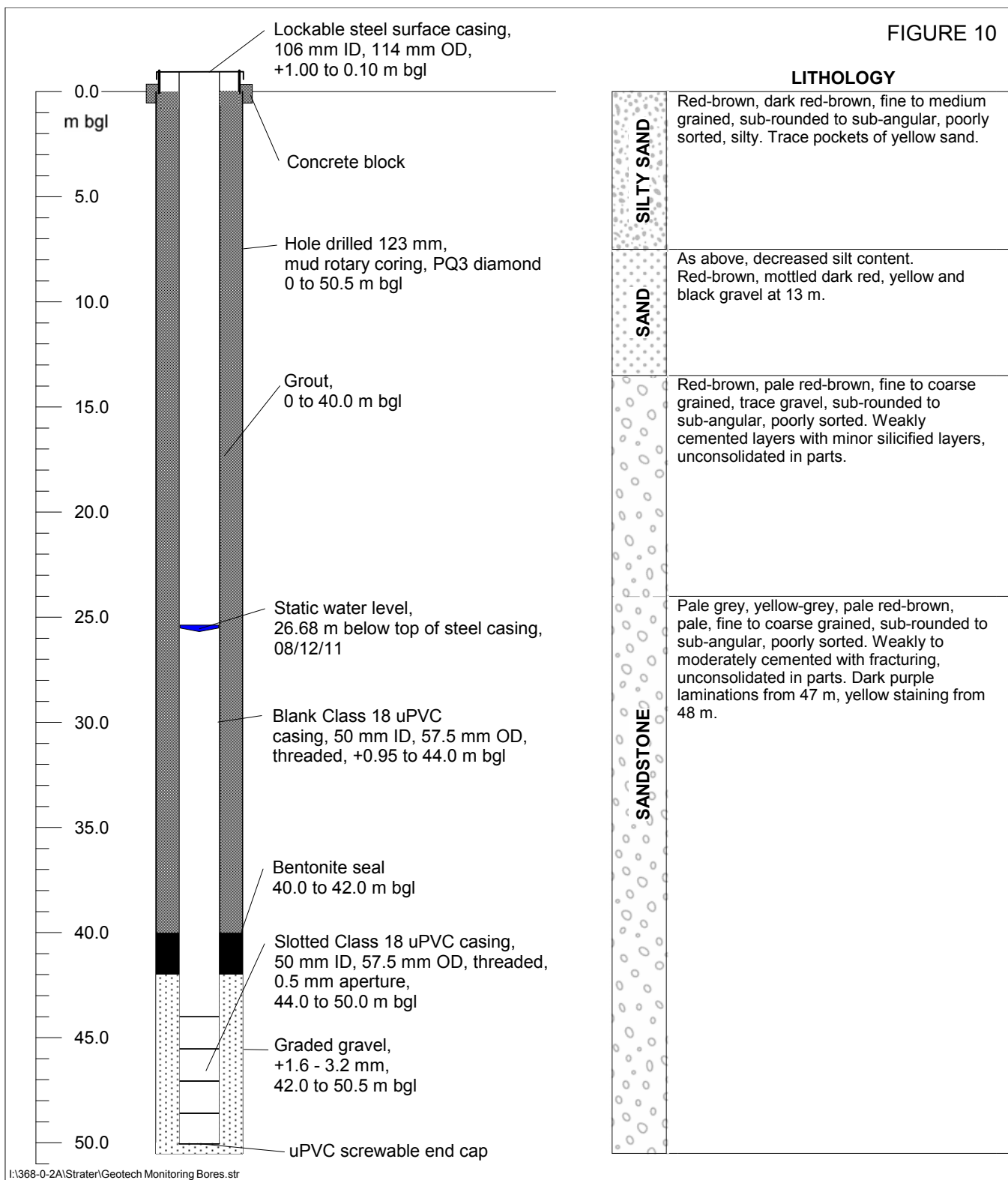
PROJECT: JPP - Monitoring Bore Completion Report

DATE: February 2012

DWG NO.: 368.0.2A/12/1-9

AP-12 COMPOSITE LOG






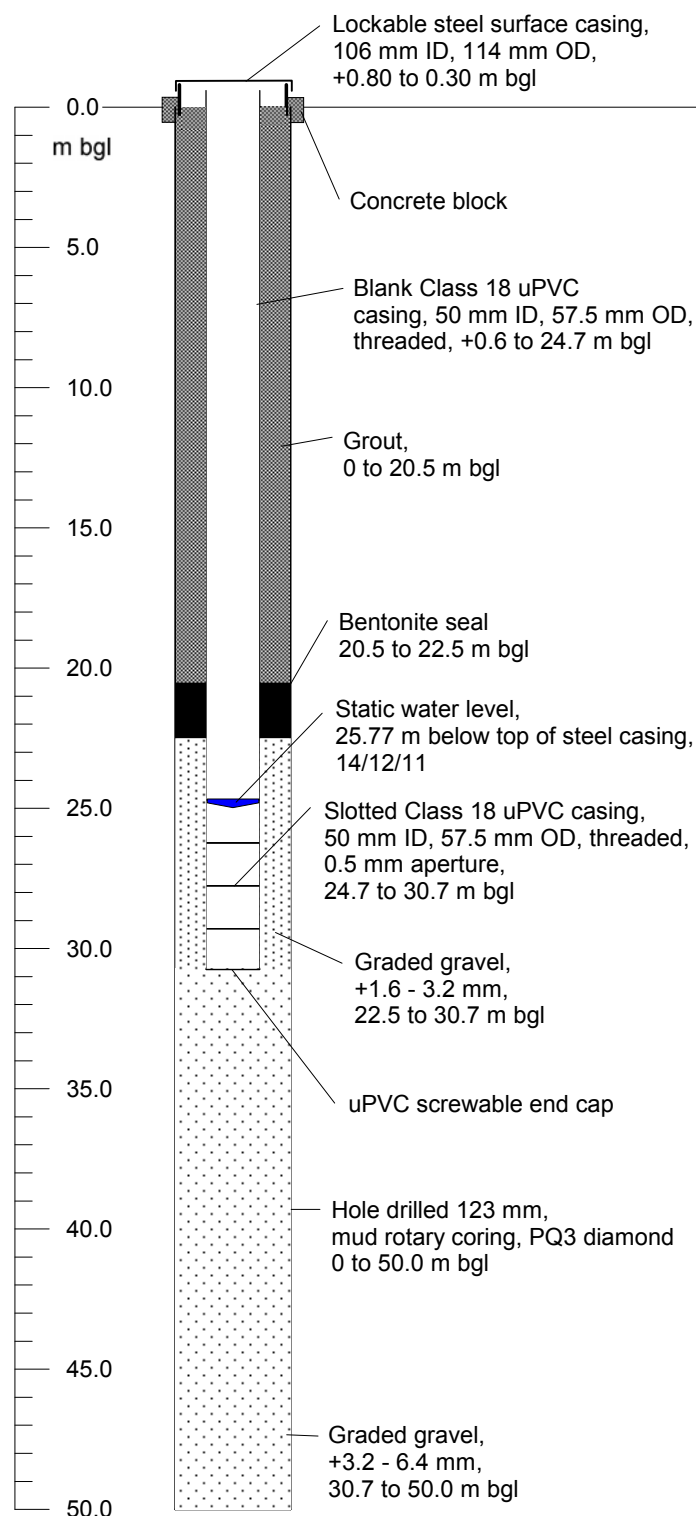
CLIENT:	Woodside Energy Ltd	<p><b>AP-14 COMPOSITE LOG</b></p> 
PROJECT:	JPP - Monitoring Bore Completion Report	
DATE:	February 2012	
DWG NO.:	368.0.2A/12/1-10	

FIGURE 11

**LITHOLOGY**

SILTY SAND	Red-brown, fine to medium grained (some coarse grained), sub-rounded to sub-angular, poorly sorted, silty. Trace pockets of yellow sand.
	As above, decreased silt content.
SAND	Red-brown, pale grey, pale yellow, yellow-brown, fine to coarse grained with some gravel, rounded to sub-angular, poorly sorted. Unconsolidated with some intervals of weakly cemented sandstone.
SAND/SANDSTONE	Pale red-brown, yellow-brown, grey, fine to coarse grained, sub-rounded to sub-angular, poorly sorted. Unconsolidated to weakly cemented, with minor well cemented intervals.
SANDSTONE	Pale red-brown, brown, pale grey-white, fine to coarse grained, sub-rounded to sub-angular, poorly sorted, weakly to moderately well cemented, minor silicified intervals and some unconsolidated sand. Minor fracturing.



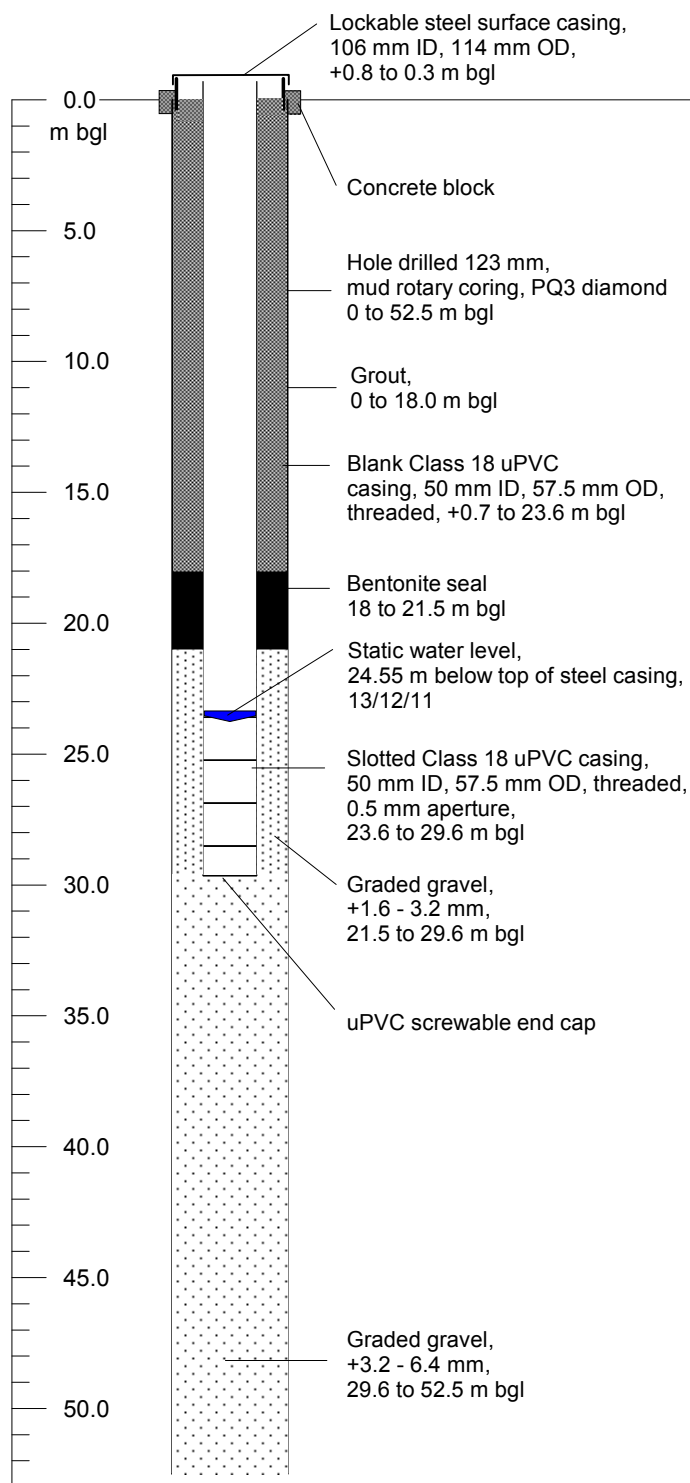
I:\368-0-2A\Strater\Geotech Monitoring Bores.str

CLIENT: Woodside Energy Ltd  
PROJECT: JPP - Monitoring Bore Completion Report  
DATE: February 2012  
DWG NO.: 368.0.2A/12/1-11

**AP-20 COMPOSITE LOG**

FIGURE 12

LITHOLOGY



<div>SANDSTONE/SAND</div>	Red, fine to medium grained, sub-rounded to sub-angular, poorly sorted, slightly silty. Trace pockets of yellow sand. Dark brown, and black gravel at 12.7 and 17 to 19 m.
	SAND
	SAND
	SAND/ SANDSTONE
	SANDSTONE
SANDSTONE/SAND	Pale yellow-brown, fine to coarse grained, sub-rounded to sub-angular, poorly sorted. Unconsolidated with minor sandstone, nodules and weakly cemented layers.
	Pale grey-brown, pale yellow-brown, pale yellow, fine to coarse grained, sub-rounded to sub-angular, poorly sorted. Well cemented with trace cavities and minor silicified intervals, moderately fractured.
SANDSTONE/SAND	As above, silty in parts, with intervals of unconsolidated sand. Red (oxidized) staining at 45 m, and from 47.5 to 50.5 m.

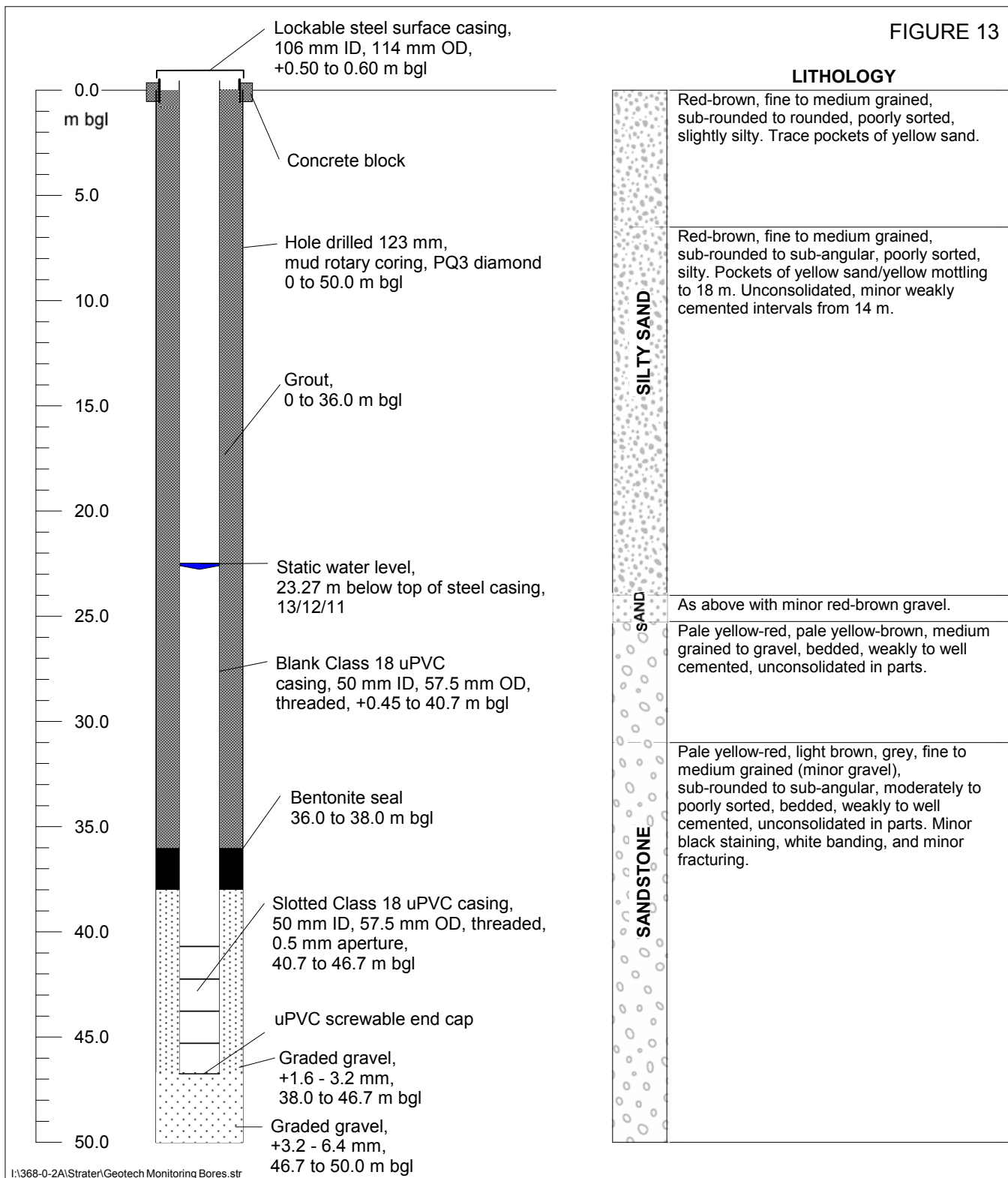
I:\368-0-2A\Strater\Geotech Monitoring Bores.str

CLIENT: Woodside Energy Ltd  
 PROJECT: JPP - Monitoring Bore Completion Report  
 DATE: February 2012  
 DWG NO.: 368.0.2A/12/1-12

AP-24 COMPOSITE LOG



FIGURE 13



CLIENT: Woodside Energy Ltd

PROJECT: JPP - Monitoring Bore Completion Report

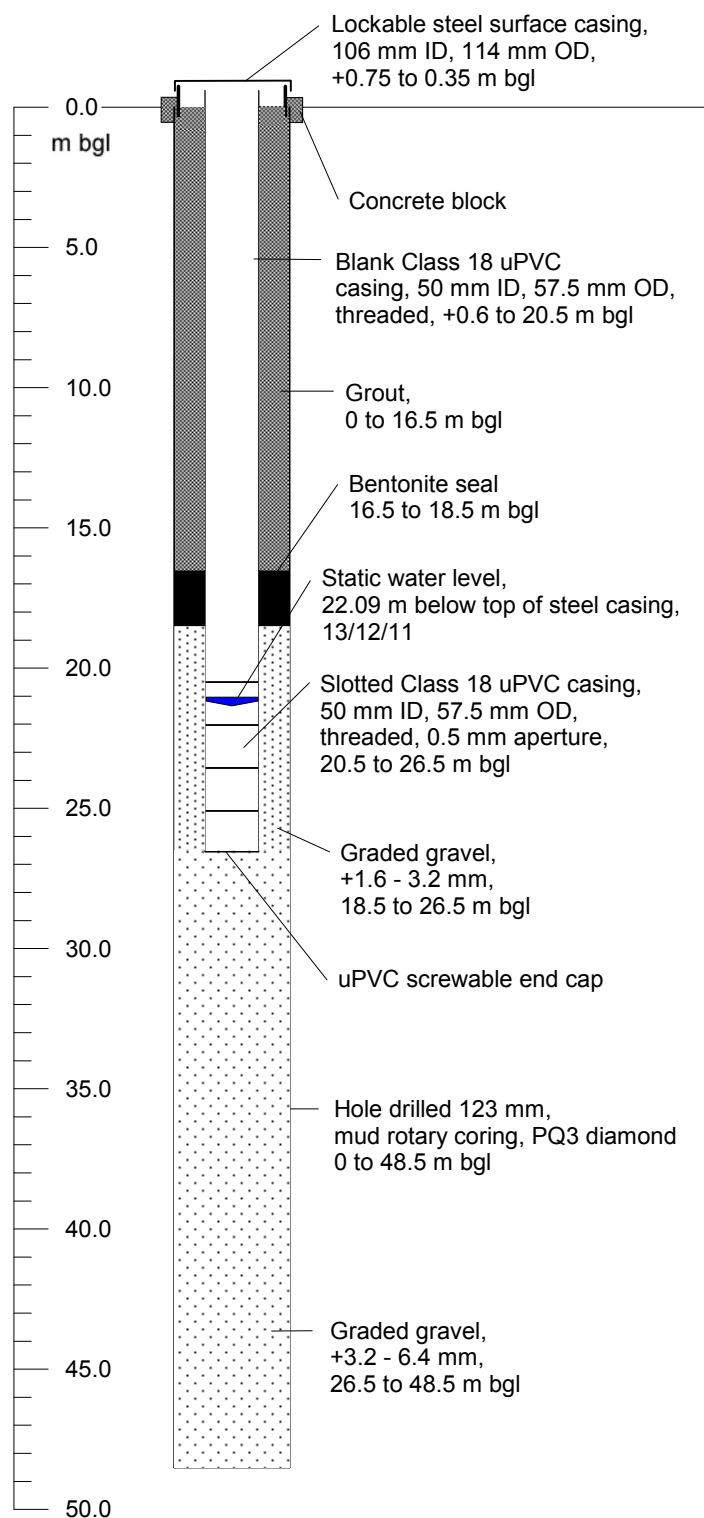
DATE: February 2012

DWG NO.: 368.0.2A/12/1-13

FIGURE 14

**LITHOLOGY**

SILTY SAND	Red-brown, fine to coarse grained, sub-rounded to sub-angular, poorly sorted, silty. Trace pockets of yellow sand.
	As above to pale-red brown, light brown, with silty sand/yellow mottling. Unconsolidated, with minor weakly cemented intervals, trace gravel.
SAND	Pale red, pale yellow, fine to coarse grained, sub-rounded to sub-angular, poorly sorted, slightly silty. Moderately consolidated.
	Yellow-brown, pale grey, pale red-brown, fine to coarse grained (trace gravel), sub-rounded to sub-angular, poorly sorted, minor silt, trace clay, unconsolidated to weakly cemented.
SANDSTONE/SAND	Grey-yellow, pale red, pale brown, fine to coarse grained (predominantly medium grained), sub-rounded to rounded, poorly sorted. Very weakly to moderately cemented, unconsolidated in parts. Note top of rock logged at 38.5 m.



I:\368-0-2A\Strater\Geotech Monitoring Bores.str

CLIENT: Woodside Energy Ltd

PROJECT: JPP - Monitoring Bore Completion Report

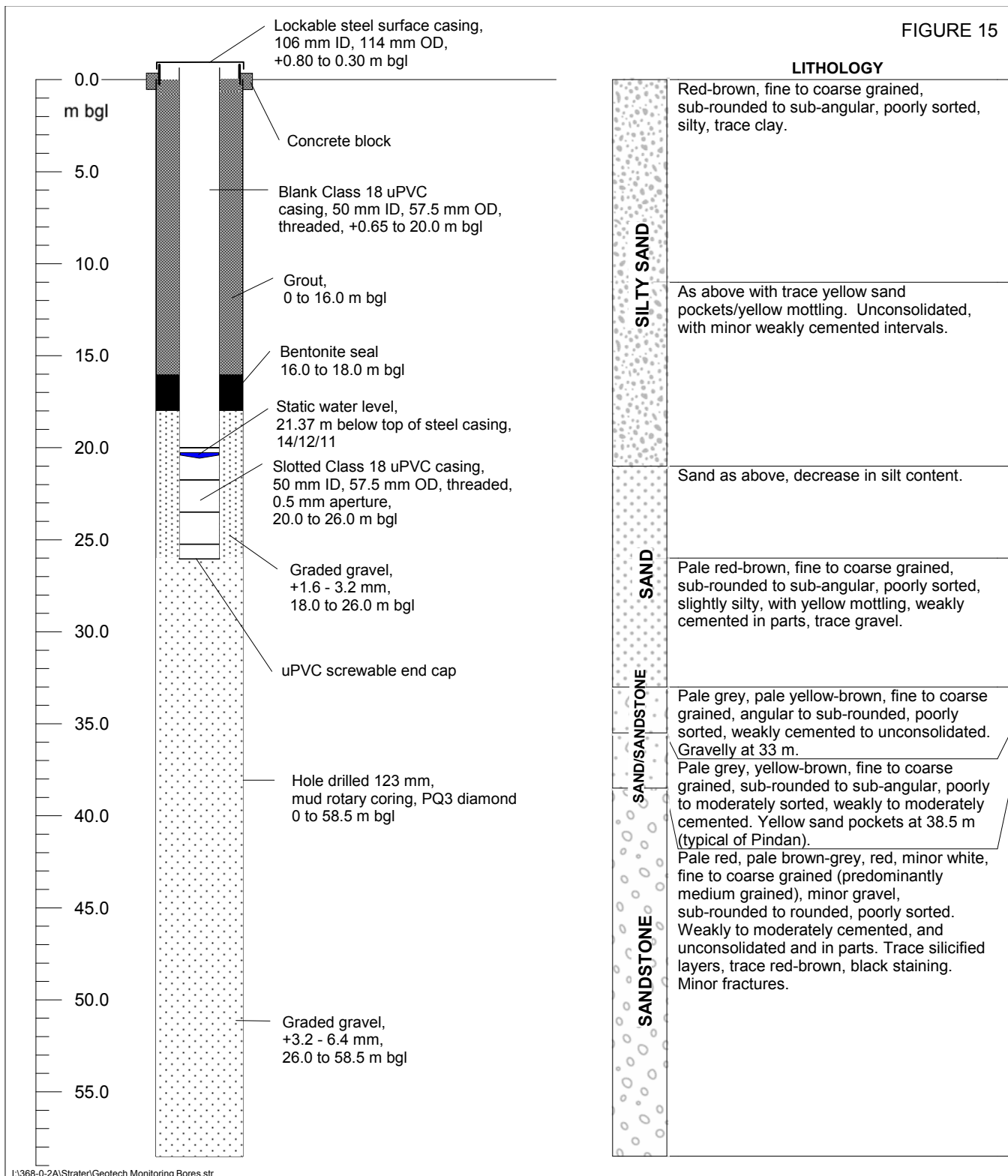
DATE: February 2012

DWG NO.: 368.0.2A/12/1-14

**AP-32 COMPOSITE LOG**

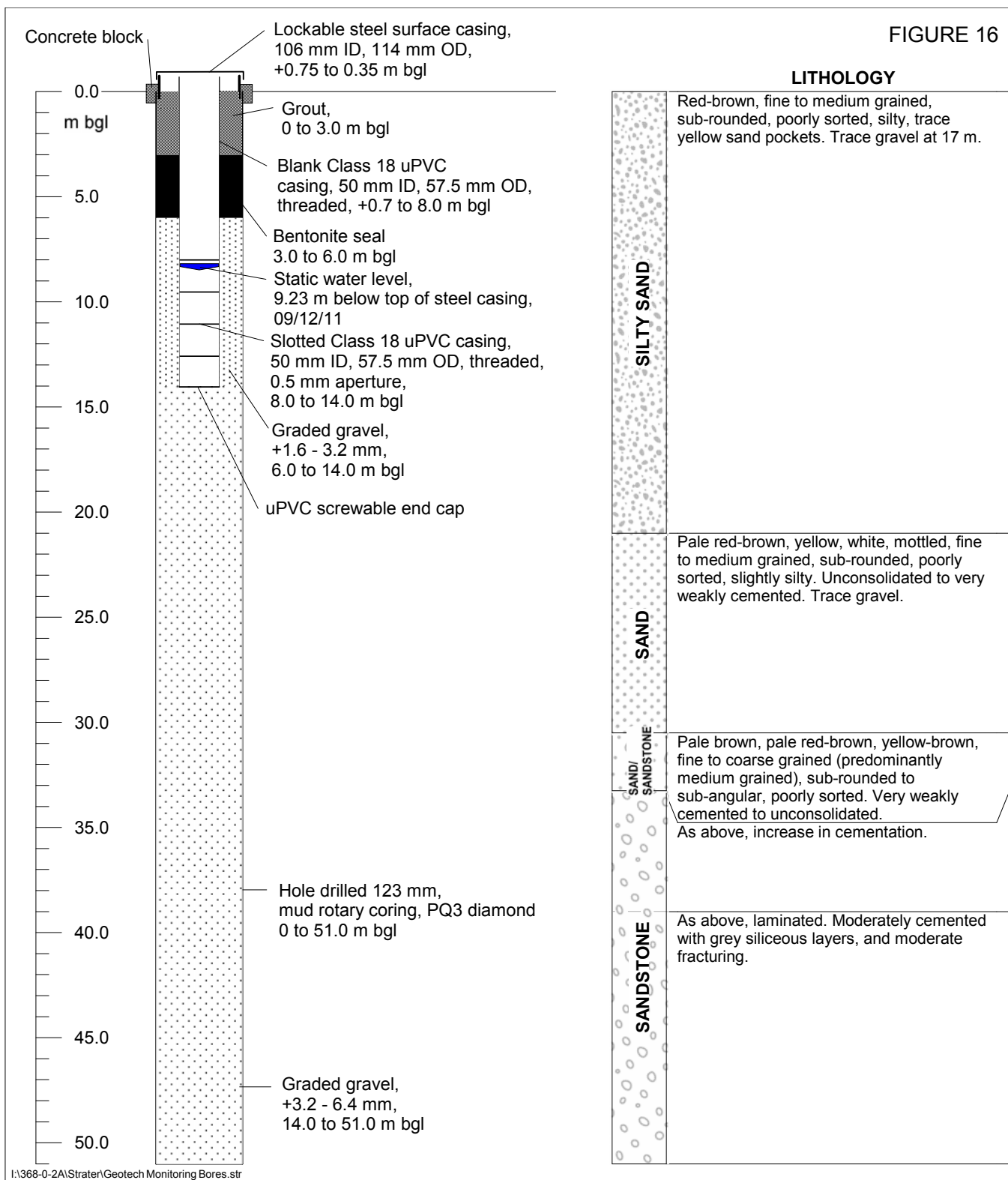


FIGURE 15



CLIENT: Woodside Energy Ltd  
 PROJECT: JPP - Monitoring Bore Completion Report  
 DATE: February 2012  
 DWG NO.: 368.0.2A/12/1-15

## AP-36 COMPOSITE LOG



CLIENT: Woodside Energy Ltd

PROJECT: JPP - Monitoring Bore Completion Report

DATE: February 2012

DWG NO.: 368.0.2A/12/1-16

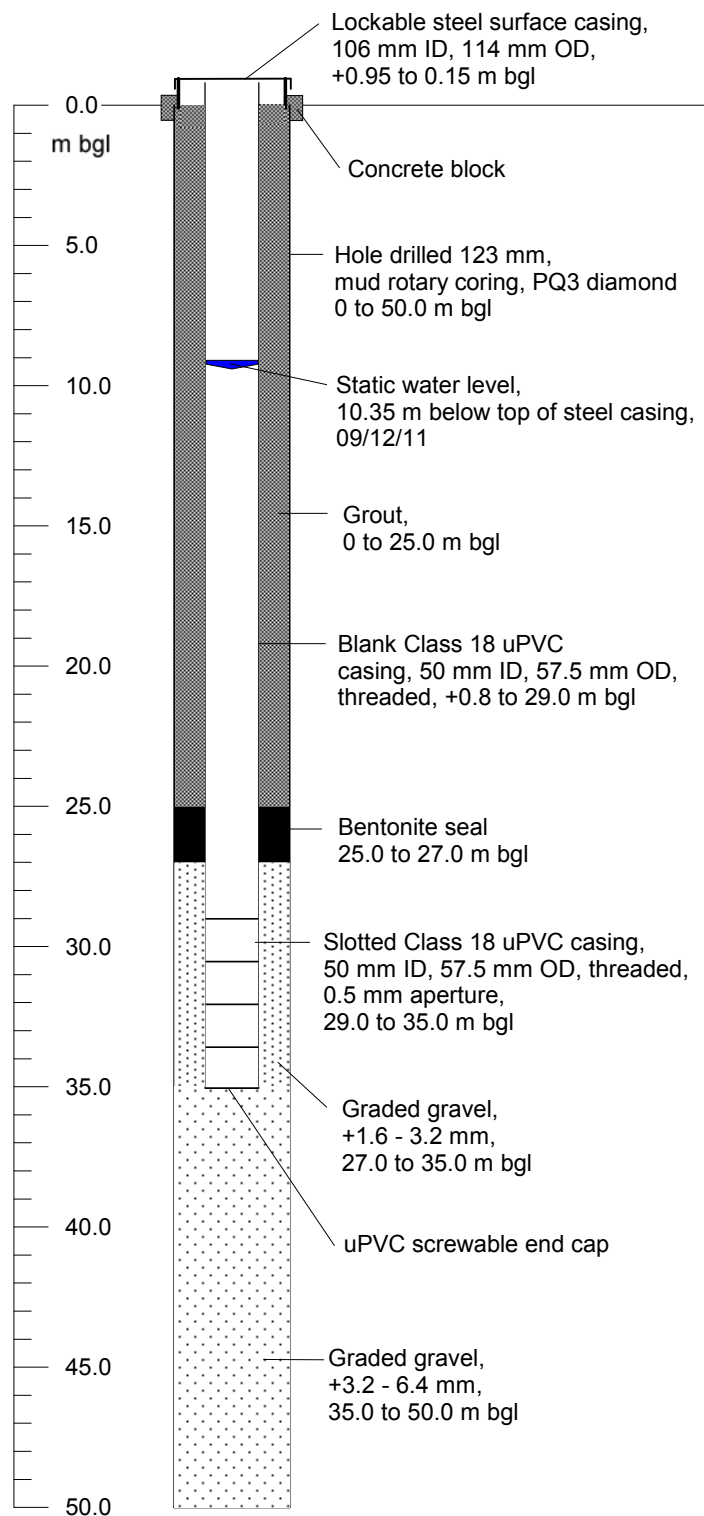
## F-14 COMPOSITE LOG



FIGURE 17

**LITHOLOGY**

SILTY SAND	Red-brown, fine to medium grained, sub-rounded to sub-angular, poorly sorted, silty, minor clay, trace yellow sand pockets and yellow mottling.
SAND	Pale red-brown, pale brown, sub-rounded to sub-angular, poorly sorted, slightly silty, trace weakly cemented nodules and minor sandstone layers.
SANDSTONE/SAND	Pale red, yellow, grey, mottled, very fine to coarse grained (predominantly medium grained), sub-rounded to sub-angular, poorly to moderately sorted. Minor gravel. Bedded, weakly to moderately cemented and unconsolidated in parts.
SANDSTONE	Pale brown, grey, white, pale red, fine to coarse grained (predominantly fine to medium grained), sub-rounded to sub-angular, poorly to moderately sorted, trace gravel. Laminated, predominantly consolidated, very weakly to moderately cemented, moderately fractured.



I:\368-0-2A\Strater\Geotech Monitoring Bores.str

CLIENT: Woodside Energy Ltd  
 PROJECT: JPP - Monitoring Bore Completion Report  
 DATE: February 2012  
 DWG NO.: 368.0.2A/12/1-17

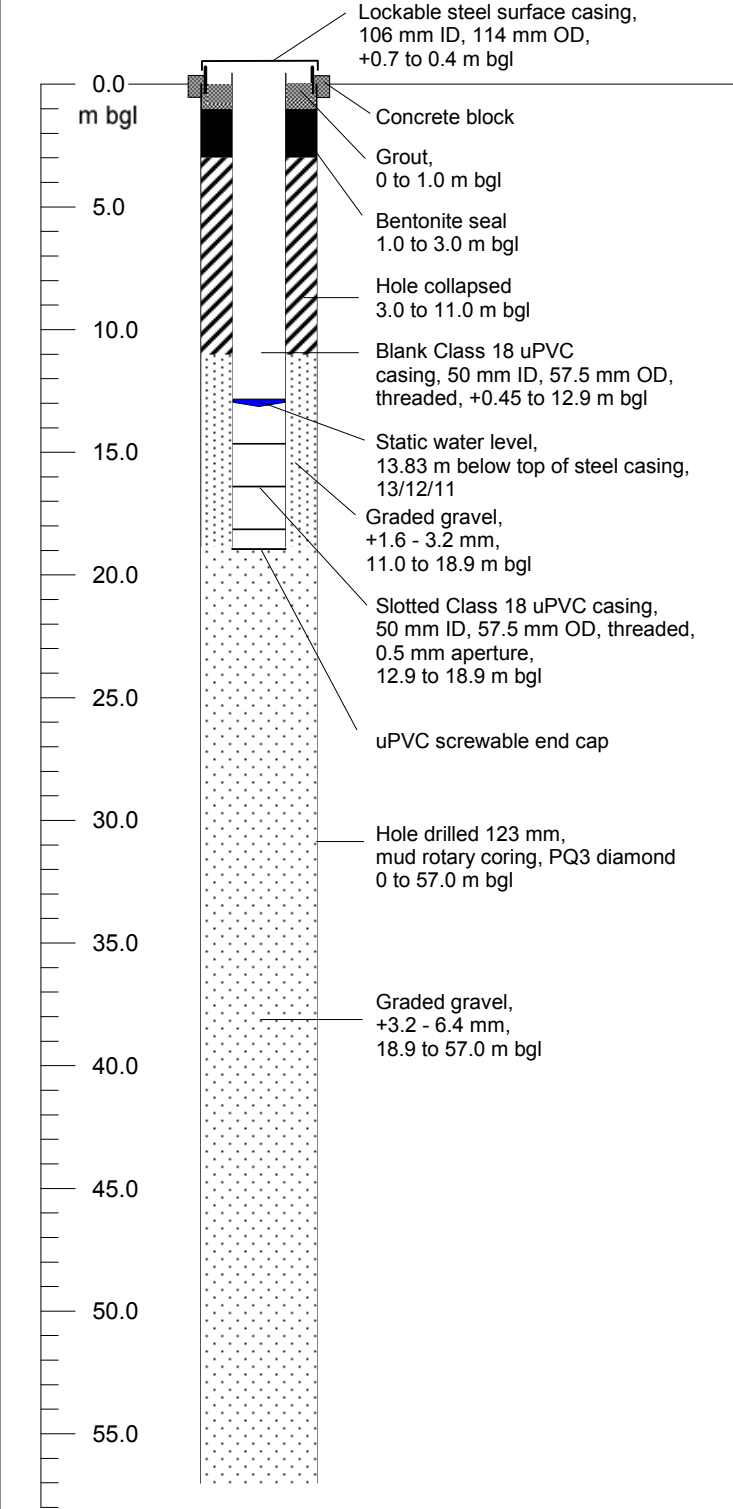
**I-16 COMPOSITE LOG**



FIGURE 18

LITHOLOGY

SILTY SAND	Red-brown, fine to medium grained, sub-rounded to sub-angular, poorly sorted, silty sand. Trace yellow sand pockets, trace gravel at 15.5 m
SAND	As above, to pale brown, minor mottling. Decrease in silt content.
SANDSTONE/SAND SAND	Pale brown, yellow-brown, medium to coarse grained, sub-rounded to sub-angular, poorly sorted, unconsolidated. Pale red-brown, grey, fine to medium grained, sub-rounded, poorly sorted, weakly cemented to unconsolidated.
SANDSTONE	As above, increased cementation with intervals of very weakly cemented to unconsolidated sand. Bedded, moderate fracturing, minor grey silicified layers. Minor mottling and oxidised layers throughout.



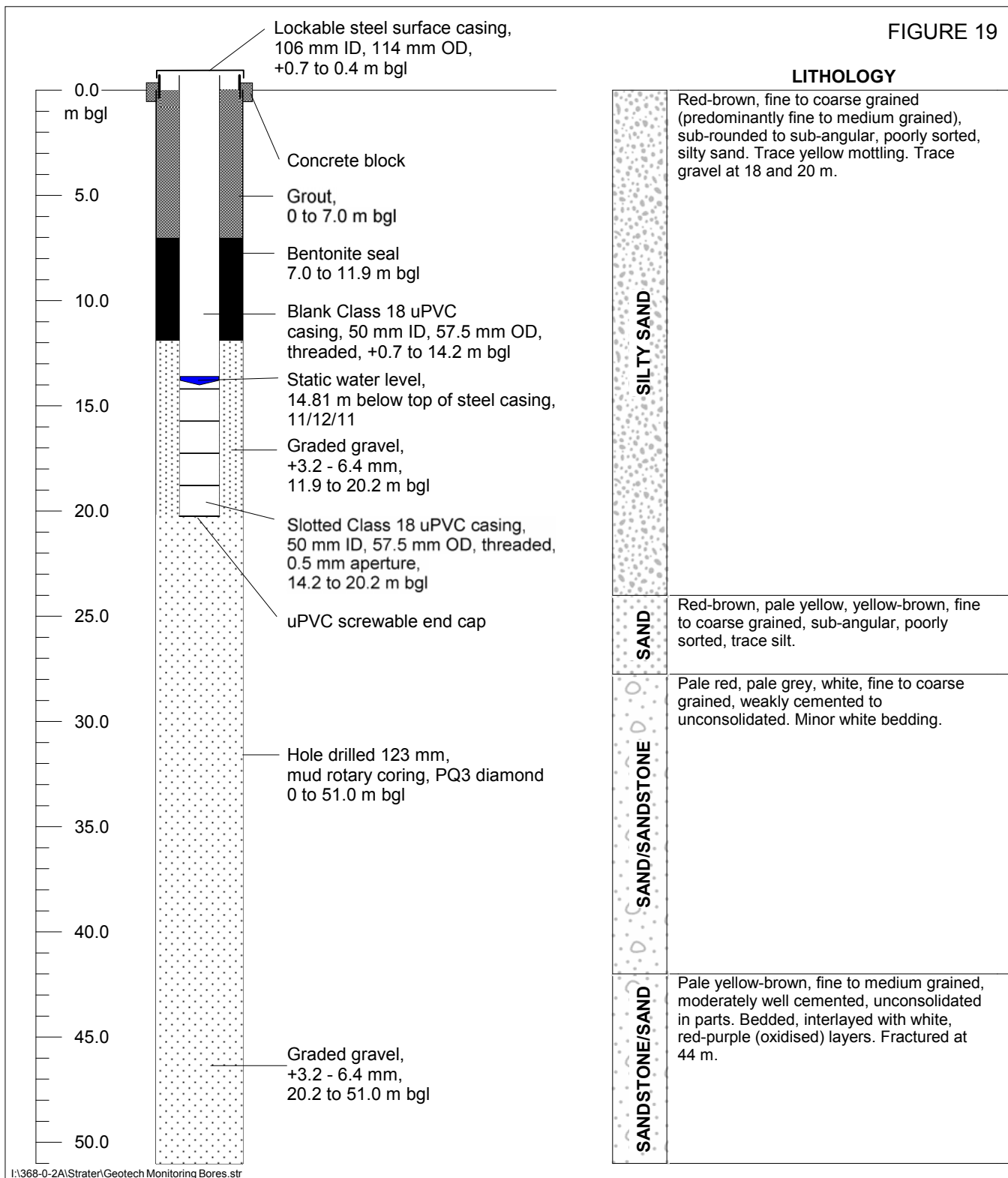
I:\368-0-2A\Strater\Geotech Monitoring Bores.str

CLIENT: Woodside Energy Ltd  
 PROJECT: JPP - Monitoring Bore Completion Report  
 DATE: February 2012  
 DWG NO.: 368.0.2A/12/1-18

N-4 COMPOSITE LOG



FIGURE 19



CLIENT: Woodside Energy Ltd  
 PROJECT: JPP - Monitoring Bore Completion Report  
 DATE: February 2012  
 DWG NO.: 368.0.2A/12/1-19

## O-10 COMPOSITE LOG



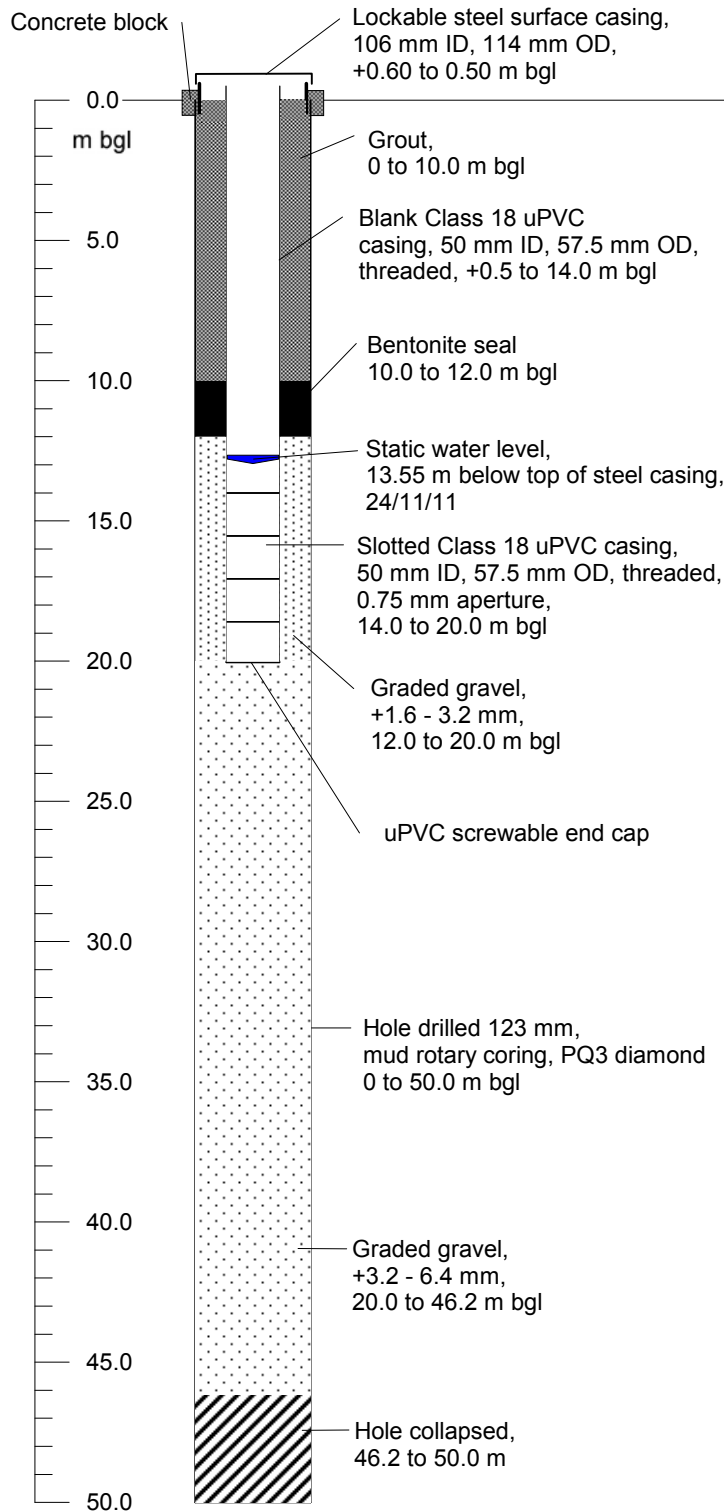


FIGURE 20

**LITHOLOGY**

SILTY SAND	Red-brown, fine to medium grained (trace coarse grained), sub-rounded to sub-angular, poorly sorted, unconsolidated, pockets of yellow.
	As above, pale red-brown.
SAND	Red-brown, pale red-brown fine to medium grained (trace coarse grained), sub-rounded, poorly sorted, silty. Trace gravel at 14.8 m. Decrease in fines from 21 m.
	Pale red-brown and pale yellow, dark grey, pale yellow, dark red (oxidised), sub-rounded to sub-angular, poorly sorted, gravelly.
SANDSTONE/SAND	Pale grey, yellow-brown, fine grained, trace medium and coarse grained, poorly sorted, predominately competent, medium to hard, with beds of unconsolidated, fine to medium grained sand. Minor mottling/weathering. Siltstone laminations at 26.8 and 27.8 m. Gravel, grey-brown, sub-rounded at 32 m.
	Sandstone as above, with pale grey to brown-grey, fine to medium grained, poorly sorted, sub-rounded to sub-angular sand. Increased grainsize from 37.5 to 38 m.
	Pale grey to yellow-brown, and dark red-brown, fine to coarse grained (predominately fine to medium grained), poorly sorted, rounded to sub-rounded, silty, competent sandstone to unconsolidated sand.

I:\368-0-2A\Strater\Geotech Monitoring Bores.str

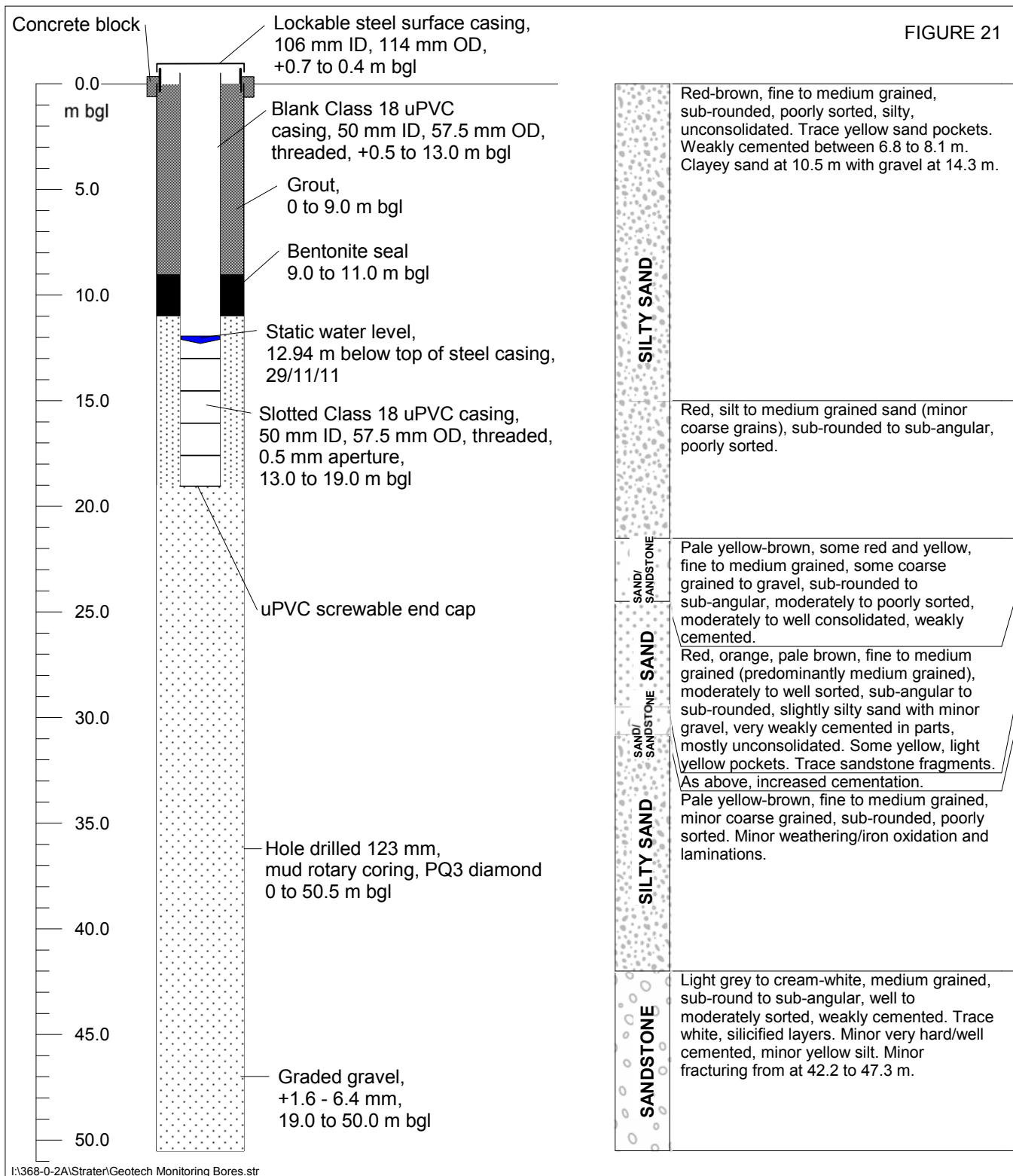
CLIENT: Woodside Energy Ltd

PROJECT: JPP - Monitoring Bore Completion Report

DATE: February 2012

DWG NO.: 368.0.2A/12/1-20

**P-17 COMPOSITE LOG**



CLIENT: Woodside Energy Ltd

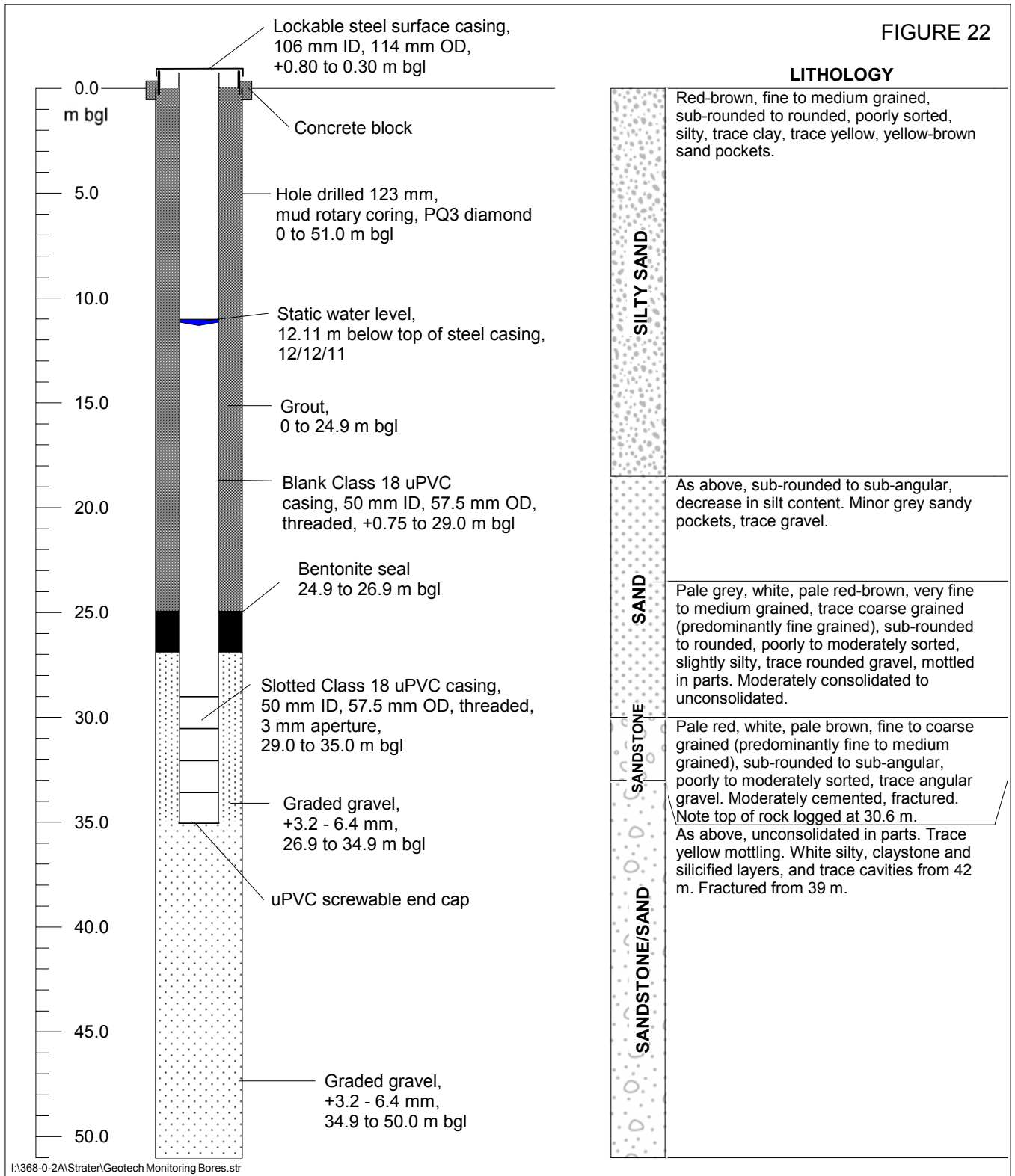
PROJECT: JPP - Monitoring Bore Completion Report

DATE: February 2012

DWG NO.: 368.0.2A/12/1-21

## P-21 COMPOSITE LOG

FIGURE 22

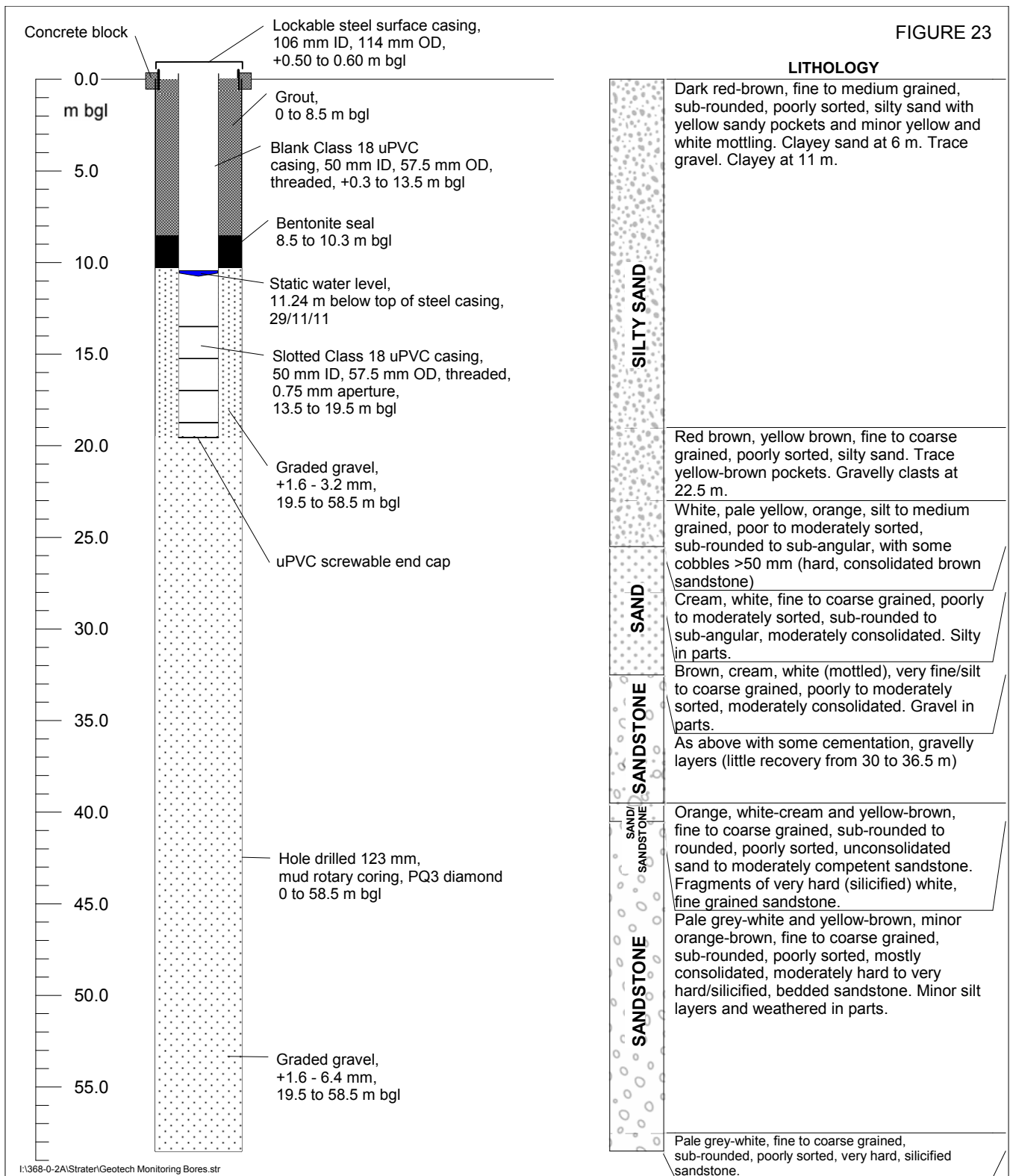


CLIENT: Woodside Energy Ltd  
PROJECT: JPP - Monitoring Bore Completion Report  
DATE: February 2012  
DWG NO.: 368.0.2A/12/1-22

P-25 COMPOSITE LOG







CLIENT: Woodside Energy Ltd

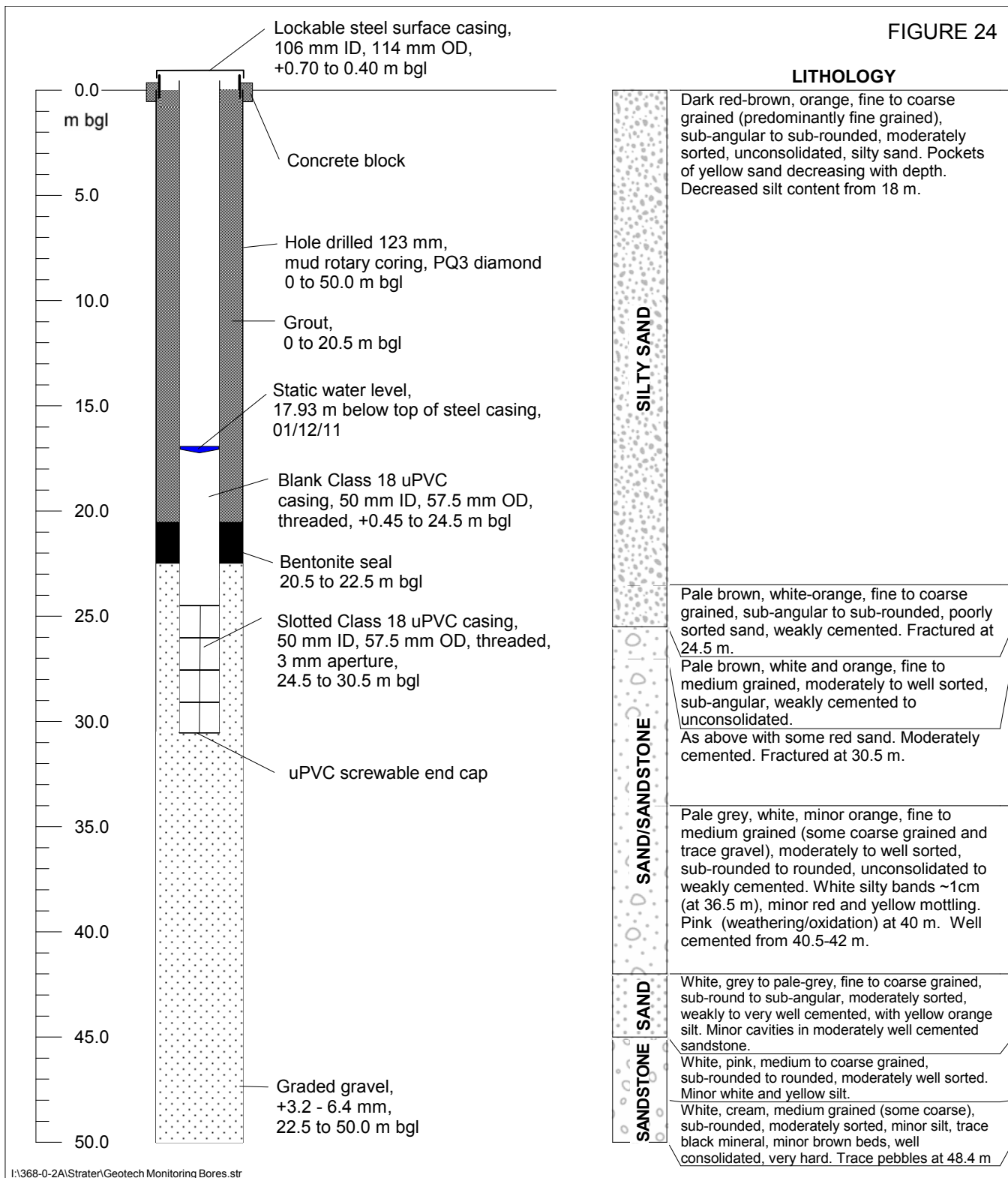
PROJECT: JPP - Monitoring Bore Completion Report

DATE: February 2012

DWG NO.: 368.0.2A/12/1-23

## P-29 COMPOSITE LOG

FIGURE 24



I:\368-0-2A\Strater\Geotech Monitoring Bores.str

CLIENT: Woodside Energy Ltd

PROJECT: JPP - Monitoring Bore Completion Report

DATE: February 2012

DWG NO.: 368.0.2A/12/1-24

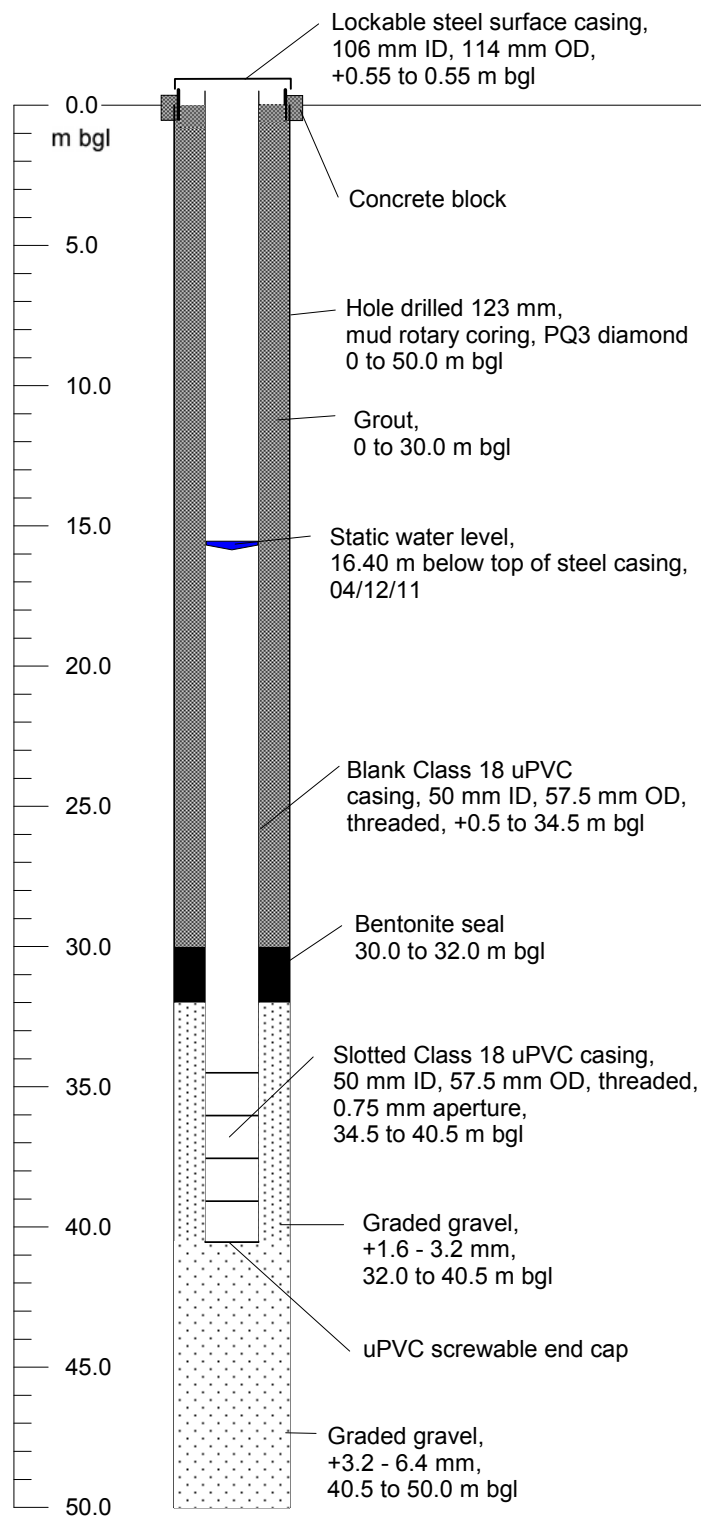
## U-10 COMPOSITE LOG



FIGURE 25

**LITHOLOGY**

SILTY SAND	Red-brown, fine to medium grained, sub-rounded to sub-angular, poorly sorted, silty, with trace yellow sand pockets. Trace weakly cemented pockets at 11 m.
SAND	As above, decrease in silt content. Trace gravel. Weakly cemented at 20.5 m, with trace sandstone fragments from 22 m.
SANDSTONE/SAND	Pale yellow, grey, pale red-brown, fine to coarse grained (predominantly fine to medium grained), sub-angular to rounded, poorly to moderately sorted. Very weakly to moderately cemented, bedded, mostly unconsolidated. As above, increase in cementation.
SANDSTONE	Pale yellow, grey, fine to coarse grained (predominantly fine to medium grained), sub-angular to rounded, poorly to moderately sorted. Weakly to moderately cemented, bedded, silicified in parts. Red, iron oxide staining at 45.5 m. Minor fracturing.



I:\368-0-2A\Strater\Geotech Monitoring Bores.str

CLIENT: Woodside Energy Ltd

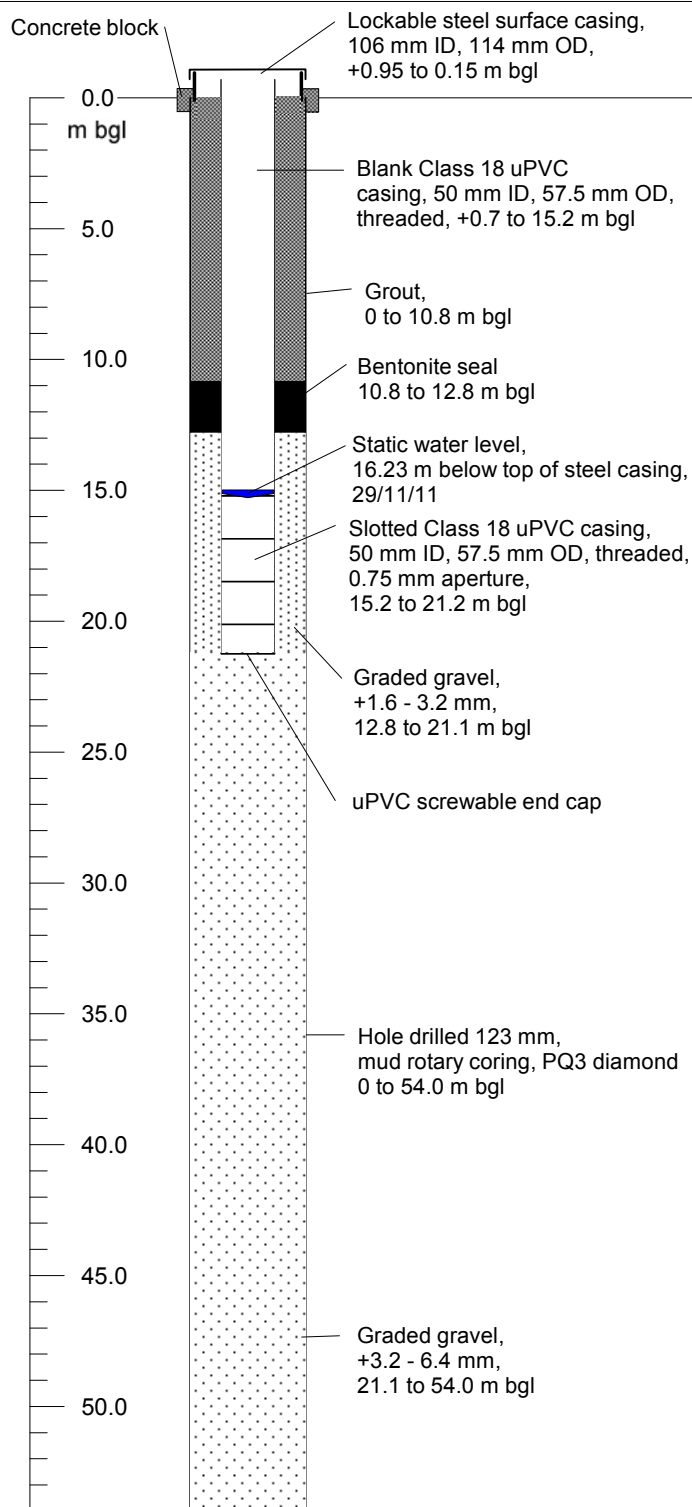
PROJECT: JPP - Monitoring Bore Completion Report

DATE: February 2012

DWG NO.: 368.0.2A/12/1-25

**U-16 COMPOSITE LOG**

FIGURE 26



I:\368-0-2A\Strater\Geotech Monitoring Bores.str

**LITHOLOGY**

SILTY SAND	Red-brown, fine to coarse grained (predominantly fine), moderately sorted, sub-rounded, silty, with some hard siltstone layers. Pockets of yellow, medium to coarse grained sand. Trace gravel at 24 m.
SANDSTONE	Orange, pale yellow, fine to medium grained (trace coarse grains), sub-rounded to sub-angular, moderately sorted, minor silt, weakly cemented to very hard, well consolidated.
SANDSTONE/SAND	As above, unconsolidated/very weakly cemented in parts. Yellow, pale yellow from 30 m, with pale grey, and pale brown from 36.7 m. 3.8 m.
SANDSTONE	Pale yellow, white/off-white, minor orange, fine to medium grained (predominantly medium grained), moderately sorted, sub-rounded to sub-angular, moderately to well cemented, weakly cemented/unconsolidated in parts. Locally bedded/laminated. Brown, purple, weathered/oxidised, very hard, and with some porosity at 47 m. Red-pink, orange staining from 50 m.

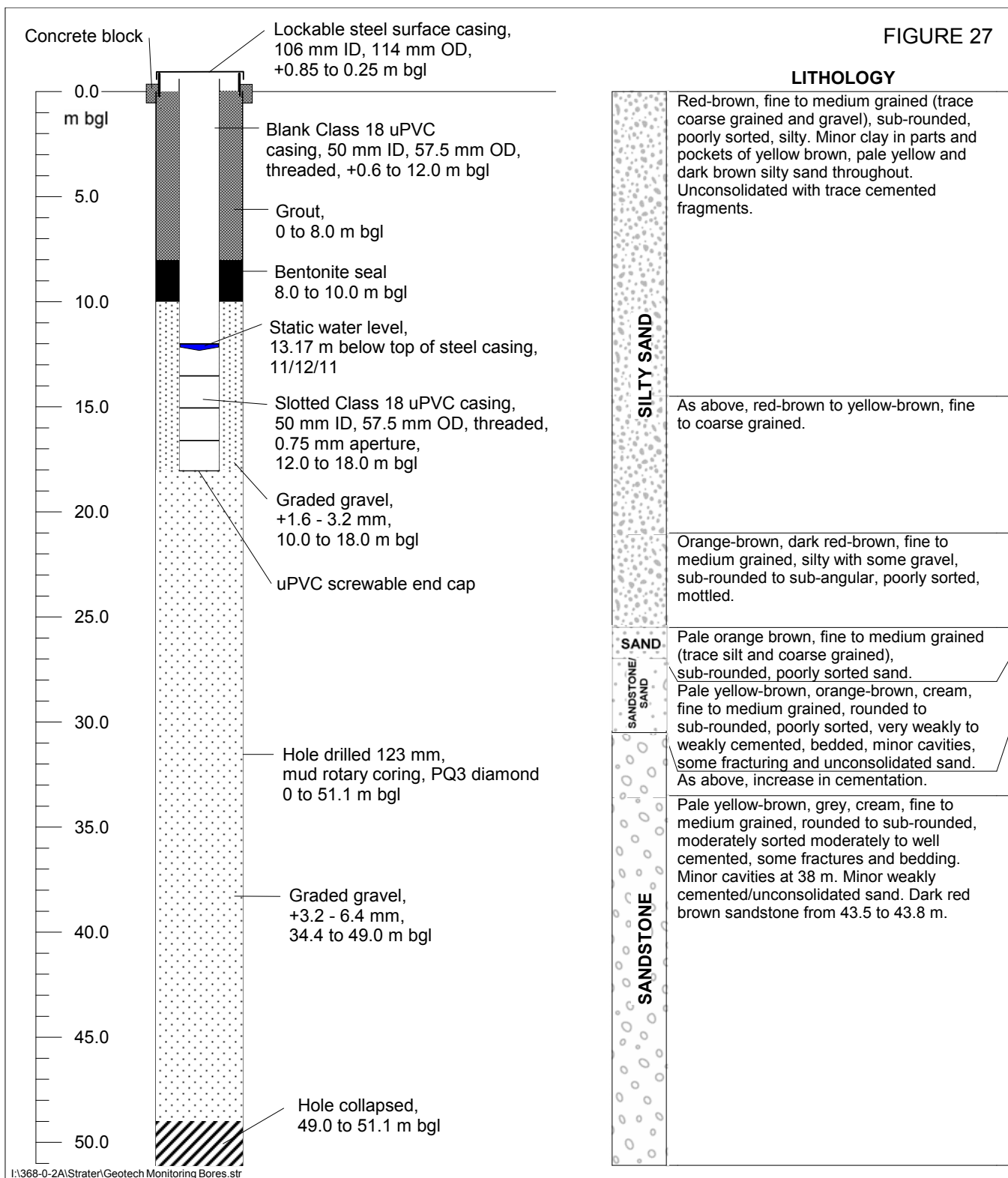
CLIENT: Woodside Energy Ltd

PROJECT: JPP - Monitoring Bore Completion Report

DATE: February 2012

DWG NO.: 368.0.2A/12/1-26

**U-20 COMPOSITE LOG**



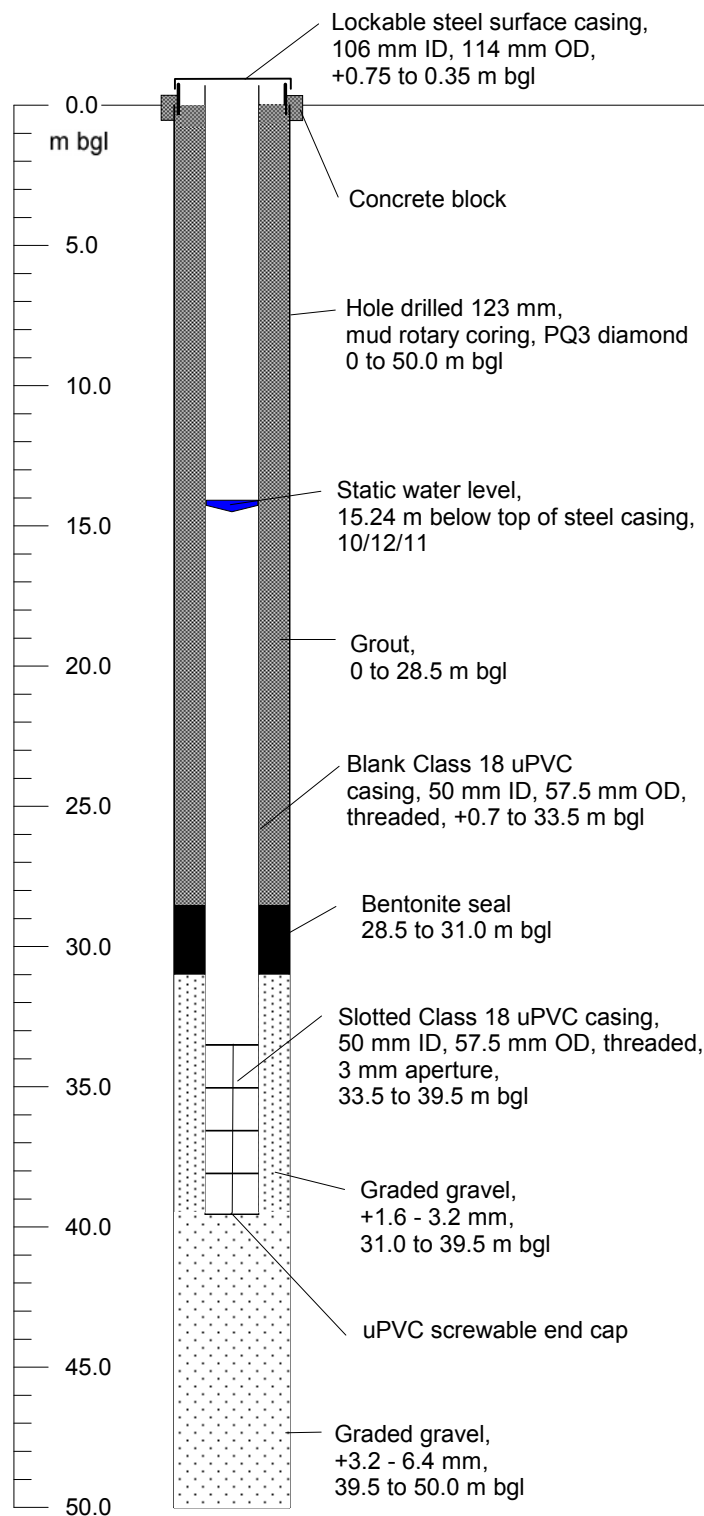
CLIENT: Woodside Energy Ltd  
 PROJECT: JPP - Monitoring Bore Completion Report  
 DATE: February 2012  
 DWG NO.: 368.0.2A/12/1-27

## U-31 COMPOSITE LOG

FIGURE 28

LITHOLOGY

SILTY SAND	Red-brown, dark red-brown, fine to medium grained, rounded to sub-angular, poorly sorted, silty, with yellow and yellow-brown sand pockets.
	As above, with trace gravel, and weakly cemented sandstone fragments.
	As above with pale grey mottling to 13.5 m, yellow sand pockets, moderately consolidated to weakly cemented.
SANDS/SANDSTONE	Pale red, yellow-brown, some mottling, fine to medium grained, sub-rounded to sub-angular, poorly sorted, trace to slightly silty. Very weakly cemented to unconsolidated.
	As above, increase in cementation.
SANDSTONE	Pale yellow-brown, grey, fine to medium grained, minor gravel, sub-rounded to sub-angular, moderately to poorly sorted. Layered, very weakly cemented to moderately cemented, moderately fractured. Minor silicified layers and some (minor) unconsolidated intervals.

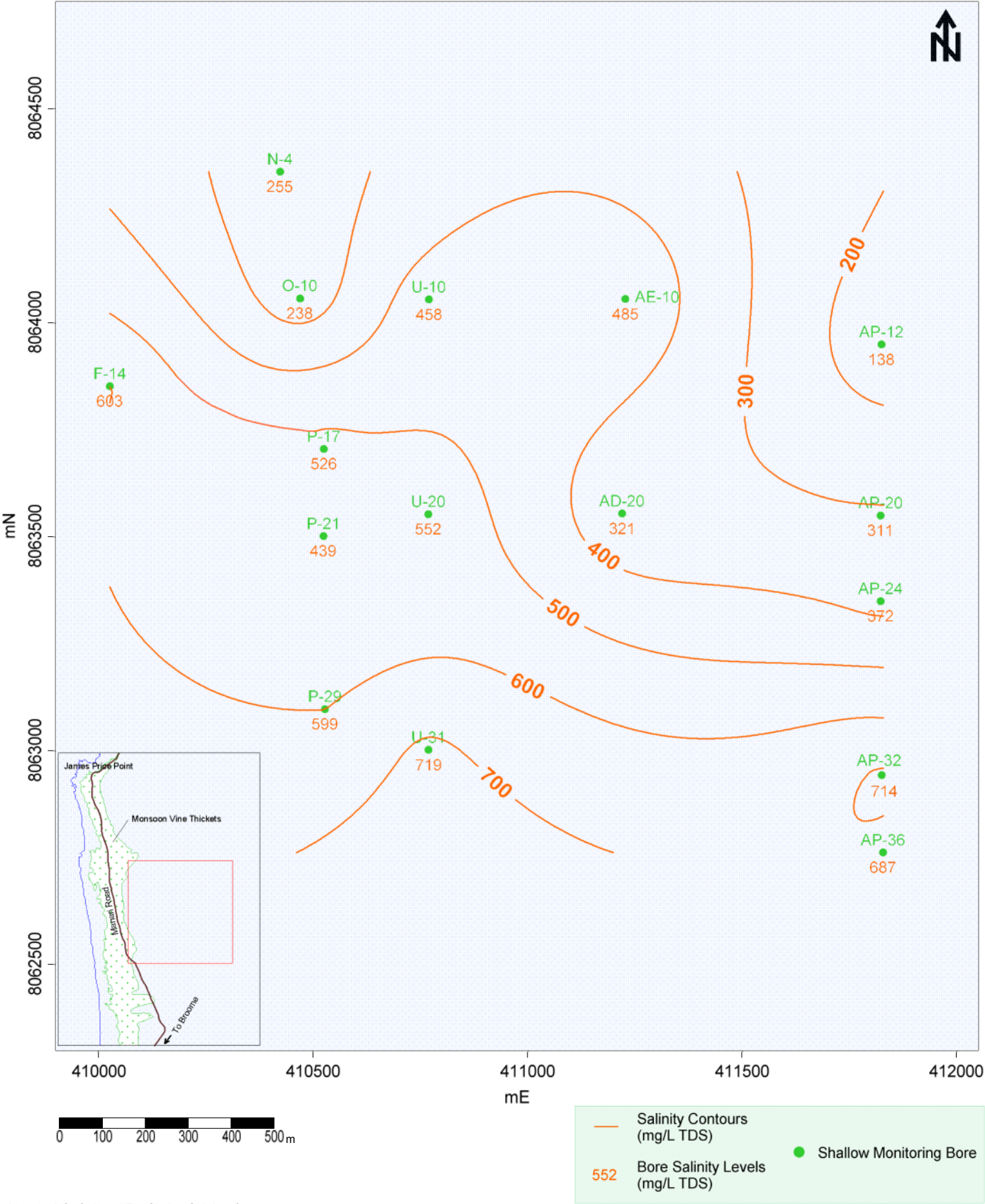


I:\368-0-2A\Strater\Geotech Monitoring Bores.str

CLIENT: Woodside Energy Ltd  
 PROJECT: JPP - Monitoring Bore Completion Report  
 DATE: February 2012  
 DWG NO.: 368.0.2A/12/1-28

V-25 COMPOSITE LOG

FIGURE 29



I:368-0-2A/Surfer/12-01/F29 Shallow Salinity.srf

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

DATE: February 2012

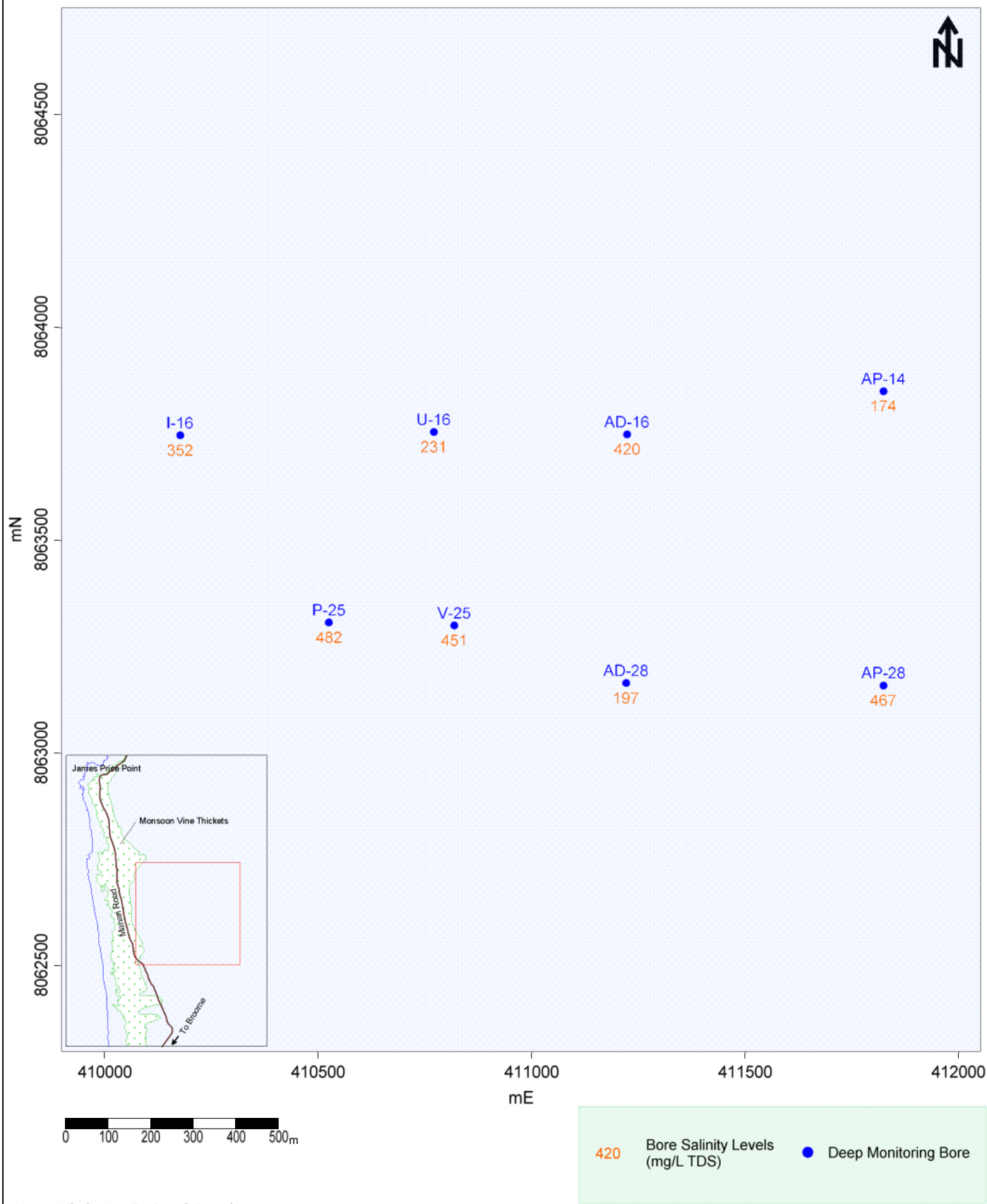
Dwg. No: 368.0.2A/12/1-29

SALINITY DATA FOR  
WATERTABLE MONITORING BORES  
DECEMBER 2011





FIGURE 30



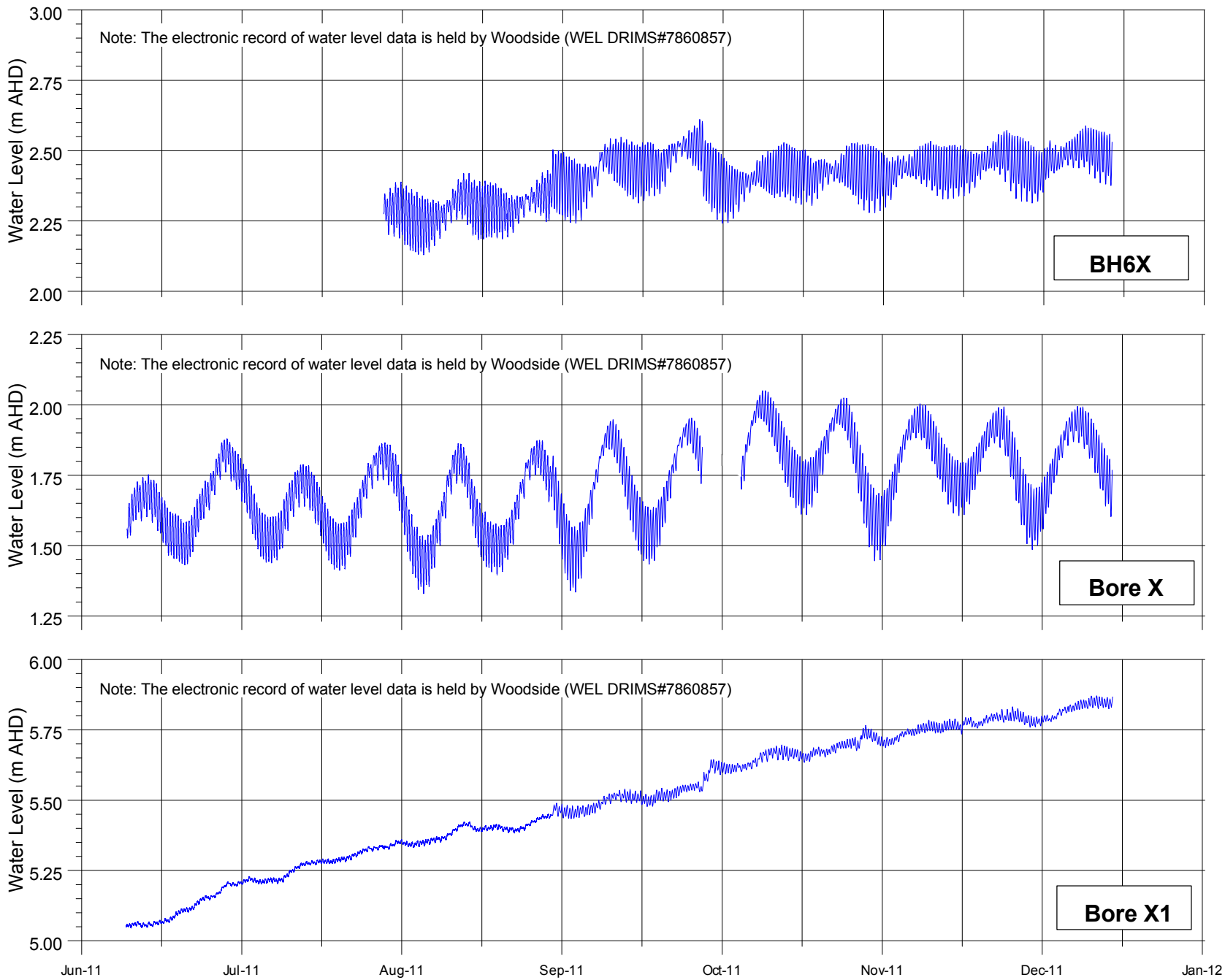
I:368-0-2A/Surfer/12-01/F30 Deep Salinity.srf

CLIENT: Woodside Energy Ltd  
PROJECT: James Price Point  
Monitoring Bore Completion Report  
DATE: February 2012  
Dwg. No: 368.0.2A/12/1-30

SALINITY DATA FOR  
DEEP MONITORING BORES  
DECEMBER 2011



Figure 31



I:/368-0-2A/Grapher/12-01/BH6X\_X\_X1Hydrographs.grf

CLIENT: Woodside Energy Ltd

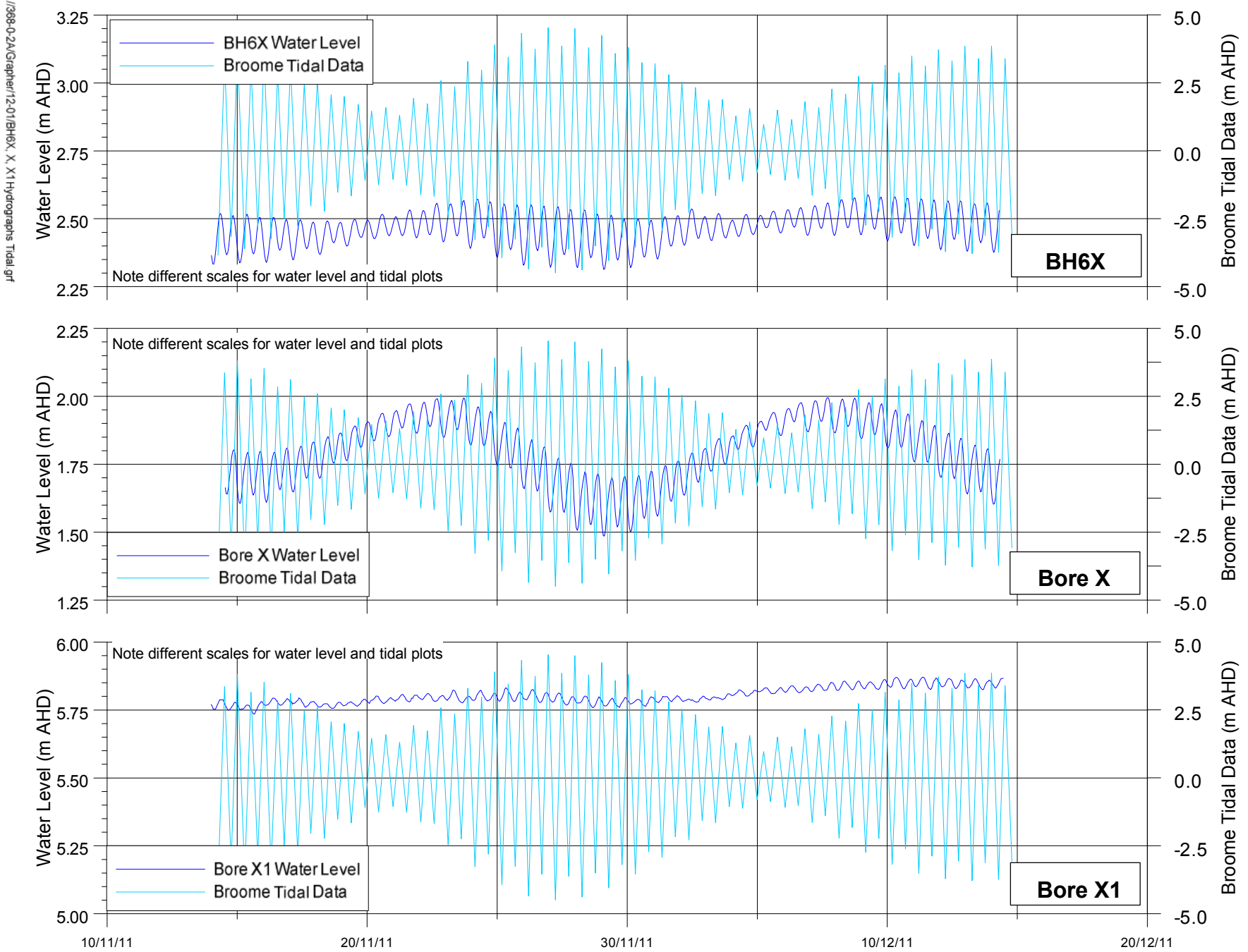
PROJECT: James Price Point  
Monitoring Bore Completion Report

DATE: February 2012

Dwg. No: 368.0.2A/12/1-31

BORES BH6X, X AND X1  
HYDROGRAPHS

Figure 32



CLIENT: Woodside Energy Ltd  
PROJECT: James Price Point  
Monitoring Bore Completion Report  
DATE: February 2012  
Dwg. No.: 368.0.2A/12/1-32

BORES BH6X, X AND X1  
HYDROGRAPHS WITH  
BROOME TIDAL DATA



## **APPENDIX I**

### **DEPARTMENT OF WATER LICENCE TO CONSTRUCT OR ALTER A WELL CAW172357(1)**





## LICENCE TO CONSTRUCT OR ALTER WELL

Granted by the Minister under section 26D of the Rights in Water and Irrigation Act 1914

Licensee(s)	Woodside Energy Ltd	
Description of Water Resource	Broome Canning - Broome	
Location of Well(s)	Lot 259 On Plan 220696 - Volume/Folio Lr3015/565 - Lot 259 Wattle Dr Waterbank	
Authorised Activities	Activity	Location of Activity
	Construct up to 30 non-artesian monitoring well(s).	Lot 259 On Plan 220696 - Volume/Folio Lr3015/565 - Lot 259 Wattle Dr Waterbank
Duration of Licence	From 29 October 2010 to 24 October 2012	

**This Licence is subject to the following terms, conditions and restrictions:**

- 1 The well must be constructed by a driller having a current class 1 water well drillers certificate issued by the Western Australian branch of the Australian Drilling Industry Association or other certification approved by the Department of Water as equivalent.
- 2 That the depth of the well/s shall be limited to the Canning-Broome aquifer.
- 3 Approval by the Department of Water is to be obtained prior to the construction of additional and replacement wells and the modification or refurbishment of existing wells.
- 4 That the licensee shall allow access, in an agreed manner, by Department of Water personnel for the purposes of inspection at any time.
- 5 The licensee is to comply with the bore construction plans subitted by Woodside Energy Ltd on 27 October 2010 and any amendments made by or with the approval of the Department.
- 6 The licensee is to provide a copy of the drillers current water well drillers certificate issued by the Western Australian branch of the Australian Drilling Industry Association or other certification approved by the Department of Water as equivalent to the Department of Water before the drilling program commences.
- 7 That should the bore/s be abandoned it/they shall be sealed off to the satisfaction of the Department of Water.
- 8 That should there be a detrimental impact on water quality as a result of the licensed activity, the Department of Water may cause the well to be closed.

**End of terms, conditions and restrictions**

**This Licence is granted subject to the Rights in Water and Irrigation Regulations 2000.**

**APPENDIX II**  
**BORE COMPLETION DATA AND LITHOLOGICAL LOGS**



## MONITORING BORE COMPLETION DATA

BORE ID:	AD-16
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Deep, Fauna
COORDINATES:	411223.4 mE 8063748.6 mN
REDUCED LEVEL (top of steel standpipe):	23.9 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	GDR650 (Rig 1)
DATE CONSTRUCTED:	04/11/11 to 09/11/11 (drilling completed 07/11/11)
DRILLING DETAILS:	0 to 50 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.5 to 44.5 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	38.5 to 44.5 m, 3 mm aperture
BOREHEAD:	+0.55 to 0.55 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.05 m above ground level
GROUTED INTERVAL:	ground surface to 31.5 m
BENTONITE SEAL:	31.5 to 34.4 m
GRAVEL PACK:	34.4 to 50.0, graded +3.2 – 6.4
STATIC WATER LEVEL (10/12/11):	20.88 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (08/12/11):	440 µS/cm / 6.6 pH units / 33.2°C (pumped sample)



## MONITORING BORE COMPLETION DATA

### AD-16 (continued)

#### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	23	SILTY SAND	Red, red-brown, very fine to medium grained, sub-rounded to sub-angular, moderately to poorly sorted, silty. Pockets of yellow sand and trace clay. Trace red and yellow-black, rounded gravel from 17 to 19.6 m.
23	27	SAND	Pale red-brown, dark-yellow brown, fine to medium grained, sub-rounded to sub-angular, poorly sorted, minor rounded gravel. Unconsolidated with minor cemented fragments.
27	38	SAND/SANDSTONE	Pale white-grey, light brown, yellow-brown, fine to coarse grained (predominantly medium grained), sub-angular to sub-rounded, poorly to moderately sorted. Bedded, weakly to moderately cemented, with minor silicified bands and fracturing. Unconsolidated in parts. Note top of rock logged at 27.16 m.
38	50	SAND/SANDSTONE	As above, increased cementation and gravel from 45 m.
Core loss of at least 0.25 m, recorded at 10.25, 16.25, 17.25, 18.35, 19.6, 24, 28.5, 48, 48.75, and 49.5 m.			E.O.H 50 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (on-site 15-50 m depth)			



## MONITORING BORE COMPLETION DATA

BORE ID:	AD-20
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Shallow
COORDINATES:	411220.3 mE 8063554.1 mN
REDUCED LEVEL (top of steel standpipe):	23.2 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Delta Base (Rig 9)
DATE CONSTRUCTED:	11/11/11 to 14/11/11 (drilling completed 14/11/11)
DRILLING DETAILS:	0 to 50 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.75 to 25.6 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	19.6 to 25.6 m, 0.5 mm aperture
BOREHEAD:	+0.8 to 0.3 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.1 m above ground level
GROUTED INTERVAL:	ground surface to 15.0 m
BENTONITE SEAL:	15.0 to 17.0 m
GRAVEL PACK:	17.0 to 25.6, graded +1.6 – 3.2 25.6 to 50.0, graded +3.2 – 6.4
STATIC WATER LEVEL (12/12/11):	20.28 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (12/12/11):	465 µS/cm / 6.9 pH units / 35.5°C (pumped sample)





# MONITORING BORE COMPLETION DATA

## AD-20 (continued)

### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	14	SILTY SAND	Red-brown, very fine to medium grained, sub-rounded to sub-angular, moderately to poorly sorted, silty. Pockets of white and yellow silty sand.
14	18	SAND	As above with minor iron oxide concentrations and gravel at 17.5 m. Note top of rock logged at 17.7 m.
18	22	SAND	Red-brown, pale brown, pale yellow-brown, fine to coarse grained (predominantly fine grained), sub-angular to sub-rounded, poorly sorted. Trace gravel. Very weakly to weakly cemented (trace sandstone), mostly unconsolidated in parts. Minor cavities at 20.7 m.
22	27.5	SAND/SANDSTONE	As above, bedded. Silty in parts with some white silicified layers.
27.5	50	SANDSTONE	Pale red, light brown, yellow-brown, fine to medium grained (trace gravel), sub-rounded, moderately to poorly sorted. Layered, with light grey silty sand, moderately to well cemented, some fracturing and minor cavities. Minor dark purple-brown layers at 29.5 and 35 and 42 m. Minor unconsolidated sand throughout.
Core loss, of at least 0.25 m, recorded at 18.2, 19.6, 24.9, 26.75, and 39 m.			<b>E.O.H 50 m</b>
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval)			



## MONITORING BORE COMPLETION DATA

BORE ID:	AD-28
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Deep
COORDINATES:	411221.0 mE 8063164.4 mN
REDUCED LEVEL (top of steel standpipe):	21.5 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Delta Base (Rig 9)
DATE CONSTRUCTED:	07/11/11 to 10/11/11 (drilling completed 10/11/11)
DRILLING DETAILS:	0 to 50.5 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.45 to 42.9 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	36.9 to 42.9 m, 0.5 mm aperture
BOREHEAD:	+0.55 to 0.55 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.1 m above ground level
GROUTED INTERVAL:	ground surface to 32.0 m
BENTONITE SEAL:	32.0 to 35.0 m
GRAVEL PACK:	35.0 to 42.9, graded +1.6 – 3.2 42.9 to 50.5, graded +3.2 – 6.4
STATIC WATER LEVEL (14/12/11):	18.56 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (13/12/11):	340 µS/cm / 6.1 pH units / 33.7°C (pumped sample)



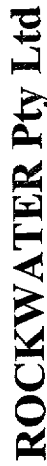
## MONITORING BORE COMPLETION DATA

### AD-28 (continued)

#### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	17	SILTY SAND	Red-brown, fine to medium grained, sub-rounded, poorly sorted, silty. Pockets of yellow-brown and white silty sand.
17	26	SAND	Red-brown, very fine to medium grained (trace coarse grained), sub-angular to sub-rounded (some rounded grains), poorly sorted, trace gravel/sandstone fragments, trace yellow sandy pockets. Silty from 19 to 23 m.
26	30.5	SAND	Pale red, yellow-brown, fine to medium grained, sub-rounded to rounded, poorly sorted. Minor silt, gravel and sandstone clasts with trace hard/silicified fragments and light grey clay bands. Unconsolidated.
30.5	33.5	SAND/SANDSTONE	Red-brown, fine to medium grained. Very weakly cemented with trace silicified layers.
33.5	50.5	SANDSTONE	Pale red-brown, light grey, fine to medium grained (trace gravel), sub-angular, poorly sorted, silty to clayey in parts. Layered, weakly to moderately cemented with minor silicified layers, unconsolidated in parts. Note top of rock logged at 30.55 m.
Core loss, of at least 0.25 m, recorded at 17.65, 18.9, 25, 29.35,40.25, 41.75, 42.5, 44, 46.5, and 55.1 m.			<b>E.O.H 50.5 m</b>
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (on-site from 18 – 44.5 m)			





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# CHAIN OF CUSTODY AND ANALYSIS REQUEST



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# CHAIN OF CUSTODY AND ANALYSIS REQUEST

Page: 1 of 1



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# CHAIN OF CUSTODY AND ANALYSIS REQUEST

Environmental Division  
Perth  
Work Order

**EP1108733**



Telephone : +61-8-9209 7655

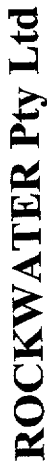




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# CHAIN OF CUSTODY AND ANALYSIS REQUEST

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Environmental Division  
Perth

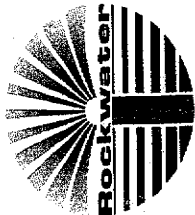
## Work Order

**EP1108795**



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## CHAIN OF CUSTODY AND ANALYSIS REQUEST

CLIENT: <b>WEL</b>	CLIENT No.: <b>368-0-2A</b>	ALS (Australian Lab. Services)
PROJECT NAME: <b>JPP #68</b>	COLLECTOR'S NAME: <b>CKJF</b>	10 Hod Way, Malaga WA 6090
LABORATORY JOB No.:	ORDER/QUOTE No. (circle): <b>EP-SS-11</b>	Ph: 9209 7655 Fax: 9209 7600

General Sample Information						Preservation Method			Analyses Required			Additional Notes/Comments	
Sample I.D.	Lab. No.	Sample Date	Sample Time	Field EC (µS/cm)	Field pH	No. of Containers	Ice	Acidified	Other (name)	Major Components Analysis*	Comprehensive Analysis*		
P-25	1	10-12-11	12:45	570	7.25	10	✓					EP-SS-11	Please note that for some samples 10/11/12 = 10/12/11  Please DO NOT analyse for nitrites if samples out of their holding time
P-17	2	10-12-11	10:15	657	7.44	10	✓					✓	
DP-17	3	10-12-11	10:15	657	7.44	10	✓					✓	
U-31	4	10-12-11	8:30	802	6.88	10	✓					✓	
U-25	5	10-12-11	12:30	326	7.14	10	✓					✓	
Environmental Division Perth Work Order <b>EP1108768</b>													
Received by: <b>W. D. Feret</b> Date/Time: <b>11/12/11 16:00</b>													
Relinquished by: <b>J. FERET</b> Date/Time: <b>11/12/11 11:22</b>													
Received by:													
Date/Time:													



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## CHAIN OF CUSTODY AND ANALYSIS REQUEST

[illegible]Environmental Division  
Perth

## Work Order

**EP1108806**



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Page:

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<b>CLIENT:</b>	Woodside	<b>CLIENT No.:</b>	368-0-1	<b>ALS (Australian Lab. Services)</b> <b>10 Hod Way, Malaga WA 6090</b> <b>Ph: 9209 7655</b> <b>Fax: 9209 7600</b>
<b>PROJECT NAME:</b>	JPP Water Sampling	<b>COLLECTOR'S NAME:</b>	DS	
<b>LABORATORY JOB No.:</b>		<b>ORDER/QUOTE No. (circle):</b>	EP/513/10 (use EP-001-09 if 1 of 2 normal suites* is analysed)	

General Sample Information							Preservation Method			Analyses Required						Additional Notes/Comments
Sample I.D.	Lab. No.	Sample Date	Sample Time	Field EC (µS/cm)	Field pH	No. of Containers	Ice	Acidified	Other (name)	Major Components*	Comprehensive Analysis*					
BH6x	1	28/7/11	13:01	469	5.81	3	Y				Y					
Relinquished by: Daisy							Received by:			Comments:						
Date/Time: 29/07/2011 14:30							Date/Time:									
Relinquished by:							Received by:			Comments:						
Date/Time:							Date/Time:									



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# CHAIN OF CUSTODY AND ANALYSIS REQUEST

CLIENT: Woodside							CLIENT No.: 368-0-1		ALS (Australian Lab. Services) 10 Hod Way, Malaga WA 6090 Ph: 9209 7655 Fax: 9209 7600					
PROJECT NAME: JPP Water Sampling							COLLECTOR'S NAME: DS							
LABORATORY JOB No.:							ORDER/QUOTE No. (circle): EP/513/10 <small>(use EP-001-09 if 1 of 2 normal suites* is analysed)</small>							
General Sample Information							Preservation Method		Analyses Required					Additional Notes/Comments
Sample I.D.	Lab. No.	Sample Date	Sample Time	Field EC ( $\mu\text{S}/\text{cm}$ )	Field pH	No. of Containers	Ice	Acidified	Other (name)	Major Components*	Comprehensive Analysis*			
BOREX1	1	9/6/11	9:50	3,281	5.81	3	Y				Y			
BOREX	2	9/6/11	14:30	7,185	4.97	3	Y				Y			
Relinquished by: Daisy							Received by:		Comments:					
Date/Time:	13/06/2011 8:30			Date/Time:										
Relinquished by:							Received by:		Comments:					
Date/Time:				Date/Time:										





## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108705</b>	<b>Page</b>	: 1 of 5
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	: Environmental Division Perth
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	: Scott James
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	: 10 Hod Way Malaga WA Australia 6090
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	: perth.enviro.services@alsglobal.com
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	: +61-8-9209 7655
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	: +61-8-9209 7600
<b>Project</b>	<b>: 368-0-2A</b>	<b>QC Level</b>	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	: 12-DEC-2011
<b>Sampler</b>	<b>: C.K &amp; J.F</b>	<b>Issue Date</b>	: 20-DEC-2011
<b>Site</b>	<b>: JPP #68</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	: 3
		<b>No. of samples analysed</b>	: 3

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

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Scott James	Laboratory Manager	Perth Inorganics

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## General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK061/EK067: LOR for samples raised due to the high amount of NO<sub>x</sub> present.**
- **EP002: It has been noted that DOC is greater than TOC for sample ID's 'AD-16' and 'N-4', however, these differences are 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.**



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AD-16	O-10	N-4	----	----
				08-DEC-2011 09:00	08-DEC-2011 11:15	08-DEC-2011 12:45	----	----
Compound	CAS Number	LOR	Unit	EP1108705-001	EP1108705-002	EP1108705-003	----	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	7.59	7.36	7.75	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	439	465	495	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	420	495	513	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	45	34	32	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.251	0.311	0.270	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	71	45	84	----	----
Total Alkalinity as CaCO3	----	1	mg/L	71	45	84	----	----
<b>ED040F: Dissolved Major Anions</b>								
Silicon	7440-21-3	0.05	mg/L	18.2	37.4	35.2	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4	20	12	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	79	82	77	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	13	7	8	----	----
Magnesium	7439-95-4	1	mg/L	3	4	3	----	----
Sodium	7440-23-5	1	mg/L	65	83	92	----	----
Potassium	7440-09-7	1	mg/L	1	1	1	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.11	0.68	0.05	----	----
Arsenic	7440-38-2	0.001	mg/L	0.003	0.006	0.011	----	----
Barium	7440-39-3	0.001	mg/L	0.035	0.030	0.066	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L	0.013	0.007	0.007	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	0.023	0.014	0.016	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Strontium	7440-24-6	0.001	mg/L	0.158	0.072	0.063	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AD-16	O-10	N-4	----	----
				08-DEC-2011 09:00	08-DEC-2011 11:15	08-DEC-2011 12:45	----	----
Compound	CAS Number	LOR	Unit	EP1108705-001	EP1108705-002	EP1108705-003	----	----
<b>EG020F: Dissolved Metals by ICP-MS - Continued</b>								
Zinc	7440-66-6	0.005	mg/L	0.052	0.009	0.020	----	----
Boron	7440-42-8	0.05	mg/L	0.11	0.22	0.18	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	0.24	<0.05	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	<0.05	<0.05	<0.05	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	39.0	80.1	75.4	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	50.1	95.6	93.1	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	<0.05	0.24	<0.05	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	<0.1	0.2	0.3	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.14	0.12	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	0.15	0.09	0.03	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	2.57	5.28	5.27	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	2.72	5.37	5.30	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.9	0.8	0.5	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
Total Nitrogen as N	----	0.1	mg/L	3.6	6.2	5.8	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.05	0.12	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	0.01	0.02	0.04	----	----
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	----	----
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	3.73	3.63	4.10	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AD-16	O-10	N-4	----	----
				08-DEC-2011 09:00	08-DEC-2011 11:15	08-DEC-2011 12:45	----	----
Compound	CAS Number	LOR	Unit	EP1108705-001	EP1108705-002	EP1108705-003	----	----
<b>EN055: Ionic Balance - Continued</b>								
Total Cations	----	0.01	meq/L	3.75	4.31	4.67	----	----
Ionic Balance	----	0.01	%	0.22	8.61	6.50	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	13	7	5	----	----
<b>EP005: Total Organic Carbon (TOC)</b>								
Total Organic Carbon	----	1	mg/L	11	7	3	----	----
<b>EP006 Total Inorganic Carbon</b>								
Total Inorganic Carbon	----	1	mg/L	23	18	28	----	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108806</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: JJP #68</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 14-DEC-2011</b>
<b>Sampler</b>	<b>: CK/JF</b>	<b>Issue Date</b>	<b>: 22-DEC-2011</b>
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 3</b>
		<b>No. of samples analysed</b>	<b>: 3</b>

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

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Scott James	Laboratory Manager	Perth Inorganics

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## General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK061G/EK067G: LOR for various samples raised due to the high amount of NOx present.**
- **EP002: It has been noted that DOC is greater than TOC for sample ID 'AP-36', however, this difference is within the limits of experimental variation.**
- **It is recognised that total phosphorus is less than reactive phosphorus for sample AP-36. However, the difference is within experimental variation of the methods.**





## Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				AD-28	FB-2	AP-36		
				13-DEC-2011 08:30	13-DEC-2011 10:00	13-DEC-2011 10:30	----	----
Compound	CAS Number	LOR	Unit	EP1108806-001	EP1108806-002	EP1108806-003	----	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	7.47	5.95	7.87	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	327	<1	1020	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	197	<5	687	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	42	<1	50	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.190	0.019	0.693	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	61	<1	150	----	----
Total Alkalinity as CaCO3	----	1	mg/L	61	<1	150	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4	<1	33	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	54	<1	216	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	12	<1	12	----	----
Magnesium	7439-95-4	1	mg/L	3	<1	5	----	----
Sodium	7440-23-5	1	mg/L	49	<1	207	----	----
Potassium	7440-09-7	1	mg/L	1	<1	2	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.09	<0.01	1.35	----	----
Arsenic	7440-38-2	0.001	mg/L	0.004	<0.001	0.011	----	----
Barium	7440-39-3	0.001	mg/L	0.035	<0.001	0.021	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	0.001	0.001	----	----
Copper	7440-50-8	0.001	mg/L	0.004	0.003	0.003	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	0.015	<0.001	0.013	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Strontium	7440-24-6	0.001	mg/L	0.099	<0.001	0.089	----	----
Zinc	7440-66-6	0.005	mg/L	0.009	0.011	0.005	----	----
Boron	7440-42-8	0.05	mg/L	0.08	0.09	0.42	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.38	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AD-28	FB-2	AP-36		
				13-DEC-2011 08:30	13-DEC-2011 10:00	13-DEC-2011 10:30	----	----
Compound	CAS Number	LOR	Unit	EP1108806-001	EP1108806-002	EP1108806-003	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	<0.05	<0.05	<b>0.05</b>	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	<b>43.1</b>	<b>0.6</b>	<b>74.8</b>	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	<b>57.2</b>	<b>0.86</b>	<b>92.4</b>	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	<0.05	<0.05	<b>0.33</b>	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	<b>0.3</b>	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	<b>0.06</b>	<0.01	<b>0.15</b>	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	<b>0.05</b>	<0.01	<b>0.13</b>	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	<b>3.39</b>	<b>0.02</b>	<b>3.87</b>	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	<b>3.44</b>	<b>0.02</b>	<b>4.00</b>	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<b>0.9</b>	<0.1	<0.5	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	<b>4.3</b>	<0.1	<b>4.0</b>	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.01	<b>0.06</b>	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	<b>0.02</b>	<0.01	<b>0.08</b>	----	----
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	----	----
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	<b>2.83</b>	<b>0.08</b>	<b>9.78</b>	----	----
Total Cations	----	0.01	meq/L	<b>3.00</b>	<0.01	<b>10.1</b>	----	----
Ionic Balance	----	0.01	%	<b>3.02</b>	----	<b>1.42</b>	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	<b>7</b>	<1	<b>11</b>	----	----



Analytical Results

Sub-Matrix: WATER

				Client sample ID	AD-28	FB-2	AP-36		
				Client sampling date / time	13-DEC-2011 08:30	13-DEC-2011 10:00	13-DEC-2011 10:30	----	----
Compound	CAS Number	LOR	Unit		EP1108806-001	EP1108806-002	EP1108806-003	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		7	<1	9	----	----
EP006 Total Inorganic Carbon									
Total Inorganic Carbon	----	1	mg/L		18	<1	46	----	----

## CERTIFICATE OF ANALYSIS

Work Order	: EP1107653	Page	: 1 of 5
Amendment	: 1		
Client	: ROCKWATER PTY LTD	Laboratory	: Environmental Division Perth
Contact	: CONSULT	Contact	: Scott James
Address	: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014	Address	: 10 Hod Way Malaga WA Australia 6090
E-mail	: consult@rockwater.com.au	E-mail	: perth.enviro.services@alsglobal.com
Telephone	: +61 08 9284 0222	Telephone	: +61-8-9209 7655
Facsimile	: +61 9284 1785	Facsimile	: +61-8-9209 7600
Project	: JPP 68	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 04-NOV-2011
Sampler	: AM & DS	Issue Date	: 23-NOV-2011
Site	: ----		
Quote number	: EP/580/11	No. of samples received	: 3
		No. of samples analysed	: 3

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.

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- General Comments
- Analytical Results



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

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
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Nikki Stepniewski	Senior Inorganic Instrument Chemist	Melbourne Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Stephen Hislop	Senior Inorganic Chemist	WB Water Lab Brisbane



## General Comments

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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

- **EP005 : Total organic carbon results for EP1107653 have been confirmed by re-preparation and re-analysis.**
- **TOC conducted by ALS Melbourne, NATA accreditation no. 825, site no 13778**



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				<b>AE-10</b>	<b>P-17</b>	<b>U-10</b>		
				04-NOV-2011 14:30	04-NOV-2011 10:25	04-NOV-2011 13:00	----	----
<i>Compound</i>	<i>CAS Number</i>	<i>LOR</i>	<i>Unit</i>	<b>EP1107653-001</b>	<b>EP1107653-002</b>	<b>EP1107653-003</b>	----	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	<b>9.21</b>	<b>7.76</b>	<b>7.57</b>	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	<b>906</b>	<b>915</b>	<b>630</b>	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	<b>722</b>	<b>526</b>	<b>458</b>	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	<b>5</b>	<b>23</b>	<b>29</b>	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	<b>0.240</b>	<b>0.350</b>	<b>0.232</b>	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<b>85</b>	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<b>185</b>	<b>261</b>	<b>144</b>	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<b>270</b>	<b>261</b>	<b>144</b>	----	----
<b>ED040F: Dissolved Major Anions</b>								
Silicon	7440-21-3	0.05	mg/L	<b>26.5</b>	<b>34.4</b>	<b>27.6</b>	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<b>51</b>	<b>33</b>	<b>17</b>	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	<b>80</b>	<b>91</b>	<b>88</b>	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	<b>2</b>	<b>6</b>	<b>5</b>	----	----
Magnesium	7439-95-4	1	mg/L	<1	<b>2</b>	<b>4</b>	----	----
Sodium	7440-23-5	1	mg/L	<b>209</b>	<b>201</b>	<b>132</b>	----	----
Potassium	7440-09-7	1	mg/L	<b>1</b>	<b>3</b>	<b>1</b>	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	<b>0.13</b>	<b>45.8</b>	<b>0.56</b>	----	----
Arsenic	7440-38-2	0.001	mg/L	<b>0.012</b>	<b>0.043</b>	<b>0.003</b>	----	----
Barium	7440-39-3	0.001	mg/L	<b>0.011</b>	<b>0.050</b>	<b>0.048</b>	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<b>0.0002</b>	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<b>0.037</b>	<0.001	----	----
Copper	7440-50-8	0.001	mg/L	<b>0.013</b>	<b>0.057</b>	<b>0.008</b>	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<b>0.022</b>	<b>0.002</b>	----	----
Manganese	7439-96-5	0.001	mg/L	<b>0.025</b>	<b>0.421</b>	<b>0.106</b>	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----

Sub-Matrix: **WATER**

*Client sample ID*

Client sampling date / time

Sub-Matrix: WATER	Client sample ID			AE-10	P-17	U-10	----	----
	Client sampling date / time			04-NOV-2011 14:30	04-NOV-2011 10:25	04-NOV-2011 13:00	----	----
Compound	CAS Number	LOR	Unit	EP1107653-001	EP1107653-002	EP1107653-003	----	----
EG020F: Dissolved Metals by ICP-MS - Continued								
Strontium	7440-24-6	0.001	mg/L	0.028	0.050	0.104	----	----
Zinc	7440-66-6	0.005	mg/L	0.005	0.066	0.017	----	----
Boron	7440-42-8	0.05	mg/L	0.18	0.38	0.16	----	----
Iron	7439-89-6	0.05	mg/L	0.08	15.4	0.34	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
EG051G: Ferrous Iron by Discrete Analyser								
Ferrous Iron	----	0.05	mg/L	<0.05	0.28	0.33	----	----
EG052F: Dissolved Silica by ICPAES								
Silica	7631-86-9	0.1	mg/L	56.8	73.7	59.1	----	----
EG052G: Silica by Discrete Analyser								
Reactive Silica	----	0.10	mg/L	69.2	74.8	76.7	----	----
EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA								
Ferric Iron	----	0.05	mg/L	0.08	15.1	<0.05	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.3	0.9	0.1	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.19	3.14	0.19	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	0.14	0.70	0.04	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	3.39	1.43	4.16	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	3.53	2.13	4.20	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.4	9.7	3.4	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
Total Nitrogen as N	----	0.1	mg/L	4.9	11.8	7.6	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	1.39	22.8	0.13	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	0.45	20.1	0.03	----	----
EK085M: Sulfide as S2-								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	----	----
EN055: Ionic Balance								





Analytical Results

Sub-Matrix: WATER

				Client sample ID				
				Client sampling date / time	AE-10	P-17	U-10	
					04-NOV-2011 14:30	04-NOV-2011 10:25	04-NOV-2011 13:00	
Compound	CAS Number	LOR	Unit		EP1107653-001	EP1107653-002	EP1107653-003	
EN055: Ionic Balance - Continued								
Total Anions	----	0.01	meq/L		8.71	8.47	5.71	----
Total Cations	----	0.01	meq/L		9.22	9.28	6.35	----
Ionic Balance	----	0.01	%		2.75	4.54	5.20	----
EP002: Dissolved Organic Carbon (DOC)								
Dissolved Organic Carbon	----	1	mg/L		60	124	55	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L		21	77	8	----
EP006 Total Inorganic Carbon								
Total Inorganic Carbon	----	1	mg/L		51	54	42	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1107664</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: JPP # 68</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 04-NOV-2011</b>
<b>Sampler</b>	<b>: AM/DS</b>	<b>Issue Date</b>	<b>: 14-NOV-2011</b>
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 2</b>
		<b>No. of samples analysed</b>	<b>: 2</b>

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

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Scott James	Laboratory Manager	Perth Inorganics

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## General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK061/67G: LOR for samples raised due to the high amount of NOx present.**
- **It has been noted that Reactive Phosphorus is greater than Total Phosphorus for sample AP-10, however this difference is within the limits of experimental variation.**



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AP-10	AD-10			
				03-NOV-2011 10:00	03-NOV-2011 15:00			
Compound	CAS Number	LOR	Unit	EP1107664-001	EP1107664-002			
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	6.47	5.57	----	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	270	275	----	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	196	192	----	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	27	24	----	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.201	0.209	----	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	24	<1	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	24	<1	----	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	3	1	----	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	55	70	----	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	6	3	----	----	----
Magnesium	7439-95-4	1	mg/L	3	4	----	----	----
Sodium	7440-23-5	1	mg/L	42	42	----	----	----
Potassium	7440-09-7	1	mg/L	1	<1	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.02	<0.01	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	----	----	----
Barium	7440-39-3	0.001	mg/L	0.069	0.059	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	0.0005	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	0.007	0.007	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.212	0.008	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	----	----
Strontium	7440-24-6	0.001	mg/L	0.078	0.117	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.045	0.008	----	----	----
Boron	7440-42-8	0.05	mg/L	0.09	0.09	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	----	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	AP-10	AD-10			
				03-NOV-2011 10:00	03-NOV-2011 15:00			
				EP1107664-001	EP1107664-002			
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	<0.05	<0.05	----	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	<b>64.9</b>	<b>46.7</b>	----	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	<b>83.1</b>	<b>57.4</b>	----	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	<0.05	<0.05	----	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	----	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	<b>0.01</b>	<0.01	----	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	<0.01	<0.01	----	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	<b>3.62</b>	<b>3.95</b>	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	<b>3.62</b>	<b>3.95</b>	----	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<b>0.8</b>	<0.5	----	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	<b>4.4</b>	<b>4.0</b>	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<b>0.28</b>	<0.05	----	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	<b>0.36</b>	<b>0.01</b>	----	----	----
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	----	----	----
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	<b>2.09</b>	<b>2.00</b>	----	----	----
Total Cations	----	0.01	meq/L	<b>2.40</b>	<b>2.31</b>	----	----	----
Ionic Balance	----	0.01	%	----	<b>7.20</b>	----	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	<b>10</b>	<1	----	----	----



Analytical Results

Sub-Matrix: WATER

				Client sample ID				
				Client sampling date / time	AP-10	AD-10		
					03-NOV-2011 10:00	03-NOV-2011 15:00	----	----
Compound	CAS Number	LOR	Unit		EP1107664-001	EP1107664-002	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L		1	<1	----	----
EP006 Total Inorganic Carbon								
Total Inorganic Carbon	----	1	mg/L		14	13	----	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108633</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
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<b>Project</b>	<b>: JPP #68</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 08-DEC-2011</b>
<b>Sampler</b>	<b>: CKJF</b>	<b>Issue Date</b>	<b>: 20-DEC-2011</b>
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 3</b>
		<b>No. of samples analysed</b>	<b>: 3</b>

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



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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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Scott James	Laboratory Manager	Perth Inorganics

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## General Comments

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **ED041G: Poor matrix spike recovery due to matrix affects. Spike has been confirmed by re-analysis**
- **EK067G: LOR for sample I-16 raised due to the high amount of NOx present.**
- **It is recognised that total phosphorus is less than reactive phosphorus for sample I-16. However, the difference is within experimental variation of the methods.**
- **TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AP-14	DP-14	I-16		
				07-DEC-2011 09:00	07-DEC-2011 10:30	07-DEC-2011 12:30	----	----
Compound	CAS Number	LOR	Unit	EP1108633-001	EP1108633-002	EP1108633-003	----	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	7.52	7.47	7.60	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	346	337	391	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	364	351	352	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	38	38	42	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.164	0.165	0.211	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	61	57	66	----	----
Total Alkalinity as CaCO3	----	1	mg/L	61	57	66	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	10	11	2	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	51	52	64	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	12	12	12	----	----
Magnesium	7439-95-4	1	mg/L	2	2	3	----	----
Sodium	7440-23-5	1	mg/L	54	54	59	----	----
Potassium	7440-09-7	1	mg/L	1	1	1	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.35	2.11	0.46	----	----
Arsenic	7440-38-2	0.001	mg/L	0.004	0.005	0.005	----	----
Barium	7440-39-3	0.001	mg/L	0.038	0.040	0.057	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L	0.033	0.043	0.008	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	0.020	0.022	0.035	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Strontium	7440-24-6	0.001	mg/L	0.094	0.103	0.092	----	----
Zinc	7440-66-6	0.005	mg/L	0.116	0.104	0.024	----	----
Boron	7440-42-8	0.05	mg/L	0.10	0.10	0.07	----	----
Iron	7439-89-6	0.05	mg/L	0.12	0.75	0.10	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AP-14	DP-14	I-16		
				07-DEC-2011 09:00	07-DEC-2011 10:30	07-DEC-2011 12:30	----	----
Compound	CAS Number	LOR	Unit	EP1108633-001	EP1108633-002	EP1108633-003	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	<0.05	<0.05	<0.05	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	55.1	55.1	47.1	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	71.8	72.2	61.9	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	0.12	0.75	0.10	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.1	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.05	0.03	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	0.02	0.02	0.03	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	2.02	2.08	2.38	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	2.04	2.10	2.41	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.8	0.7	0.8	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	2.8	2.8	3.2	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	1.11	0.95	<0.05	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	0.01	0.01	0.05	----	----
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	----	----
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	2.87	2.83	3.17	----	----
Total Cations	----	0.01	meq/L	3.14	3.14	3.44	----	----
Ionic Balance	----	0.01	%	4.51	5.06	4.10	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	16	17	6	----	----



Analytical Results

Sub-Matrix: WATER

				Client sample ID	AP-14	DP-14	I-16		
				Client sampling date / time	07-DEC-2011 09:00	07-DEC-2011 10:30	07-DEC-2011 12:30	----	----
Compound	CAS Number	LOR	Unit		EP1108633-001	EP1108633-002	EP1108633-003	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		16	18	6	----	----
EP006 Total Inorganic Carbon									
Total Inorganic Carbon	----	1	mg/L		22	22	21	----	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108733</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: JPP 78</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 12-DEC-2011</b>
<b>Sampler</b>	<b>: CK/JF</b>	<b>Issue Date</b>	<b>: 20-DEC-2011</b>
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 3</b>
		<b>No. of samples analysed</b>	<b>: 3</b>

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

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Scott James	Laboratory Manager	Perth Inorganics

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## General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK061G/EK067G: LOR for samples raised due to the high amount of NOx present.**
- **EP002: It has been noted that DOC is greater than TOC for sample ID 'AP-20', however, this difference is within the limits of experimental variation.**



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AP-20	DAP-20	AD-20		
				11-DEC-2011 10:30	11-DEC-2011 10:30	11-DEC-2011 08:00	----	----
Compound	CAS Number	LOR	Unit	EP1108733-001	EP1108733-002	EP1108733-003	----	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	7.68	7.43	7.49	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	446	415	464	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	311	269	321	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	71	69	54	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.244	0.232	0.262	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	85	70	81	----	----
Total Alkalinity as CaCO3	----	1	mg/L	85	70	81	----	----
<b>ED040F: Dissolved Major Anions</b>								
Silicon	7440-21-3	0.05	mg/L	31.4	32.6	32.5	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	8	6	14	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	69	66	81	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	22	21	15	----	----
Magnesium	7439-95-4	1	mg/L	4	4	4	----	----
Sodium	7440-23-5	1	mg/L	58	54	65	----	----
Potassium	7440-09-7	1	mg/L	1	1	2	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.68	5.85	0.36	----	----
Arsenic	7440-38-2	0.001	mg/L	0.005	0.006	0.006	----	----
Barium	7440-39-3	0.001	mg/L	0.037	0.046	0.050	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	0.004	<0.001	----	----
Copper	7440-50-8	0.001	mg/L	0.008	0.013	0.007	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	0.003	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	0.012	0.018	0.015	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Strontium	7440-24-6	0.001	mg/L	0.159	0.160	0.128	----	----





## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AP-20	DAP-20	AD-20		
				11-DEC-2011 10:30	11-DEC-2011 10:30	11-DEC-2011 08:00	----	----
Compound	CAS Number	LOR	Unit	EP1108733-001	EP1108733-002	EP1108733-003	----	----
<b>EG020F: Dissolved Metals by ICP-MS - Continued</b>								
Zinc	7440-66-6	0.005	mg/L	0.016	0.028	0.028	----	----
Boron	7440-42-8	0.05	mg/L	0.11	0.10	0.16	----	----
Iron	7439-89-6	0.05	mg/L	0.18	1.85	0.08	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	<0.05	<0.05	<0.05	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	67.3	69.9	69.6	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	87.2	86.9	89.8	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	0.18	1.85	0.08	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	0.1	<0.1	0.1	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	0.07	0.05	0.09	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	0.08	0.06	0.07	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	2.66	2.90	3.34	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	2.74	2.96	3.41	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	0.8	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
Total Nitrogen as N	----	0.1	mg/L	2.7	3.0	4.2	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<0.05	0.17	<0.05	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	0.03	0.03	0.04	----	----
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	----	----
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	3.81	3.39	4.19	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AP-20	DAP-20	AD-20		
				11-DEC-2011 10:30	11-DEC-2011 10:30	11-DEC-2011 08:00	----	----
Compound	CAS Number	LOR	Unit	EP1108733-001	EP1108733-002	EP1108733-003	----	----
<b>EN055: Ionic Balance - Continued</b>								
Total Cations	----	0.01	meq/L	3.98	3.75	3.96	----	----
Ionic Balance	----	0.01	%	2.10	5.12	2.94	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	15	13	7	----	----
<b>EP005: Total Organic Carbon (TOC)</b>								
Total Organic Carbon	----	1	mg/L	13	14	7	----	----
<b>EP006 Total Inorganic Carbon</b>								
Total Inorganic Carbon	----	1	mg/L	26	23	21	----	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108795</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: 368-0-2A</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 13-DEC-2011</b>
<b>Sampler</b>	<b>: CKJM</b>	<b>Issue Date</b>	<b>: 22-DEC-2011</b>
<b>Site</b>	<b>: JPP #68</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 4</b>
		<b>No. of samples analysed</b>	<b>: 4</b>

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

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics

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## General Comments

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK061G/EK067G: LOR for various samples raised due to the high amount of NOx present.**
- **EP002: It has been noted that DOC is greater than TOC for sample ID 'AP-28', however, this difference is within the limits of experimental variation.**
- **It is recognised that total Phosphorus (EK067G) is less than Reactive Phosphorus (EK071G) for samples 'AP-36'. However, the difference is within experimental variation of the methods.**



## Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				AP-28	AP-24	AP-32	FB-1	----
				12-DEC-2011 09:00	12-DEC-2011 10:30	12-DEC-2011 12:00	12-DEC-2011 13:00	----
Compound	CAS Number	LOR	Unit	EP1108795-001	EP1108795-002	EP1108795-003	EP1108795-004	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	7.21	7.22	6.97	6.05	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	596	393	1080	1	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	467	372	714	<5	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	55	22	61	<1	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.418	0.211	0.898	<0.010	----
<b>ED037P: Alkalinity by PC Titrator</b>								
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	73	74	70	<1	----
Total Alkalinity as CaCO3	----	1	mg/L	73	74	70	<1	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	5	3	33	<1	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	118	58	277	<1	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	12	4	8	<1	----
Magnesium	7439-95-4	1	mg/L	6	3	10	<1	----
Sodium	7440-23-5	1	mg/L	94	76	208	<1	----
Potassium	7440-09-7	1	mg/L	2	<1	2	<1	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.07	0.36	0.78	<0.01	----
Arsenic	7440-38-2	0.001	mg/L	0.006	0.007	<0.001	<0.001	----
Barium	7440-39-3	0.001	mg/L	0.046	0.054	0.058	<0.001	----
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	----
Copper	7440-50-8	0.001	mg/L	0.010	0.019	0.003	0.001	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Manganese	7439-96-5	0.001	mg/L	0.024	0.025	0.062	<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	0.141	0.052	0.209	<0.001	----
Zinc	7440-66-6	0.005	mg/L	0.097	0.020	0.042	0.018	----
Boron	7440-42-8	0.05	mg/L	0.14	0.13	0.25	0.34	----
Iron	7439-89-6	0.05	mg/L	<0.05	0.12	0.18	<0.05	----



## Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				AP-28	AP-24	AP-32	FB-1	
				12-DEC-2011 09:00	12-DEC-2011 10:30	12-DEC-2011 12:00	12-DEC-2011 13:00	----
Compound	CAS Number	LOR	Unit	EP1108795-001	EP1108795-002	EP1108795-003	EP1108795-004	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	<0.05	0.12	<0.05	<0.05	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	52.3	67.9	76.7	4.5	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	59.2	75.5	82.9	5.11	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	<0.05	<0.05	0.18	<0.05	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	<0.1	0.1	0.1	<0.1	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	0.08	0.06	0.03	0.02	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	0.05	0.03	0.09	<0.01	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	4.47	2.70	11.2	<0.01	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	4.52	2.73	11.3	<0.01	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.3	0.5	<0.5	<0.1	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	5.8	3.2	11.3	<0.1	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.05	0.43	0.03	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	0.02	0.03	<0.01	<0.01	----
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	4.89	3.18	9.90	<0.01	----
Total Cations	----	0.01	meq/L	5.23	3.75	10.3	<0.01	----
Ionic Balance	----	0.01	%	3.35	8.26	2.06	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	11	13	1	<1	----



Analytical Results

Sub-Matrix: WATER

				Client sample ID	AP-28	AP-24	AP-32	FB-1	
				Client sampling date / time	12-DEC-2011 09:00	12-DEC-2011 10:30	12-DEC-2011 12:00	12-DEC-2011 13:00	----
Compound	CAS Number	LOR	Unit		EP1108795-001	EP1108795-002	EP1108795-003	EP1108795-004	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		9	14	1	<1	----
EP006 Total Inorganic Carbon									
Total Inorganic Carbon	----	1	mg/L		25	27	31	<1	----





## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108513</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: JPP</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 06-DEC-2011</b>
<b>Sampler</b>	<b>: CK</b>	<b>Issue Date</b>	<b>: 14-DEC-2011</b>
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 2</b>
		<b>No. of samples analysed</b>	<b>: 2</b>

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

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics
Nikki Stepniewski	Senior Inorganic Instrument Chemist	Melbourne Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics

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## General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- 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.



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				F-14	AP-12			
				04-DEC-2011 09:00	04-DEC-2011 12:30			
Compound	CAS Number	LOR	Unit	EP1108513-001	EP1108513-002			
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	6.81	6.68	----	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	784	278	----	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	603	555	----	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	40	16	----	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.750	0.226	----	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	77	42	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	77	42	----	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	6	5	----	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	218	54	----	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	8	3	----	----	----
Magnesium	7439-95-4	1	mg/L	5	2	----	----	----
Sodium	7440-23-5	1	mg/L	148	56	----	----	----
Potassium	7440-09-7	1	mg/L	<1	1	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.62	0.52	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.001	----	----	----
Barium	7440-39-3	0.001	mg/L	0.037	0.044	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	0.002	0.010	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.016	0.143	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	----	----
Strontium	7440-24-6	0.001	mg/L	0.139	0.060	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.009	0.059	----	----	----
Boron	7440-42-8	0.05	mg/L	0.19	0.10	----	----	----
Iron	7439-89-6	0.05	mg/L	0.18	0.37	----	----	----



## Analytical Results

Sub-Matrix: **WATER**

				Client sample ID	F-14	AP-12			
				Client sampling date / time	04-DEC-2011 09:00	04-DEC-2011 12:30			
Compound	CAS Number	LOR	Unit		EP1108513-001	EP1108513-002			
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	----	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>									
Ferrous Iron	----	0.05	mg/L		<0.05	0.25	----	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>									
Silica	7631-86-9	0.1	mg/L		45.0	66.0	----	----	----
<b>EG052G: Silica by Discrete Analyser</b>									
Reactive Silica	----	0.10	mg/L		54.1	76.8	----	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>									
Ferric Iron	----	0.05	mg/L		0.18	0.12	----	----	----
<b>EK040P: Fluoride by PC Titrator</b>									
Fluoride	16984-48-8	0.1	mg/L		<0.1	<0.1	----	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>									
Ammonia as N	7664-41-7	0.01	mg/L		0.05	0.04	----	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>									
Nitrite as N	----	0.01	mg/L		0.01	<0.01	----	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>									
Nitrate as N	14797-55-8	0.01	mg/L		3.49	2.94	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L		3.50	2.94	----	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		1.4	0.9	----	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L		4.9	3.8	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L		0.20	0.18	----	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>									
Reactive Phosphorus as P	----	0.01	mg/L		<0.01	<0.01	----	----	----
<b>EK085M: Sulfide as S2-</b>									
Sulfide as S2-	18496-25-8	0.1	mg/L		<0.1	<0.1	----	----	----
<b>EN055: Ionic Balance</b>									
Total Anions	----	0.01	meq/L		7.81	2.47	----	----	----
Total Cations	----	0.01	meq/L		7.25	2.78	----	----	----
Ionic Balance	----	0.01	%		3.77	----	----	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>									
Dissolved Organic Carbon	----	1	mg/L		2	10	----	----	----



Analytical Results

Sub-Matrix: WATER

				Client sample ID	F-14	AP-12			
				Client sampling date / time	04-DEC-2011 09:00	04-DEC-2011 12:30			
Compound	CAS Number	LOR	Unit		EP1108513-001	EP1108513-002			
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		1	1	----	----	----
EP006 Total Inorganic Carbon									
Total Inorganic Carbon	----	1	mg/L		12	9	----	----	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1107604</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: JPP # 68</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 03-NOV-2011</b>
<b>Sampler</b>	<b>: AM/DS</b>	<b>Issue Date</b>	<b>: 10-NOV-2011</b>
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 3</b>
		<b>No. of samples analysed</b>	<b>: 3</b>

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.

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- Analytical Results



NATA Accredited Laboratory 825

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### Signatories

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<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK061/67G: LOR for samples raised due to the high amount of NOx present.**



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				P-21	P-29	U-20		
				01-NOV-2011 13:25	01-NOV-2011 11:35	01-NOV-2011 09:25	----	----
Compound	CAS Number	LOR	Unit	EP1107604-001	EP1107604-002	EP1107604-003	----	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	7.65	7.24	7.58	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	613	912	736	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	439	599	552	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	16	50	22	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.308	0.712	0.435	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	121	82	119	----	----
Total Alkalinity as CaCO3	----	1	mg/L	121	82	119	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	73	36	32	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	101	219	137	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	3	7	4	----	----
Magnesium	7439-95-4	1	mg/L	2	8	3	----	----
Sodium	7440-23-5	1	mg/L	140	192	170	----	----
Potassium	7440-09-7	1	mg/L	1	2	2	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.16	0.02	1.00	----	----
Arsenic	7440-38-2	0.001	mg/L	0.002	<0.001	0.002	----	----
Barium	7440-39-3	0.001	mg/L	0.014	0.036	0.027	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L	0.001	0.002	0.003	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	0.012	0.012	0.042	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Strontium	7440-24-6	0.001	mg/L	0.056	0.154	0.064	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	0.010	0.008	----	----
Boron	7440-42-8	0.05	mg/L	0.37	0.14	0.24	----	----
Iron	7439-89-6	0.05	mg/L	0.06	<0.05	0.36	----	----





## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				P-21	P-29	U-20		
				01-NOV-2011 13:25	01-NOV-2011 11:35	01-NOV-2011 09:25	----	----
Compound	CAS Number	LOR	Unit	EP1107604-001	EP1107604-002	EP1107604-003	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	<0.05	<0.05	<0.05	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	<b>43.5</b>	<b>36.4</b>	<b>62.6</b>	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	<b>56.0</b>	<b>48.4</b>	<b>79.2</b>	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	<b>0.06</b>	<0.05	<b>0.36</b>	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	<b>0.3</b>	<0.1	<b>0.2</b>	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	<b>0.04</b>	<b>0.08</b>	<b>0.05</b>	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	<b>0.17</b>	<b>0.10</b>	<b>0.16</b>	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	<b>4.54</b>	<b>2.73</b>	<b>6.13</b>	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	<b>4.71</b>	<b>2.83</b>	<b>6.29</b>	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	<b>0.8</b>	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	<b>4.7</b>	<b>2.8</b>	<b>7.1</b>	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.05	<0.05	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	<b>0.02</b>	<0.01	<b>0.03</b>	----	----
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	----	----
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	<b>6.79</b>	<b>8.57</b>	<b>6.91</b>	----	----
Total Cations	----	0.01	meq/L	<b>6.43</b>	<b>9.41</b>	<b>7.89</b>	----	----
Ionic Balance	----	0.01	%	<b>2.74</b>	<b>4.67</b>	<b>6.61</b>	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	<b>4</b>	<b>2</b>	<b>3</b>	----	----



Analytical Results

Sub-Matrix: WATER

				Client sample ID				
				Client sampling date / time	P-21	P-29	U-20	
					01-NOV-2011 13:25	01-NOV-2011 11:35	01-NOV-2011 09:25	
Compound	CAS Number	LOR	Unit		EP1107604-001	EP1107604-002	EP1107604-003	
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L		4	2	3	
EP006 Total Inorganic Carbon								
Total Inorganic Carbon	----	1	mg/L		35	29	33	



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108768</b>	<b>Page</b>	<b>: 1 of 4</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: 368-0-2A</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 13-DEC-2011</b>
<b>Sampler</b>	<b>: CKJF</b>	<b>Issue Date</b>	<b>: 22-DEC-2011</b>
<b>Site</b>	<b>: JPP #68</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 5</b>
		<b>No. of samples analysed</b>	<b>: 5</b>

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

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK067G: LOR for various samples raised due to the high amount of NOx present.**
- **EP002: It has been noted that DOC is greater than TOC for sample ID's 'P-25' and 'V-25', however, these differences are within the limits of experimental variation.**
- **It is recognised that Total Phosphorus (EK067G) is less than Reactive Phosphorus for samples 'P-17' and 'DP-17'. However, the difference is within experimental variation of the methods.**
- **TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**



## Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				P-25	P-17	DP-17	U-31	V-25
				10-DEC-2011 12:15	10-DEC-2011 10:15	10-DEC-2011 10:15	10-DEC-2011 08:30	09-DEC-2011 12:30
Compound	CAS Number	LOR	Unit	EP1108768-001	EP1108768-002	EP1108768-003	EP1108768-004	EP1108768-005
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	7.51	7.76	7.79	7.24	7.54
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	541	623	636	787	491
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	482	937	775	719	451
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	74	23	23	36	66
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.321	0.260	0.261	0.547	0.286
<b>ED037P: Alkalinity by PC Titrator</b>								
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	94	179	185	129	78
Total Alkalinity as CaCO3	----	1	mg/L	94	179	185	129	78
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	8	<1	<1	18	7
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	105	68	67	164	98
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	23	6	6	6	20
Magnesium	7439-95-4	1	mg/L	4	2	2	5	4
Sodium	7440-23-5	1	mg/L	93	135	137	153	81
Potassium	7440-09-7	1	mg/L	2	2	2	<1	2
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.56	2.92	2.44	0.52	0.85
Arsenic	7440-38-2	0.001	mg/L	0.007	0.023	0.022	<0.001	0.003
Barium	7440-39-3	0.001	mg/L	0.046	0.027	0.027	0.021	0.046
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	0.003	0.002	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	0.009	0.003	0.002	0.008	0.018
Lead	7439-92-1	0.001	mg/L	0.001	0.006	0.005	0.002	0.001
Manganese	7439-96-5	0.001	mg/L	0.038	0.104	0.104	0.049	0.018
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	0.131	0.046	0.046	0.124	0.214
Zinc	7440-66-6	0.005	mg/L	0.038	<0.005	0.006	0.040	0.037
Boron	7440-42-8	0.05	mg/L	0.16	0.46	0.46	0.64	0.11
Iron	7439-89-6	0.05	mg/L	0.17	1.19	0.91	0.41	0.29



## Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				P-25	P-17	DP-17	U-31	V-25
				10-DEC-2011 12:15	10-DEC-2011 10:15	10-DEC-2011 10:15	10-DEC-2011 08:30	09-DEC-2011 12:30
Compound	CAS Number	LOR	Unit	EP1108768-001	EP1108768-002	EP1108768-003	EP1108768-004	EP1108768-005
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	0.12	<0.05	<0.05	0.13	0.08
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	52.5	80.1	84.9	71.8	48.9
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	63.4	87.0	87.4	89.8	59.0
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	0.05	1.19	0.91	0.28	0.21
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	0.1	0.9	0.9	0.8	<0.1
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	0.13	1.53	1.45	0.03	0.05
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	3.93	1.84	1.98	5.09	3.06
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.0	3.7	3.3	0.8	0.6
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	4.9	5.5	5.3	5.9	3.7
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	0.06	8.09	8.50	<0.05	<0.05
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	0.06	8.73	9.29	0.02	0.01
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	5.01	5.49	5.59	7.58	4.47
Total Cations	----	0.01	meq/L	5.57	6.39	6.47	7.37	4.90
Ionic Balance	----	0.01	%	5.34	7.47	7.32	1.46	4.61
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	9	42	42	<1	8
<b>EP005: Total Organic Carbon (TOC)</b>								
Total Organic Carbon	----	1	mg/L	7	44	43	<1	6
<b>EP006 Total Inorganic Carbon</b>								
Total Inorganic Carbon	----	1	mg/L	28	52	52	44	25



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108475</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: JPP #68</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 05-DEC-2011</b>
<b>Sampler</b>	<b>: AM/CK</b>	<b>Issue Date</b>	<b>: 14-DEC-2011</b>
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 1</b>
		<b>No. of samples analysed</b>	<b>: 1</b>

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.

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- General Comments
- Analytical Results



NATA Accredited Laboratory 825

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<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics

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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

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- **EK061G/EK067G: LOR for samples raised due to possible matrix interference**





## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				<b>U-16</b>	----	----	----	----
				01-DEC-2011 10:20	----	----	----	----
<i>Compound</i>	<i>CAS Number</i>	<i>LOR</i>	<i>Unit</i>	<b>EP1108475-001</b>	----	----	----	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	<b>7.14</b>	----	----	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	<b>317</b>	----	----	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	<b>231</b>	----	----	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	<b>9</b>	----	----	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	<b>0.134</b>	----	----	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<b>&lt;1</b>	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<b>&lt;1</b>	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<b>80</b>	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<b>80</b>	----	----	----	----
<b>ED040F: Dissolved Major Anions</b>								
Silica	7631-86-9	0.1	mg/L	<b>38.4</b>	----	----	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<b>9</b>	----	----	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	<b>43</b>	----	----	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	<b>2</b>	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<b>1</b>	----	----	----	----
Sodium	7440-23-5	1	mg/L	<b>62</b>	----	----	----	----
Potassium	7440-09-7	1	mg/L	<b>&lt;1</b>	----	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	<b>1.25</b>	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<b>0.003</b>	----	----	----	----
Barium	7440-39-3	0.001	mg/L	<b>0.016</b>	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<b>&lt;0.0001</b>	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<b>&lt;0.001</b>	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<b>0.004</b>	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<b>0.001</b>	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	<b>0.018</b>	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<b>&lt;0.01</b>	----	----	----	----
Strontium	7440-24-6	0.001	mg/L	<b>0.042</b>	----	----	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				U-16				
				01-DEC-2011 10:20				
Compound	CAS Number	LOR	Unit	EP1108475-001				
<b>EG020F: Dissolved Metals by ICP-MS - Continued</b>								
Zinc	7440-66-6	0.005	mg/L	0.015				
Boron	7440-42-8	0.05	mg/L	0.06				
Iron	7439-89-6	0.05	mg/L	0.47				
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001				
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron		0.05	mg/L	0.23				
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	38.4				
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica		0.10	mg/L	44.4				
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron		0.05	mg/L	0.24				
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	<0.1				
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	0.18				
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N		0.01	mg/L	<0.01				
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	1.71				
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N		0.01	mg/L	1.71				
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N		0.1	mg/L	<0.5				
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
Total Nitrogen as N		0.1	mg/L	1.7				
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P		0.01	mg/L	0.49				
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P		0.01	mg/L	0.36				
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1				
<b>EN055: Ionic Balance</b>								
Total Anions		0.01	meq/L	3.00				



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

**U-16**

Client sampling date / time

01-DEC-2011 10:20

Compound	CAS Number	LOR	Unit	EP1108475-001	----	----	----	----
<b>EN055: Ionic Balance - Continued</b>								
Total Cations	----	0.01	meq/L	<b>2.88</b>	----	----	----	----
Ionic Balance	----	0.01	%	<b>2.08</b>	----	----	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	<1	----	----	----	----
<b>EP005: Total Organic Carbon (TOC)</b>								
Total Organic Carbon	----	1	mg/L	<b>2</b>	----	----	----	----
<b>EP006 Total Inorganic Carbon</b>								
Total Inorganic Carbon	----	1	mg/L	<b>19</b>	----	----	----	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1103652</b>	<b>Page</b>	<b>: 1 of 4</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
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<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: 368-0-1 JPP Water Sampling</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 13-JUN-2011</b>
<b>C-O-C number</b>	<b>: ----</b>	<b>Issue Date</b>	<b>: 20-JUN-2011</b>
<b>Sampler</b>	<b>: DS</b>	<b>No. of samples received</b>	<b>: 2</b>
<b>Site</b>	<b>: ----</b>	<b>No. of samples analysed</b>	<b>: 2</b>
<b>Quote number</b>	<b>: EP/513/10</b>		

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

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics

**Environmental Division Perth**  
Part of the **ALS Laboratory Group**

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## 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.

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- It is recognised that TP is less than RP for sample 'BOREX1'. However, the difference is within experimental variation of the methods.



## Analytical Results

Sub-Matrix: GROUNDWATER

Client sample ID

Client sampling date / time

				BOREX1	BOREX			
				09-JUN-2011 09:50	09-JUN-2011 14:30			
Compound	CAS Number	LOR	Unit	EP1103652-001	EP1103652-002			
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	6.80	5.92	----	----	----
<b>EA010: Conductivity</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	1230	361	----	----	----
<b>EA015: Total Dissolved Solids</b>								
^ Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	991	259	----	----	----
<b>EA065: Total Hardness as CaCO3</b>								
^ Total Hardness as CaCO3	----	1	mg/L	190	30	----	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	46	6	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	46	6	----	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	30	4	----	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	454	86	----	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	20	4	----	----	----
Magnesium	7439-95-4	1	mg/L	34	5	----	----	----
Sodium	7440-23-5	1	mg/L	215	41	----	----	----
Potassium	7440-09-7	1	mg/L	2	<1	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.004	0.004	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	0.011	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	----	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	23.6	55.5	----	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								



## Analytical Results

Sub-Matrix: GROUNDWATER

Client sample ID

Client sampling date / time

				BOREX1	BOREX			
				09-JUN-2011 09:50	09-JUN-2011 14:30			
Compound	CAS Number	LOR	Unit	EP1103652-001	EP1103652-002			
<b>EK055G: Ammonia as N by Discrete Analyser - Continued</b>								
Ammonia as N	7664-41-7	0.01	mg/L	0.09	0.36	----	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	<0.01	0.01	----	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
^ Nitrate as N	14797-55-8	0.01	mg/L	2.67	3.50	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	2.67	3.51	----	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.0	0.6	----	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	3.7	4.1	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	0.03	0.07	----	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	0.04	0.07	----	----	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1104886</b>	<b>Page</b>	<b>: 1 of 4</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: DANA E RONEY</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: droney@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: ----</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: 368-0-1</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 29-JUL-2011</b>
<b>Sampler</b>	<b>: D.S</b>	<b>Issue Date</b>	<b>: 05-AUG-2011</b>
<b>Site</b>	<b>: JPP Water Sampling</b>		
<b>Quote number</b>	<b>: EP/513/10</b>	<b>No. of samples received</b>	<b>: 1</b>
		<b>No. of samples analysed</b>	<b>: 1</b>

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.

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Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting



## Analytical Results

Sub-Matrix: GROUNDWATER

Client sample ID

Client sampling date / time

				BH6x				
				28-JUL-2011 13:01				
Compound	CAS Number	LOR	Unit	EP1104886-001				
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	5.96	----	----	----	----
<b>EA010: Conductivity</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	348	----	----	----	----
<b>EA015: Total Dissolved Solids</b>								
^ Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	244	----	----	----	----
<b>EA065: Total Hardness as CaCO3</b>								
^ Total Hardness as CaCO3	----	1	mg/L	33	----	----	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	5	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	5	----	----	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	1	----	----	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	94	----	----	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	5	----	----	----	----
Magnesium	7439-95-4	1	mg/L	5	----	----	----	----
Sodium	7440-23-5	1	mg/L	46	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	<0.01	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.011	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	----	----	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	36.9	----	----	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								



## Analytical Results

Sub-Matrix: GROUNDWATER

Client sample ID

Client sampling date / time

				BH6x				
				28-JUL-2011 13:01				
Compound	CAS Number	LOR	Unit	EP1104886-001				
<b>EK055G: Ammonia as N by Discrete Analyser - Continued</b>								
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	----	----	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	<0.01	----	----	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
^ Nitrate as N	14797-55-8	0.01	mg/L	2.99	----	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	2.99	----	----	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.2	----	----	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	4.2	----	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	0.22	----	----	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	<0.01	----	----	----	----
<b>EN055: Ionic Balance</b>								
^ Total Anions	----	0.01	meq/L	2.77	----	----	----	----
^ Total Cations	----	0.01	meq/L	2.66	----	----	----	----



1st Floor, 76 Jersey Street, Jolimont, WA 6014  
Tel (08) 9284 0222 Fax (08) 9284 1785  
PO Box 201, Jolimont  
WESTERN AUSTRALIA 6913  
A.C.N. 008 804 653

Client Number: 368-0-2

Collector's Name: NE &amp; DS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466
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Jason Tranter  
B19 Room 242  
*Edith Cowan University*  
1270 Joondalup Drive  
Joondalup Drive WA 6027  
Perth, Western Australia

REMARKS

2

Comments:

29 July/11 17:00





**ROCKWATER Pty Ltd**  
**HYDROGEOLOGICAL & ENVIRONMENTAL**  
**CONSULTANTS**

**CHAIN OF CUSTODY AND ANALYSIS REQUEST**

1st Floor, 76 Jersey Street, Jolimont, WA 6014  
Tel (08) 9284 0222 Fax (08) 9284 1785  
PO Box 201, Jolimont  
WESTERN AUSTRALIA 6913  
A.C.N. 008 804 653

Client: Woodside Energy Ltd

Client Number: 368-0-2A

Project Name: JPP Isotope Sampling (SKM)

Collector's Name: CK & JF

Laboratory Job No.:

**PRESERVATION**  
**METHOD**

**SAMPLE DETAILS**

**ANALYSES**  
**REQUIRED**

**REMARKS**

**SAMPLE ID**

Laboratory  
number

Ice

Acidified

100% Ethanol

None

Sampling Date

Sample Time

Field EC  
( $\mu\text{S}/\text{cm}$ )

Field pH

No. of  
Containers

Isotopes

No samples field filtered.

AP-12

1

✓

04/12/11

12:30

294

6.20

2

✓

No samples field filtered.

AP-14

2

✓

07/12/11

09:00

329

6.58

2

✓

No samples field filtered.

F-14

3

✓

04/12/11

09:00

804

6.05

2

✓

No samples field filtered.

P-17

4

✓

10/12/11

10:15

657

7.44

2

✓

No samples field filtered.

P-17A

5

✓

10/12/11

10:15

657

7.44

2

✓

No samples field filtered.

U-16

6

✓

01/12/11

10:20

397

7.26

2

✓

No samples field filtered.

U-31

7

✓

10/12/11

08:30

802

6.58

2

✓

No samples field filtered.

TOTAL (Sites)

7

TOTAL (Vials)

14

Relinquished by: Adam Mahon  
Date/time: 10:00 am 16/12/11

Received by: Jason Tranter  
Date/time: 13:55 16/12/11

Comments:



**Rockwater**

# STABLE ISOTOPE RESULTS

## BATCH REPORT

15th Dec 2011

**Organisation:** RockWater Pty Ltd  
**Contact:** Daisy Scott  
**Project Id (ECU):** RW-11-11-04-1  
**Project Id (RW):** JPP Isotope Sampling (SKM)  
**Sample Description:** Water  
**No. of Samples:** 2  
**Analysis Performed:** d2H and d18O

**Notes:** Nil

Sample Name	d2H Reportable Value (permil)	d2H Standard Deviation (permil)	d18O Reportable Value (permil)	d18O Standard Deviation (permil)
AE-10	-48.4	0.2	-7.30	0.02
U-20	-48.0	0.2	-7.19	0.06

# STABLE ISOTOPE RESULTS

## BATCH REPORT

# STABLE ISOTOPE RESULTS

## BATCH REPORT

20-December-2011

**Organisation:** RockWater  
**Contact:** Daisy Scott  
**Project Id (ECU):** RW-11-12-16-1  
**Project Id (RW):** JPP Isotope Sampling (SKM)  
**Sample Description:** Water  
**No. of Samples:** 7  
**Analysis Performed:** d2H and d18O

**Notes:** Samples were filtered through a 0.45um filter prior to analysis.

Sample Name	d2H Reportable Value (permil)	d2H Standard Deviation (permil)	d18O Reportable Value (permil)	d18O Standard Deviation (permil)
AP-12	-48.5	0.1	-7.24	0.06
AP-14	-48.3	0.3	-7.20	0.02
F-14	-49.2	0.3	-7.33	0.05
P-17A	-48.9	0.1	-7.33	0.02
P-17	-49.0	0.2	-7.31	0.06
U-16	-49.5	0.3	-7.36	0.03
U-31	-48.2	0.3	-7.19	0.02



# STABLE ISOTOPE RESULTS

## BATCH REPORT

## MONITORING BORE COMPLETION DATA

BORE ID:	AE-10
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore - Shallow
COORDINATES:	411227.8 mE 8064055.3 mN
REDUCED LEVEL (top of steel standpipe):	24.7 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Hydropower Scout (Rig 7)
DATE CONSTRUCTED:	29/08/11 to 15/09/11 (drilling completed 13/09/11)
DRILLING DETAILS:	0 to 50 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
SURFACE CASING:	nil
CASING:	+0.45 to 18.0 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	21.2 to 27.2 m, 0.75 mm aperture
BOREHEAD:	+0.65 to 0.45 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.15 m above ground level
GROUTED INTERVAL:	ground surface to 15.3 m
BENTONITE SEAL:	15.3 to 17.4 m
GRAVEL PACK:	17.4 to 26.6, graded +1.6 – 3.2 26.6 to 50.0 m, graded +3.2 – 6.4
STATIC WATER LEVEL (29/11/11):	22.00 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (02/11/11):	620 µS/cm / 9.0 pH units / 33.1°C (pumped sample)



# MONITORING BORE COMPLETION DATA

## AE-10 (continued)

### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	13.75	SILTY SAND	Red-brown, dark red-brown, fine to coarse grained (predominantly fine grained), sub-rounded to sub-angular, poorly sorted, silty. Pockets of yellow and pale grey-yellow sand and minor mottling.
13.75	19	SAND/SANDSTONE	Orange, cream, pale grey, mottled, fine to medium grained with some silt, minor red sand and gravel. Weakly cemented to unconsolidated.
19	24	SAND/SANDSTONE	Pale grey, yellow, red, fine to coarse grained, sub-angular to sub-rounded, moderately to well sorted, decreasing silt content. Very weakly to weakly cemented with white silty, cemented bands.
24	27	SAND/SANDSTONE	Pale grey brown, white, very fine to coarse grained, sub-round to rounded, moderately to poorly sorted. Minor yellow, yellow-grey pockets. Moderately consolidated/weakly cemented. Note top of rock logged at 19.7 m.
27	30	SANDSTONE	White, cream, fine to medium grained, sub-rounded, moderately sorted, some bedding. Dark brown silt at 28.5m.
30	39	SANDSTONE	Pale grey-yellow, cream, medium grained, moderately to well sorted, sub-rounded to rounded, weakly to well cemented, minor white silt in parts, trace black very fine grains. Minor yellow-grey unconsolidated sand.
39	50	SANDSTONE/SAND	As above, bedded. Unconsolidated in parts. Yellow staining, and minor dark red brown iron oxide layers.
Core loss, greater than 0.25 m, recorded at 1.25, 4.95, 9.45, 10.95, 15.25, 16.7, 17.25, 18, 18.75, 19.5, 21, 21.75, 22.5, 24.4, 26.25, 28.6, 31.6, 33.1, 33.95, 34.5, 39.8, and 46 m.			E.O.H 50 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (on-site 19-33 m depth)			



## MONITORING BORE COMPLETION DATA

BORE ID:	AP-12
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Shallow
COORDINATES:	411824.1 mE 8063949.2 mN
REDUCED LEVEL (top of steel standpipe):	29.0 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Hydrapower Scout (Rig 7)
DATE CONSTRUCTED:	31/10/11 to 03/11/11 (drilling completed 02/11/11)
DRILLING DETAILS:	0 to 50 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.45 to 32.0 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	26.0 to 32.0 m, 0.75 mm aperture
BOREHEAD:	+0.55 to 0.55 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.1 m above ground level
GROUTED INTERVAL:	ground surface to 22.0 m
BENTONITE SEAL:	22.0 to 24.0 m
GRAVEL PACK:	24.0 to 32.0, graded +1.6 – 3.2 32.0 to 50.0, graded +3.2 – 6.4
STATIC WATER LEVEL (07/12/11):	25.70 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (04/12/11):	290 µS/cm / 6.2 pH units / 46.1°C (pumped sample)



# MONITORING BORE COMPLETION DATA

## AP-12 (continued)

### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	17	SILTY SAND	Red-brown, dark red-brown, fine to medium grained, sub-rounded to sub-angular, poorly sorted, silty. Pockets of yellow sand.
17	20.25	SAND	Red-brown, fine coarse grained, sub-angular to sub-rounded (some rounded grains), poorly sorted, trace silt, trace yellow sandy pockets.
20.25	23	SAND	Yellow-brown, red-brown, minor grey mottling, fine to coarse grained, sub-rounded to sub-angular, poorly sorted. Trace sandstone nodules, and weakly cemented layers. Note top of rock logged at 22.6 m.
23	28	SANDSTONE	Pale grey, pale red-brown, minor pale red mottling, fine to coarse grained (predominantly medium grained), sub-angular, poorly sorted. Layered, weakly to moderately cemented with minor pale grey, silicified layers.
28	50	SANDSTONE	Pale grey, pale brown, minor red, red-blue staining, fine to coarse grained, moderately to well cemented. Minor unconsolidated intervals. Minor red and white (silty) laminations at 32 m and from 40 m. Increased grainsize (to predominantly medium) from 42 m.
Core loss, of at least 0.25 m, recorded at 5.65, 8.35, 15.45, 19.17, 25.35, 32.65, 34.1, and 55.1 m			E.O.H 50 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval).			



## MONITORING BORE COMPLETION DATA

BORE ID:	AP-14
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Deep
COORDINATES:	411823.3 mE 8063850 mN
REDUCED LEVEL (top of steel standpipe):	30.1 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	GDR650 (Rig 1)
DATE CONSTRUCTED:	12/11/11 to 15/11/11 (drilling completed 15/11/11)
DRILLING DETAILS:	0 to 50.5 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.95 to 44.0 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	44.0 to 50.0 m, 0.5 mm aperture
BOREHEAD:	+1.0 to 0.1 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.05 m above ground level
GROUTED INTERVAL:	ground surface to 40.0 m
BENTONITE SEAL:	40.0 to 42.0 m
GRAVEL PACK:	42.0 to 50.5, graded +1.6 – 3.2
STATIC WATER LEVEL (08/12/11):	26.68 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (07/12/11):	330 µS/cm / 6.6 pH units / 34.1°C (pumped sample)



## MONITORING BORE COMPLETION DATA

### AP-14 (continued)

#### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	7.5	SILTY SAND	Red-brown, dark red-brown, fine to medium grained, sub-rounded to sub-angular, poorly sorted, silty. Trace pockets of yellow sand.
7.5	13	SAND	As above, decreased silt content.
13	13.5	SAND and GRAVEL	Red-brown, mottled dark red, yellow and black, fine grained to gravel, sub-rounded to angular, poorly sorted.
13.5	24	SANDSTONE	Red-brown, pale red-brown, fine to coarse grained, trace gravel, sub-rounded to sub-angular, poorly sorted. Weakly cemented layers with minor silicified layers, unconsolidated in parts. Note top of rock logged at 13.74 m
24	50.5	SANDSTONE	Pale grey, yellow-grey, pale red-brown, pale, fine to coarse grained, sub-rounded to sub-angular, poorly sorted. Weakly to moderately cemented with fracturing, and unconsolidated in parts. Dark purple laminations from 47 m, yellow staining from 48 m.
Core loss, of at least 0.25 m, recorded at 15, 17.18, 18.7, 22.35, 22.5, 33.55, 37.5, 40.05, and 41.5 m.			E.O.H 50.5 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval).			



## MONITORING BORE COMPLETION DATA

BORE ID:	AP-20
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Shallow
COORDINATES:	411821.9 mE 8063549.7 mN
REDUCED LEVEL (top of steel standpipe):	29.0 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	GDR650 (Rig 1)
DATE CONSTRUCTED:	08/11/11 to 13/11/11 (drilling completed 11/11/11)
DRILLING DETAILS:	0 to 50 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.6 to 24.7 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	24.7 to 30.7 m, 0.5 mm aperture
BOREHEAD:	+0.8 to 0.3 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.05 m above ground level
GROUTED INTERVAL:	ground surface to 20.5 m
BENTONITE SEAL:	20.5 to 22.5 m
GRAVEL PACK:	22.5 to 30.7, graded +1.6 – 3.2 30.7 to 50.0, graded +3.2 – 6.4
STATIC WATER LEVEL (14/12/11):	25.77 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (11/12/11):	450 µS/cm / 7.2 pH units / 37.2°C (pumped sample)





## MONITORING BORE COMPLETION DATA

### AP-20 (continued)

#### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	10	SILTY SAND	Red-brown, fine to medium grained (some coarse grained), sub-rounded to sub-angular, poorly sorted, silty. Trace pockets of yellow sand.
10	16	SAND	As above, decreased silt content.
31	50	SANDSTONE	Pale red-brown, brown, pale grey-white, fine to coarse grained, sub-rounded to sub-angular, poorly sorted, weakly to moderately well cemented, minor silicified intervals and some unconsolidated sand. Minor fracturing.
16	24.5	SAND	Red-brown, pale grey, pale yellow, yellow-brown, fine to coarse grained with some gravel, rounded to sub-angular, poorly sorted. Unconsolidated with some intervals of weakly cemented consolidated sandstone.
24.5	31	SAND/SANDSTONE	Pale red-brown, yellow-brown, grey, fine to coarse grained (predominantly medium grained), sub-rounded to sub-angular, poorly sorted. Unconsolidated to weakly cemented, with minor well cemented intervals. Note top of rock logged at 26.9 m.
Core loss, of at least 0.25 m, recorded at 8, 20.39, 22.25, 25.5, 40.05, 43.5, 44.25, 45.35, and 49 m.			E.O.H 50 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval).			



## MONITORING BORE COMPLETION DATA

BORE ID:	AP-24
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Shallow
COORDINATES:	411822.1 mE 8063349.5 mN
REDUCED LEVEL (top of steel standpipe):	27.9 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	GDR650 (Rig 1)
DATE CONSTRUCTED:	27/11/11 to 30/11/11 (drilling completed 30/11/11)
DRILLING DETAILS:	0 to 52.5 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.7 to 23.6 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	23.6 to 29.6 m, 0.5 mm aperture
BOREHEAD:	+0.8 to 0.3 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.15 m above ground level
GROUTED INTERVAL:	ground surface to 18.0 m
BENTONITE SEAL:	18.0 to 21.5 m
GRAVEL PACK:	21.5 to 29.6, graded +1.6 – 3.2 29.6 to 52.5, graded +3.2 – 6.4
STATIC WATER LEVEL (13/12/11):	24.55 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (12/12/11):	400 µS/cm / 6.8 pH units / 32.6°C (pumped sample)



# MONITORING BORE COMPLETION DATA

## AP-24 (continued)

### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	19.5	SILTY SAND	Red, fine to medium grained, sub-rounded to sub-angular, poorly sorted, slightly silty. Trace pockets of yellow sand. Dark brown, and black gravel at 12.7 and 17 to 19 m.
19.5	23	SAND	Red-brown, fine to coarse grained, sub-rounded to sub-angular, poorly graded, slightly silty, unconsolidated. Trace gravel.
23	29	SAND	Pale yellow-brown, pale red-brown, fine to coarse grained (predominantly fine to medium grained), sub-rounded to sub-angular, poorly sorted. Unconsolidated with minor sandstone, nodules and weakly cemented layers.
29	32.5	SAND/SANDSTONE	Pale yellow-brown, fine to medium grained, sub-rounded to sub-angular, poorly sorted, moderately cemented to unconsolidated. Note top of rock logged at 32.4 m.
32.5	40	SANDSTONE	Pale grey-brown, pale yellow-brown, pale yellow, fine to coarse grained, sub-rounded to sub-angular, poorly sorted. Well cemented with trace cavities and minor silicified intervals, moderately fractured.
40	52.5	SANDSTONE/SAND	As above, silty in parts, with intervals of unconsolidated sand. Red, oxidisation staining at 45 m and from 47.5 to 50.5 m.
Core loss, of at least 0.25 m, recorded at 3.7, 11.2, 18.85, 24, 28.5, 30.7, 36.35, 39, 40.5, and 41.15 m.			E.O.H 52.5 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval).			



## MONITORING BORE COMPLETION DATA

BORE ID:	AP-28
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Deep
COORDINATES:	411823.1 mE 8063159.0 mN
REDUCED LEVEL (top of steel standpipe):	26.7 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Hydrapower Scout (Rig 7)
DATE CONSTRUCTED:	13/11/11 to 16/11/11 (drilling completed 15/11/11)
DRILLING DETAILS:	0 to 50 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.45 to 46.7 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	40.7 to 46.7 m, 0.5 mm aperture
BOREHEAD:	+0.5 to 0.6 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.1 m above ground level
GROUTED INTERVAL:	ground surface to 36.0 m
BENTONITE SEAL:	36.0 to 38.0 m
GRAVEL PACK:	38.0 to 46.7, graded +1.6 – 3.2 46.7 to 50.0, graded +3.2 – 6.4
STATIC WATER LEVEL (13/12/11):	23.27 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (12/12/11):	610 µS/cm / 7.2 pH units / 34.2°C (pumped sample)



# MONITORING BORE COMPLETION DATA

## AP-28 (continued)

### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	6.5	SAND	Red-brown, fine to medium grained, sub-rounded to rounded, poorly sorted, slightly silty. Trace pockets of yellow sand.
6.5	24	SILTY SAND	Red-brown, fine to medium grained, sub-rounded to sub-angular, poorly sorted, silty. Pockets of yellow sand/yellow mottling to 18 m. Unconsolidated, minor weakly cemented intervals from 14 m.
24	25.25	SAND	As above with minor red-brown gravel.
25.25	31	SANDSTONE	Pale yellow-red, pale yellow-brown, medium grained to gravel, layered, weakly to well cemented, unconsolidated in parts. Note top of rock logged at 25.25 m.
31	50	SANDSTONE	Pale yellow-red, light brown, grey, fine to medium grained (minor gravel), sub-rounded to sub-angular, moderately to poorly sorted, layered, weakly to well cemented, unconsolidated in parts. Minor black staining, white banding, and minor fracturing.
Core loss, of at least 0.25 m, recorded at 1.95, 7.1, 31.23, 33, 33.77, 40.5, 42, 44.5, 47.25, and 49.5 m.			E.O.H 50 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval).			



## MONITORING BORE COMPLETION DATA

BORE ID:	AP-32
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Shallow
COORDINATES:	411824.7 mE 8062943.1 mN
REDUCED LEVEL (top of steel standpipe):	25.4 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Hydrapower Scout (Rig 7)
DATE CONSTRUCTED:	03/11/11 to 07/11/11 (drilling completed 07/11/11)
DRILLING DETAILS:	0 to 48.5 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.6 to 20.5 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	20.5 to 26.5 m, 0.5 mm aperture
BOREHEAD:	+0.75 to 0.35 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.2 m above ground level
GROUTED INTERVAL:	ground surface to 16.5 m
BENTONITE SEAL:	16.5 to 18.5 m
GRAVEL PACK:	18.5 to 26.5, graded +1.6 – 3.2 26.5 to 48.5, graded +3.2 – 6.4
STATIC WATER LEVEL (13/12/11):	22.09 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (12/12/11):	1050 µS/cm / 6.3 pH units / 37.4°C (pumped sample)



## MONITORING BORE COMPLETION DATA

### AP-32 (continued)

#### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	17	SILTY SAND	Red-brown, fine to coarse grained, sub-rounded to sub-angular, poorly sorted, silty. Trace pockets of yellow sand.
17	22	SILTY SAND	As above to pale-red brown, light brown, with silty sand/yellow mottling. Unconsolidated, with minor weakly cemented intervals, trace gravel.
22	31	SAND	Pale red, pale yellow, fine to coarse grained, sub-rounded to sub-angular, poorly sorted, slightly silty. Moderately consolidated.
31	38.5	SAND	Yellow-brown, pale grey, pale red-brown, fine to coarse grained (trace gravel), sub-rounded to sub-angular, poorly sorted, minor silt, trace clay, unconsolidated to weakly cemented.
38.5	48.5	SANDSTONE/SAND	Grey-yellow, pale red, pale brown, fine to coarse grained (predominantly medium grained), sub-rounded to rounded, poorly sorted. Very weakly to moderately cemented, and unconsolidated in parts. Note top of rock logged at 38.5 m.
Core loss, of at least 0.25 m, recorded 4.95, 20.13, 22.4, 23.7, 31.65, 36.09, 37.5, 38.25, 39, 42, and 44.35 m.			<b>E.O.H 48.5 m</b>
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval).			



## MONITORING BORE COMPLETION DATA

BORE ID:	AP-36
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Shallow
COORDINATES:	411827.9 mE 8062762.5 mN
REDUCED LEVEL (top of steel standpipe):	24.7 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Hydrapower Scout (Rig 7)
DATE CONSTRUCTED:	07/11/11 to 12/11/11 (drilling completed 12/11/11)
DRILLING DETAILS:	0 to 58.5 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.65 to 26.0 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	20.0 to 26.0 m, 0.5 mm aperture
BOREHEAD:	+0.8 to 0.3 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.1 m above ground level
GROUTED INTERVAL:	ground surface to 16.0 m
BENTONITE SEAL:	16.0 to 18.0 m
GRAVEL PACK:	18.0 to 26.0, graded +1.6 – 3.2 26.0 to 58.5, graded +3.2 – 6.4
STATIC WATER LEVEL (14/12/11):	21.37 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (13/12/11):	1060 µS/cm / 7.0 pH units / 36.0°C (pumped sample)





## MONITORING BORE COMPLETION DATA

### AP-36 (continued)

#### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	11	SILTY SAND	Red-brown, fine to coarse grained, sub-rounded to sub-angular, poorly sorted, silty, trace clay.
11	21	SILTY SAND	As above with trace yellow sand pockets/yellow mottling. Unconsolidated, with minor weakly cemented intervals.
21	26	SAND	Sand as above, decrease in silt content.
26	33	SAND	Pale red-brown, fine to coarse grained, sub-rounded to sub-angular, poorly sorted, slightly silty, with yellow mottling, weakly cemented in parts, trace gravel.
33	35.5	SAND/SANDSTONE	Pale grey, pale yellow-brown, fine to coarse grained, angular to sub-rounded, poorly sorted, weakly cemented to unconsolidated. Gravelly at 33 m.
35.5	38.5	SANDSTONE/SAND	Pale grey, yellow-brown, fine to coarse grained, sub-rounded to sub-angular, poorly to moderately sorted, weakly to moderately cemented. Yellow sand pockets at 38.5 m (typical of Mowanjum Sand?). Note top of rock logged at 38.5 m.
38.5	58.5	SANDSTONE	Pale red, pale brown-grey, red, minor white, fine to coarse grained (predominantly medium grained), minor gravel, sub-rounded to rounded, poorly sorted. Weakly to moderately cemented, and unconsolidated and in parts. Trace silicified layers, trace red-brown, black staining. Minor fractures.
Core loss, of at least 0.25 m, recorded at 16.25, 31.7, 41.9, 45.9, 48.75 m.			E.O.H 58.5 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval).			



## MONITORING BORE COMPLETION DATA

BORE ID:	<b>F-14</b>
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Shallow
COORDINATES:	410027.0 mE 8063851.8 mN
REDUCED LEVEL (top of steel standpipe):	11.4 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	GDR650 (Rig 1)
DATE CONSTRUCTED:	16/11/11 to 20/11/11 (drilling completed 20/11/11)
DRILLING DETAILS:	0 to 51 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.7 to 14.0 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	8.0 to 14.0 m, 0.5 mm aperture
BOREHEAD:	+0.75 to 0.35 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.05 m above ground level
GROUTED INTERVAL:	ground surface to 3.0 m
BENTONITE SEAL:	3.0 to 6.0 m
GRAVEL PACK:	6.0 to 14.0, graded +1.6 – 3.2 14.0 to 51.0, graded +3.2 – 6.4
STATIC WATER LEVEL (09/12/11):	9.23 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (04/12/11):	800 µS/cm / 6.1 pH units / 33.6°C (pumped sample)



# MONITORING BORE COMPLETION DATA

## F-14 (continued)

### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	21	SILTY SAND	Red-brown, fine to medium grained, sub-rounded, poorly sorted, silty, trace yellow sand pockets. Trace gravel at 17 m.
21	30.5	SAND	Pale red-brown, yellow, white, mottled, fine to medium grained, sub-rounded, poorly sorted, slightly silty. Unconsolidated to very weakly cemented. Trace gravel.
30.5	33.25	SAND/SANDSTONE	Pale brown, pale red-brown, yellow-brown, fine to coarse grained (predominantly medium grained), sub-rounded to sub-angular, poorly sorted. Very weakly cemented to unconsolidated. Note top of rock logged at 29.87 m.
33.25	39	SANDSTONE	As above, increase in cementation.
39	51	SANDSTONE	As above, laminated. Moderately cemented with grey siliceous layers, and moderate fracturing.
Core loss, of at least 0.25 m, recorded at 0.8, 12.85, 25.74, 32.6, 34.25, 34.7, and 36.4 m.			E.O.H 51 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval).			



## MONITORING BORE COMPLETION DATA

BORE ID:	I-16
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Deep
COORDINATES:	410177.6 mE 8063746.4 mN
REDUCED LEVEL (top of steel standpipe):	12.6 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Hydrapower Scout (Rig 7)
DATE CONSTRUCTED:	17/11/11 to 20/11/11 (drilling completed 20/11/11)
DRILLING DETAILS:	0 to 50 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.8 to 35.0 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	29.0 to 35.0 m, 0.5 mm aperture
BOREHEAD:	+0.95 to 0.15 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.15 m above ground level
GROUTED INTERVAL:	ground surface to 25.0 m
BENTONITE SEAL:	25.0 to 27.0 m
GRAVEL PACK:	27.0 to 35.0, graded +1.6 – 3.2 35.0 to 50.0, graded +3.2 – 6.4
STATIC WATER LEVEL (09/12/11):	10.35 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (07/12/11):	380 µS/cm / 7.0 pH units / 34.8°C (pumped sample)



## MONITORING BORE COMPLETION DATA

### I-16 (continued)

#### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	21	SILTY SAND	Red-brown, fine to medium grained, sub-rounded to sub-angular, poorly sorted, silty, minor clay, trace yellow sand pockets and yellow mottling.
21	29.5	SAND	Pale red-brown, pale brown, sub-rounded to sub-angular, poorly sorted, slightly silty, trace weakly cemented nodules and minor sandstone layers.
29.5	36	SANDSTONE/SAND	Pale red, yellow, grey, mottled, very fine to coarse grained (predominantly medium grained), sub-rounded to sub-angular, poorly to moderately sorted. Minor gravel. Layered, weakly to moderately cemented and unconsolidated in parts. Note top of rock logged at 29.65 m.
36	50	SANDSTONE	Pale brown, grey, white, pale red, fine to coarse grained (predominantly fine to medium grained), sub-rounded to sub-angular, poorly to moderately sorted, trace gravel. Laminated, predominantly consolidated, very weakly to moderately cemented, moderately fractured.
Core loss, of at least 0.25 m, recorded at 9.45, 23.45, 25.05, 26.25, 27.24, 31.5, 34.4, 35.65, 42.6, and 49 m.			E.O.H 50 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval).			



## MONITORING BORE COMPLETION DATA

BORE ID:	N-4
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Shallow
COORDINATES:	410423.4 mE 8064353.1 mN
REDUCED LEVEL (top of steel standpipe):	16.0 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	GDR650 (Rig 1)
DATE CONSTRUCTED:	22/11/11 to 27/11/11 (drilling completed 26/11/11)
DRILLING DETAILS:	0 to 57.0 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.45 to 18.9 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	12.9 to 18.9 m, 0.5 mm aperture
BOREHEAD:	+0.7 to 0.4 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to ground level
GROUTED INTERVAL:	ground surface to 1.0 m
BENTONITE SEAL:	1.0 to 3.0 m (hole collapsed from 3.0 to 11.0 m)
GRAVEL PACK:	11.0 to 18.9, graded +1.6 – 3.2 18.9 to 57.0, graded +3.2 – 6.4
STATIC WATER LEVEL (13/12/11):	13.83 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (08/12/11):	500 µS/cm / 6.9 pH units / 34.0°C (pumped sample)



# MONITORING BORE COMPLETION DATA

## N-4 (continued)

### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	16.5	SILTY SAND	Red-brown, fine to medium grained, sub-rounded to sub-angular, poorly sorted, silty sand. Trace yellow sand pockets, trace gravel at 15.5 m
16.5	24.5	SAND	As above, to pale brown, minor mottling. Decrease in silt content.
24.5	26.75	SAND	Pale brown, yellow-brown, medium to coarse grained, sub-rounded to sub-angular, poorly sorted, unconsolidated.
26.75	36.5	SANDSTONE/SAND	Pale red-brown, grey, fine to medium grained, sub-rounded, poorly sorted, weakly cemented to unconsolidated.
36.5	57	SANDSTONE	As above, increased cementation with intervals of very weakly cemented to unconsolidated sand. Bedded, moderate fracturing, minor grey silicified layers. Minor mottling and oxidised layers throughout. Note top of rock logged at 36.6 m.
Core loss, of at least 0.25 m, recorded at 15.45, 16.89, 17.75, 18.8, 24.25, 24.75, 26.25, 29, 45, 46.5, 48.7, 49.5, and 52.5 m.			E.O.H 57 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval).			



## MONITORING BORE COMPLETION DATA

BORE ID:	<b>O-10</b>
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Shallow
COORDINATES:	410469.9 mE 8064056.8 mN
REDUCED LEVEL (top of steel standpipe):	17.1 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Delta Base (Rig 9)
DATE CONSTRUCTED:	18/11/11 to 23/11/11 (drilling completed 22/11/11)
DRILLING DETAILS:	0 to 51 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.7 to 20.2 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	14.2 to 20.2 m, 0.5 mm aperture
BOREHEAD:	+0.7 to 0.4 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to ground level
GROUTED INTERVAL:	ground surface to 7.0 m
BENTONITE SEAL:	7.0 to 11.9 m
GRAVEL PACK:	11.9 to 20.2, graded +1.6 – 3.2 20.2 to 51.0, graded +3.2 – 6.4
STATIC WATER LEVEL (11/12/11):	14.81 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (08/12/11):	470 µS/cm / 6.6 pH units / 33.8°C (pumped sample)





## MONITORING BORE COMPLETION DATA

### O-10 (continued)

#### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	24	SILTY SAND	Red-brown, fine to coarse grained (predominantly fine to medium grained), sub-rounded to sub-angular, poorly sorted, silty sand. Trace yellow mottling. Trace gravel at 18 and 20 m.
24	27.75	SAND	Red-brown, pale yellow, yellow-brown, fine to coarse grained, sub-angular, poorly sorted, trace silt.
27.75	42	SAND/SANDSTONE	Pale red, pale grey, white, fine to coarse grained, weakly cemented to unconsolidated. Minor white bedding. Note top of rock logged at 28.1 m.
42	51	SANDSTONE/SAND	Pale yellow-brown, fine to medium grained, moderately well cemented, unconsolidated in parts. Bedded, interlayered with white, red-purple (oxidised) layers. Fractured at 44 m.
Core loss, of at least 0.25 m, recorded at 1.95, 16.15, 33, and 37.5 m.			E.O.H 51 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval).			



## MONITORING BORE COMPLETION DATA

BORE ID:	<b>P-17</b>
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore - Shallow
COORDINATES:	410525.2 mE 8063705.2 mN
REDUCED LEVEL (top of steel standpipe):	16.1 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Delta Base 520 (Rig 9)
DATE CONSTRUCTED:	01/10/11 to 07/10/11 (drilling completed 06/10/11)
DRILLING DETAILS:	0 to 50 m mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.5 to 20 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	14.0 to 20.0 m, 0.75 mm aperture
BOREHEAD:	+0.6 to 0.5 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.1 m above ground level
GROUTED INTERVAL:	ground surface to 10.0 m
BENTONITE SEAL:	10.0 to 12.0 m
GRAVEL PACK:	12.0 to 20.0 m, graded +1.6 – 3.2 20.0 to 46.2, graded +3.2 – 6.4 (hole collapsed at 46.2 m)
STATIC WATER LEVEL (24/11/11):	13.55 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (02/11/11):	600 µS/cm / 7.5 pH units / 35.6°C (pumped sample)



# MONITORING BORE COMPLETION DATA

## P-17 (continued)

### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	11	SILTY SAND	Red-brown, fine to medium grained (trace coarse grained), sub-rounded to sub-angular, poorly sorted, loose, pockets of yellow.
11	14	SILTY SAND	As above, pale red-brown.
14	21	SAND	Red-brown, fine to medium grained (trace coarse grained), sub-rounded, poorly sorted, silty. Trace gravel at 14.8 m.
21	22	SAND	Pale red-brown and pale yellow, fine to medium grained (trace coarse grains), sub-rounded to sub-angular, poorly sorted. Decrease in silt content.
22	24.5	SAND	As above with gravel, dark grey, pale yellow, dark red (oxidised), sub-rounded to sub-angular, poorly sorted.
24.5	32.5	SANDSTONE/SAND	Pale grey, yellow-brown, fine grained, trace medium and coarse grained, poorly sorted, predominately competent, medium to hard, with beds of unconsolidated, fine to medium grained sand. Minor mottling/weathering. Siltstone laminations at 26.8 and 27.8 m. Gravel, grey-brown, sub-rounded at 32 m. Note top of rock logged at 24.39 m.
32.5	40.5	SANDSTONE/SAND	Sandstone as above, with pale grey to brown-grey, fine to medium grained, poorly sorted, sub-rounded to sub-angular sand. Increased grainsize from 37.5 to 38 m.
40.5	50	SANDSTONE/SAND	Pale grey to yellow-brown, and dark red-brown, fine to coarse grained (predominately fine to medium grained), poorly sorted, rounded to sub-rounded, silty, moderately well cemented sandstone to unconsolidated sand.
Core loss, greater than 0.25 m, recorded at 1.95, 23.2, 28, 33.15, 34.75, 36, 39, 39.5, 43.5, 45.6, 47, 48, and 49 m.			E.O.H 50 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (on-site 0-24.4 m depth)			



## MONITORING BORE COMPLETION DATA

BORE ID:	<b>P-21</b>
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore - Shallow
COORDINATES:	410524.4 mE 8063501.7 mN
REDUCED LEVEL (top of steel standpipe):	15.3 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Hydrapower Scout (Rig 7)
DATE CONSTRUCTED:	28/09/11 to 02/10/11 (drilling completed 01/10/11)
DRILLING DETAILS:	0 to 50.5 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
SURFACE CASING:	nil
CASING:	+0.45 to 19 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	13.0 to 19.0 m, 0.5 mm aperture
BOREHEAD:	+0.65 to 0.35 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.05 m above ground level
GROUTED INTERVAL:	ground surface to 9.0 m
BENTONITE SEAL:	9.0 to 11.0 m
GRAVEL PACK:	11.0 to 19.0 m, graded +1.6 – 3.2 19.0 to 50.5 m, +3.2 – 6.4
STATIC WATER LEVEL (29/11/11):	12.94 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (01/11/11):	670 µS/cm / 6.8 pH units / 32.6°C (pumped sample)



# MONITORING BORE COMPLETION DATA

## P-21 (continued)

### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	15	SILTY SAND	Red-brown, fine to medium grained, sub-rounded, poorly sorted, silty, unconsolidated. Trace yellow sand pockets. Weakly cemented between 6.8 to 8.1 m. Clayey sand at 10.5 m with gravel at 14.3 m.
15	21.5	SILTY SAND	Red, silt to medium grained sand (minor coarse grains), sub-rounded to sub-angular, poorly sorted.
21.5	24.5	SAND/ SANDSTONE	Pale yellow-brown, some red and yellow, fine to medium grained, some coarse grained to gravel, sub-rounded to sub-angular, moderately to poorly sorted, moderately to well consolidated, weakly cemented.
24.5	29.5	SAND	Red, orange, pale brown, fine to medium grained (predominantly medium grained), moderately to well sorted, sub-angular to sub-rounded, slightly silty sand with minor gravel, very weakly cemented in parts, mostly unconsolidated. Some yellow, light yellow pockets. Trace sandstone fragments.
29.5	30.75	SANDSTONE/SAND	As above, increased cementation.
30.75	42	SILTY SAND	Pale yellow-brown, fine to medium grained (minor coarse grained), sub-rounded, poorly sorted. Minor weathering/iron oxidation and laminations. Note top of rock logged at 30.3 m.
42	50.5	SANDSTONE	Light grey to cream-white, medium grained, sub-rounded to sub-angular, well to moderately sorted, weakly cemented. Trace white, silicified layers. Minor very hard/well cemented, minor yellow silt. Minor fracturing from at 42.2 to 47.3 m.
Core loss, greater than 0.25 m, recorded at 13.95, 25.75, 27.75, 36, 37.5, 44.6, and 49 m.			<b>E.O.H 50.5 m</b>
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (on-site 0-30.3 m depth)			



## MONITORING BORE COMPLETION DATA

BORE ID:	<b>P-25</b>
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Deep
COORDINATES:	410525.7 mE 8063306.7 mN
REDUCED LEVEL (top of steel standpipe):	14.7 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Delta Base (Rig 9)
DATE CONSTRUCTED:	02/11/11 to 08/11/11 (drilling completed 05/11/11)
DRILLING DETAILS:	0 to 51.0 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.75 to 35.0 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	29.0 to 35.0 m, 0.5 mm aperture
BOREHEAD:	+0.8 to 0.3 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.1 m above ground level
GROUTED INTERVAL:	ground surface to 24.9 m
BENTONITE SEAL:	24.9 to 26.9 m
GRAVEL PACK:	26.9 to 34.9, graded +1.6 – 3.2 34.9 to 51.0, graded +3.2 – 6.4
STATIC WATER LEVEL (12/12/11):	12.11 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (11/12/11):	570 µS/cm / 7.3 pH units / 34.8°C (pumped sample)



# MONITORING BORE COMPLETION DATA

## P-25 (continued)

### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	18.5	SILTY SAND	Red-brown, fine to medium grained, sub-rounded to rounded, poorly sorted, silty, trace clay, trace yellow, yellow-brown sand pockets.
18.5	23.5	SAND	As above, sub-rounded to sub-angular, decrease in silt content. Minor grey sandy pockets, trace gravel.
23.5	30	SAND	Pale grey, white, pale red-brown, very fine to medium grained, trace coarse grained (predominantly fine grained), sub-rounded to rounded, poorly to moderately sorted, slightly silty, trace rounded gravel, mottled in parts. Moderately consolidated to unconsolidated.
30	33	SANDSTONE	Pale red, white, pale brown, fine to coarse grained (predominantly fine to medium grained), sub-rounded to sub-angular, poorly to moderately sorted, trace angular gravel. Moderately cemented, fractured. Note top of rock logged at 30.6 m.
33	51	SANDSTONE/SAND	As above, unconsolidated in parts. Trace yellow mottling. White, silty, claystone and silicified layers, and trace cavities from 42 m. Fractured from 39 m.
Core loss, of at least 0.25 m, recorded at 27.25, 29.35, 31.5, 32.51, 33.35, 34.15, 35.63, and 36.35 m.			
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval).			<b>E.O.H 51 m</b>



## MONITORING BORE COMPLETION DATA

BORE ID:	<b>P-29</b>
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore - Shallow
COORDINATES:	410527.5 mE 8063097.3 mN
REDUCED LEVEL (top of steel standpipe):	13.6 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	GDR650 (Rig 1)
DATE CONSTRUCTED:	28/09/11 to 03/10/11 (drilling completed 02/10/11)
DRILLING DETAILS:	0 to 58.5 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
SURFACE CASING:	nil
CASING:	+0.3 to 19.8 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	13.8 to 19.8 m, 0.75 mm aperture
BOREHEAD:	+0.5 to 0.6 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.05 m above ground level
GROUTED INTERVAL:	ground surface to 8.5 m
BENTONITE SEAL:	8.5 to 10.3 m
GRAVEL PACK:	10.3 to 19.5 m, graded +1.6 – 3.2 19.5 m to 58.5, graded +3.2 – 6.4
STATIC WATER LEVEL (29/11/11):	11.24 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (01/11/11):	960 µS/cm / 6.4 pH units / 32.1°C (pumped sample)





## MONITORING BORE COMPLETION DATA

### P-29 (continued)

#### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	11	SILTY SAND	Dark red-brown, fine to medium grained, sub-rounded, poorly sorted, silty sand with yellow sandy pockets and minor yellow and white mottling. Clayey sand at 6 m. Trace gravel.
11	13.5	CLAYEY SAND	Dark red-brown, yellow-brown, fine to medium grained sand, clayey. Trace sandstone gravel.
13.5	19	SILTY SAND	Red-brown, fine to medium grained (trace coarse grains), sub-rounded, poorly sorted, slightly clayey, silty sand. Trace gravel and yellow sandy pockets.
19	23	SILTY SAND	Red brown, yellow brown, fine to coarse grained, poorly sorted, silty sand. Trace yellow-brown pockets. Gravelly clasts at 22.5 m.
23	25.5	SILTY SAND	White, pale yellow, orange, silt to medium grained, poor to moderately sorted, sub-rounded to sub-angular, with some cobbles >50 mm (hard, consolidated brown sandstone)
25.5	28	SAND	Cream, white, fine to coarse grained, poorly to moderately sorted, sub-rounded to sub-angular, moderately consolidated. Silty in parts.
28	32.5	SAND	Brown, cream, white (mottled), very fine/silt to coarse grained, poorly to moderately sorted, moderately consolidated. Gravel in parts.
32.5	39.5	SANDSTONE	As above with some cemented, gravelly layers (little recovery from 30 to 36.5 m)
36.5	40.5	SAND/ SANDSTONE	Orange, white-cream and yellow-brown, fine to coarse grained, sub-rounded to rounded, poorly sorted, unconsolidated sand to moderately cementedt sandstone. Fragments of very hard (silicified) white, fine grained sandstone. Note top of rock logged at 38.1 m.
40.5	57.5	SANDSTONE	Pale grey-white and yellow-brown, minor orange-brown, fine to coarse grained, sub-rounded, poorly sorted, mostly consolidated, moderately hard to very hard/silicified, bedded sandstone. Minor silt layers and weathered in parts.
57.5	58.5	SANDSTONE	Pale grey-white, fine to coarse grained, sub-rounded, poorly sorted, very hard, silicified sandstone.
Core loss, greater than 0.25 m, recorded at 0.45, 1.95, 32.2, 33.3, 33.9, 35, 37.7, 39, 42.35, 47.75, and 53.4 m.			E.O.H 58.5 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (on-site 9-50 m depth)			



## MONITORING BORE COMPLETION DATA

BORE ID:	U-10
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Shallow, Fauna
COORDINATES:	410770.2 mE 8064054.3 mN
REDUCED LEVEL (top of steel standpipe):	20.4 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Delta Base (Rig 9)
DATE CONSTRUCTED:	29/08/11 to 06/09/11 (drilling completed 04/09/11)
DRILLING DETAILS:	0 to 50 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
SURFACE CASING:	nil
CASING:	+0.45 to 24.0 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	24.0 to 30.0 m, 3 mm aperture
BOREHEAD:	+0.7 to 0.4 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.15 m above ground level
GROUTED INTERVAL:	ground surface to 20.5 m
BENTONITE SEAL:	20.5 to 22.5 m
GRAVEL PACK:	22.5 to 50.5 m, graded +3.2 – 6.4
STATIC WATER LEVEL (01/12/11):	17.93 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (02/11/11):	650 $\mu$ S/cm / 7.2 pH units / 33.3°C (pumped sample)



## MONITORING BORE COMPLETION DATA

### U-10 (continued)

#### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	18	SILTY SAND	Dark red-brown, orange, fine to coarse grained (predominantly fine grained), sub-angular to sub-rounded, moderately sorted, unconsolidated, silty sand. Pockets of yellow sand decreasing with depth.
18	23.5	SAND	Red brown, pale red-brown, fine to coarse grained, sub-angular to sub-rounded, poorly sorted sand. Trace silt.
23.5	25.5	SILTY SAND	Pale brown, white-orange, fine to coarse grained, sub-angular to sub-rounded, poorly sorted sand, weakly cemented. Fractured at 24.5 m.
25.5	27	SAND/SANDSTONE	Pale brown, white and orange, fine to medium grained, moderately to well sorted, sub-angular, weakly cemented to unconsolidated.
27	34	SAND/SANDSTONE	As above with some red sand. Moderately cemented. Fractured at 30.5 m. Note top of rock logged at 27.75 m.
34	42	SAND/SANDSTONE	Pale grey, white, minor orange, fine to medium grained (some coarse grained and trace gravel), moderately to well sorted, sub-rounded to rounded, unconsolidated to weakly cemented. White silty bands ~ 1cm at 36.5 m, minor red and yellow mottling. Pink (weathering/oxidation) at 40 m. Well cemented and hard from 40.5 to 42 m.
42	45	SAND	White, grey to pale-grey, fine to coarse grained, sub-rounded to sub-angular, moderately sorted, weakly to very well cemented, with yellow orange silt. Minor cavities in moderately well cemented sandstone.
45	48	SANDSTONE	White, pink, medium to coarse grained, sub-rounded to rounded, moderately well sorted. Minor white and yellow silt.
48	50	SANDSTONE	White, cream, medium grained (some coarse grained), sub-rounded, moderately sorted, minor white silt, trace fine grained black mineral, minor brown bedding layers, well consolidated, very hard. Trace pebbles at 48.4 m
Core loss, greater than 0.25 m, recorded at 18.35, 19.65, 21.05, 22.55, 24.2, 25.5, 27.75, 29.5 m.			
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (on-site 0-50 m depth).			<b>E.O.H 50 m</b>



## MONITORING BORE COMPLETION DATA

BORE ID:	U-16
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Deep
COORDINATES:	410771.0 mE 8063754.4 mN
REDUCED LEVEL (top of steel standpipe):	19.0 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Hydrapower Scout (Rig 7)
DATE CONSTRUCTED:	07/10/11 to 13/10/11 (drilling completed 13/10/11)
DRILLING DETAILS:	0 to 50.0 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.5 to 40.5 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	34.5 to 40.5 m, 0.75 mm aperture
BOREHEAD:	+0.55 to 0.55 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.05 m above ground level
GROUTED INTERVAL:	ground surface to 30.0 m
BENTONITE SEAL:	30.0 to 32.0 m
GRAVEL PACK:	32.0 to 40.5, graded +1.6 – 3.2 40.5 to 50.0, graded +3.2 – 6.4
STATIC WATER LEVEL (04/12/11):	16.40 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (01/12/11):	400 µS/cm / 7.3 pH units / 37.2°C (pumped sample)



# MONITORING BORE COMPLETION DATA

## U-16 (continued)

### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	15	SILTY SAND	Red-brown, fine to medium grained, sub-rounded to sub-angular, poorly sorted, silty, with trace yellow sand pockets. Trace weakly cemented pockets at 11 m.
15	28.5	SAND	As above, decrease in silt content. Trace gravel. Weakly cemented at 20.5 m, with trace sandstone fragments from 22 m.
28.5	30	SAND/SANDSTONE	Pale yellow, grey, pale red-brown, fine to coarse grained (predominantly fine to medium grained), sub-angular to rounded, poorly to moderately sorted. Very weakly to moderately cemented, layered, mostly unconsolidated. Note top of rock logged at 28.7 m.
30	36	SANDSTONE/SAND	As above, increase in cementation.
36	50	SANDSTONE	Pale yellow, grey, fine to coarse grained (predominantly fine to medium grained), sub-angular to rounded, poorly to moderately sorted. Weakly to moderately cemented, layered, silicified in parts. Red, iron oxide staining at 45.5 m. Minor fracturing.
Core loss, of at least 0.25 m, recorded at 10.8, 12.45, 21.45, 24, 25.5, 26.25, 27, 41.05, 42, and 46.15 m.			<b>E.O.H 50 m</b>
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval).			



## MONITORING BORE COMPLETION DATA

BORE ID:	U-20
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore - Shallow
COORDINATES:	410768.4 mE 8063552.9 mN
REDUCED LEVEL (top of steel standpipe):	18.7 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Hydrapower Scout (Rig 7)
DATE CONSTRUCTED:	02/10/11 to 06/09/11 (drilling completed 05/10/11)
DRILLING DETAILS:	0 to 54 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
SURFACE CASING:	nil
CASING:	+0.7 to 21.2 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	15.2 to 21.2 m, 0.75 mm aperture
BOREHEAD:	+0.95 to 0.15 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.15 m above ground level
GROUTED INTERVAL:	ground surface to 10.8 m
BENTONITE SEAL:	10.8 to 12.8 m
GRAVEL PACK:	12.8 to 21.2 m, graded +1.6 – 3.2 21.2 to 54.0 M, graded +3.2 – 6.4
STATIC WATER LEVEL (29/11/11):	16.23 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (01/11/11):	750 µS/cm / 6.8 pH units / 32.4°C (pumped sample)



## MONITORING BORE COMPLETION DATA

### U-20 (continued)

#### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	24	SILTY SAND	Red-brown, fine to coarse grained (predominantly fine grained), moderately sorted, sub-rounded, silty, with some hard siltstone layers. Pockets of yellow, medium to coarse grained sand. Trace gravel at 24 m.
24	26	SANDSTONE	Orange, pale yellow, fine to medium grained (trace coarse grained), sub-rounded to sub-angular, moderately sorted, minor silt, weakly cemented to very hard, well consolidated.
26	39.75	SANDSTONE/SAND	As above, unconsolidated/very weakly cemented in parts. Yellow, pale yellow from 30 m, with pale grey, and pale brown from 36.7 m. Note top of rock at 33.8 m.
39.75	54	SANDSTONE	Pale yellow, white/off-white, minor orange, fine to medium grained (predominantly medium grained), moderately sorted, sub-rounded to sub-angular, moderately to well cemented, weakly cemented/unconsolidated in parts. Locally bedded/laminated. Brown, purple, weathered/oxidised, very hard, and with some porosity at 47 m. Red-pink, orange staining from 50 m.
Core loss, greater than 0.25 m, recorded at 6.25, 13.95, 27, 32.25, 36, 39, 41.25, m.			<b>E.O.H 54 m</b>
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (on-site 0-50 m depth).			



## MONITORING BORE COMPLETION DATA

BORE ID:	U-31
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore - Shallow
COORDINATES:	410769.2 mE 8063001.9 mN
REDUCED LEVEL (top of steel standpipe):	15.7 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	Delta Base (Rig 1)
DATE CONSTRUCTED:	03/10/11 to 06/10/11 (drilling completed 06/10/11)
DRILLING DETAILS:	0 to 51.1 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
SURFACE CASING:	nil
CASING:	+0.6 to 18.0 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	12.0 to 18.0 m, 0.75 mm aperture
BOREHEAD:	+0.85 to 0.25 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.10 m above ground level
GROUTED INTERVAL:	ground surface to 8.0 m
BENTONITE SEAL:	8.0 to 10.0 m
GRAVEL PACK:	10.0 to 18.0, graded +1.6 – 3.2 18.0 to 49.0 m, graded +3.2 – 6.4 (hole collapsed at 49.0 m)
STATIC WATER LEVEL (11/12/11):	13.17 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (10/12/11):	800 µS/cm / 6.6 pH units / 34.3°C (pumped sample)





# MONITORING BORE COMPLETION DATA

## U-31 (continued)

### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	14.5	SILTY SAND	Red-brown, fine to medium grained (trace coarse grained and gravel), sub-rounded, poorly sorted, silty. Minor clay in parts and pockets of yellow brown, pale yellow and dark brown silty sand throughout. Unconsolidated with trace cemented fragments.
14.5	21	SILTY SAND	As above, red-brown to yellow-brown, fine to coarse grained.
21	25.5	SILTY SAND	Orange-brown, dark red-brown, fine to medium grained with some gravel, sub-rounded to sub-angular, poorly sorted, mottled, silty sand.
25.5	27	SAND	Pale orange brown, fine to medium grained (trace silt and coarse grained), sub-rounded, poorly sorted sand. Note top of rock at 26.9 m.
27	30.5	SANDSTONE/SAND	Pale yellow-brown, orange-brown, cream, fine to medium grained, rounded to sub-rounded, poorly sorted, very weakly to weakly cemented, bedded, minor cavities, some fracturing and unconsolidated sand.
30.5	33.5	SANDSTONE	As above, increase in cementation.
33.5	51.1	SANDSTONE	Pale yellow-brown, grey, cream, fine to medium grained, rounded to sub-rounded, moderately sorted moderately to well cemented, some fractures and bedding. Minor cavities at 38 m. Minor weakly cemented/unconsolidated sand. Dark red brown sandstone from 43.5 to 43.8 m.
Core loss, greater than 0.25 m, recorded at 25.2, 33, 34.3, 35.25, 36, 36.75, 39, 40.9, 42.1, 46.85, and 49 m.			
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (on-site 6-31 m depth)			<b>E.O.H 51.1 m</b>



## MONITORING BORE COMPLETION DATA

BORE ID:	V-25
LOCATION:	James Price Point, Browse Onshore Precinct (#68 Geotechnical Drilling Programme)
STATUS:	Monitoring Bore – Deep, Fauna
COORDINATES:	410818.9 mE 8063299.9 mN
REDUCED LEVEL (top of steel standpipe):	18.0 m AHD
DRILLING CONTRACTOR:	Hagstrom (under supervision of Fugro)
DRILLING RIG:	GDR650 (Rig 1)
DATE CONSTRUCTED:	31/10/11 to 05/11/11 (drilling completed 03/11/11)
DRILLING DETAILS:	0 to 50.0 m, mud rotary coring, PQ3, diamond
HOLE DIAMETER:	123 mm
CASING:	+0.7 to 39.5 m, 50 mm ID, 57.5 mm OD, Class 18 uPVC casing, threaded, 3 m lengths, with screwed-on end cap
SLOTTED INTERVAL:	33.5 to 39.5 m, 3.0 mm aperture
BOREHEAD:	+0.75 to 0.35 m, 100 mm diameter, steel standpipe, pad-locked 0.5 x 0.5 m square block cemented to +0.05 m above ground level
GROUTED INTERVAL:	ground surface to 28.5 m
BENTONITE SEAL:	28.5 to 31.0 m
GRAVEL PACK:	31.0 to 50.5, graded +3.2 – 6.4
STATIC WATER LEVEL (10/12/11):	15.24 m below datum (ie top of steel standpipe)
EC/pH/TEMPERATURE (09/12/11):	330 µS/cm / 7.1 pH units / 36.9°C (pumped sample)



# MONITORING BORE COMPLETION DATA

## V-25 (continued)

### LITHOLOGY:

Depth From (m)	Depth To (m)	Lithology	Description
0	10.5	SILTY SAND	Red-brown, dark red-brown, fine to medium grained, rounded to sub-angular, poorly sorted, silty, with yellow and yellow-brown sand pockets.
10.5	12.45	SILTY SAND	As above, with trace gravel, and weakly cemented sandstone fragments.
12.45	21.5	SILTY SAND	As above with pale grey mottling to 13.5 m, yellow sand pockets, moderately consolidated to weakly cemented.
21.5	27	SAND/SANDSTONE	Pale red, yellow-brown, some mottling, fine to medium grained, sub-rounded to sub-angular, poorly sorted, trace to slightly silty. Very weakly cemented to unconsolidated.
27	30.5	SANDSTONE	As above, increase in cementation.
30.5	50	SANDSTONE	Pale yellow-brown, grey, fine to medium grained, minor gravel, sub-rounded to sub-angular, moderately to poorly sorted. Layered, very weakly cemented to moderately cemented, moderately fractured. Minor silicified layers and some (minor) unconsolidated intervals. Note top of rock at 28.7 m.
Core loss, of at least 0.25 m, recorded at,4.25, 9.2, 16.25, 27.7, and 34.55 m			E.O.H 50 m
Log derived by Fugro borehole log and core photographs (Fugro 2011) and Rockwater hydrogeologist (slotted interval)..			



**APPENDIX III**

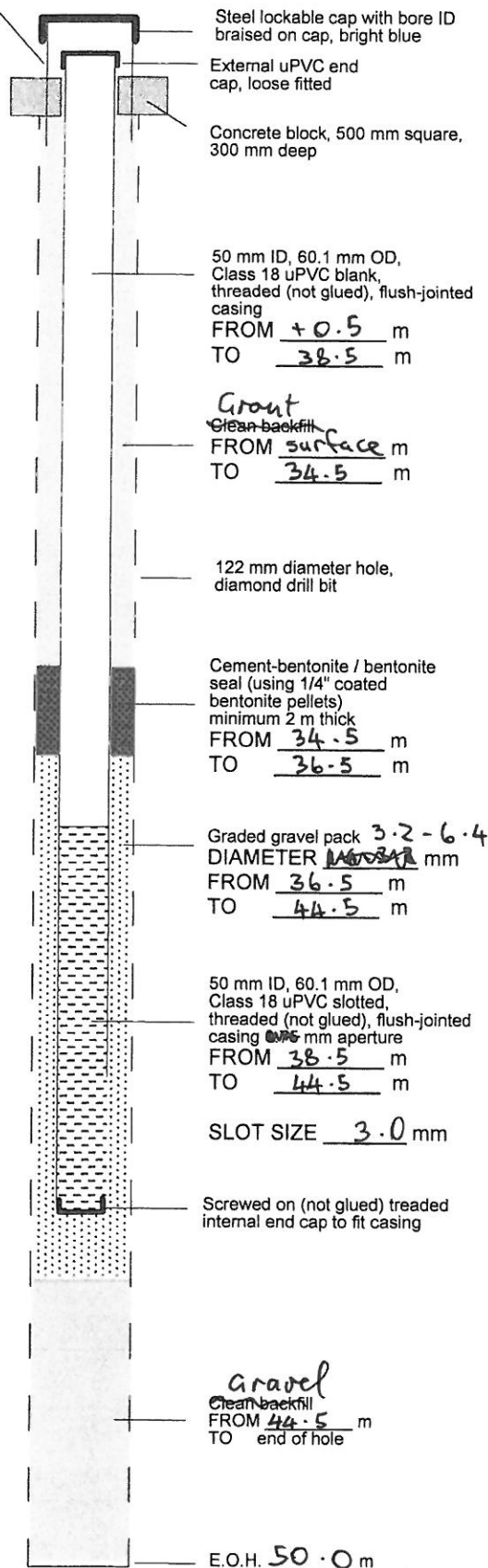
**ROCKWATER MONITORING BORE DESIGNS**



# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



Not to scale

# COMPLETION DETAILS

LOCATION JEP

HOLE ID AD-16

CO-ORDS mE mN

RL mAHD

BORE TYPE MONITORING / STYGOFAUNA

DEEP ☒ FAUNA ☒

SHALLOW ☐ PASS ☐

STYGO HABITAT PRESENT

YES ☒ NO ☐

DRILLING

DATE                      commence

DATE                      complete

CONTRACTOR HAGSTROM

DRILLER                     

CREW                     

RIG TYPE                     

ABANDONED/BACKFILLED no yes

DRILL METHOD                     

DRILL DEPTH                      m from natural surface

HOLE DIAMETER                      mm TYPE                     

CUT WATER                      m

SWL                      m

BORE CONSTRUCTION

DATE                      commence

DATE                      complete

DESIGNED BY                     

SUPERVISED BY                     

CONSTRUCTED BY                     

CASED DEPTH                      m below natural surface

TOP OF MAIN CASING                      m above natural surface

SURFACE CASING left-in ☐ removed ☐

                     m material

                     m below natural surface

                     m above natural surface

MAIN BORE CASING                      m depth from

                     m depth to

                     ID                      OD

                     material

                     m total length

SLOT INTERVAL                      m depth from

                     m depth to

SLOT SIZE                      mm

ANNULUS

GRAVEL PACK

BACKFILL

CEMENT

BENTONITE

HEADWORKS

TYPE standpipe ☐ surface casing ☐

MATERIAL                      m below natural surface

                     m above natural surface

SECURITY                     

OTHER DETAILS                     

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: Nov  
August 2011

Drg. No.: 368-0-2A/11/XX

AD - 16

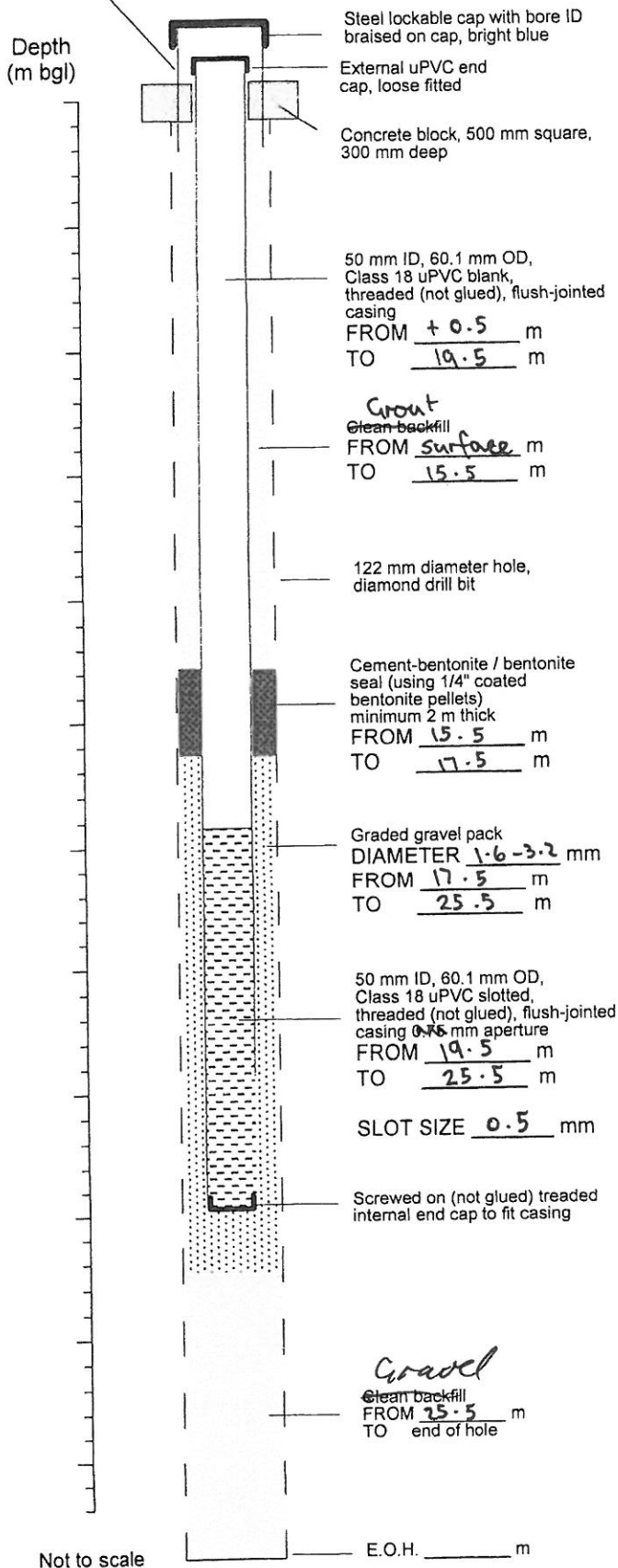
**MONITORING BORE CONSTRUCTION**

Submitted to Arup / Fugro / Hagstrom 07/11/11 Ammon

Rockwater Pty Ltd

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue



# COMPLETION DETAILS

LOCATION JPP  
HOLE ID AD-20

CO-ORDS mE mN  
RL mAHD  
BORE TYPE MONITORING

DEEP ☐ FAUNA ☐  
SHALLOW ☒ PASS ☐

STYGO HABITAT PRESENT  
YES ☐ NO ☒

DRILLING  
DATE \_\_\_\_\_ commence  
DATE \_\_\_\_\_ complete  
CONTRACTOR \_\_\_\_\_  
DRILLER \_\_\_\_\_  
CREW \_\_\_\_\_  
RIG TYPE \_\_\_\_\_  
ABANDONED/BACKFILLED ☐ no ☐ yes  
DRILL METHOD \_\_\_\_\_  
DRILL DEPTH \_\_\_\_\_ m from natural surface  
HOLE DIAMETER \_\_\_\_\_ mm TYPE \_\_\_\_\_  
CUT WATER \_\_\_\_\_ m  
SWL \_\_\_\_\_ m

BORE CONSTRUCTION  
DATE \_\_\_\_\_ commence  
DATE \_\_\_\_\_ complete  
DESIGNED BY \_\_\_\_\_  
SUPERVISED BY \_\_\_\_\_  
CONSTRUCTED BY \_\_\_\_\_

CASED DEPTH \_\_\_\_\_ m below natural surface  
TOP OF MAIN CASING \_\_\_\_\_ m above natural surface

SURFACE CASING left-in ☐ removed ☐  
material \_\_\_\_\_  
\_\_\_\_\_ m below natural surface  
\_\_\_\_\_ m above natural surface

MAIN BORE CASING \_\_\_\_\_ m depth from  
\_\_\_\_\_ m depth to  
\_\_\_\_\_ ID \_\_\_\_\_ OD  
\_\_\_\_\_ material  
\_\_\_\_\_ m total length

SLOT INTERVAL \_\_\_\_\_ m depth from  
\_\_\_\_\_ m depth to

SLOT SIZE \_\_\_\_\_ mm

ANNULUS  
GRAVEL PACK \_\_\_\_\_  
BACKFILL \_\_\_\_\_  
CEMENT \_\_\_\_\_  
BENTONITE \_\_\_\_\_

HEADWORKS  
TYPE ☒ standpipe ☐ surface casing  
MATERIAL \_\_\_\_\_  
\_\_\_\_\_ m below natural surface  
\_\_\_\_\_ m above natural surface

SECURITY \_\_\_\_\_

OTHER DETAILS \_\_\_\_\_

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL  
Project: #68 Geotech Drilling - Construction of Monitoring Bores  
Date: Nov August 2011  
Drg. No.: 368-0-2A/11/XX

AD-20  
**MONITORING BORE CONSTRUCTION**

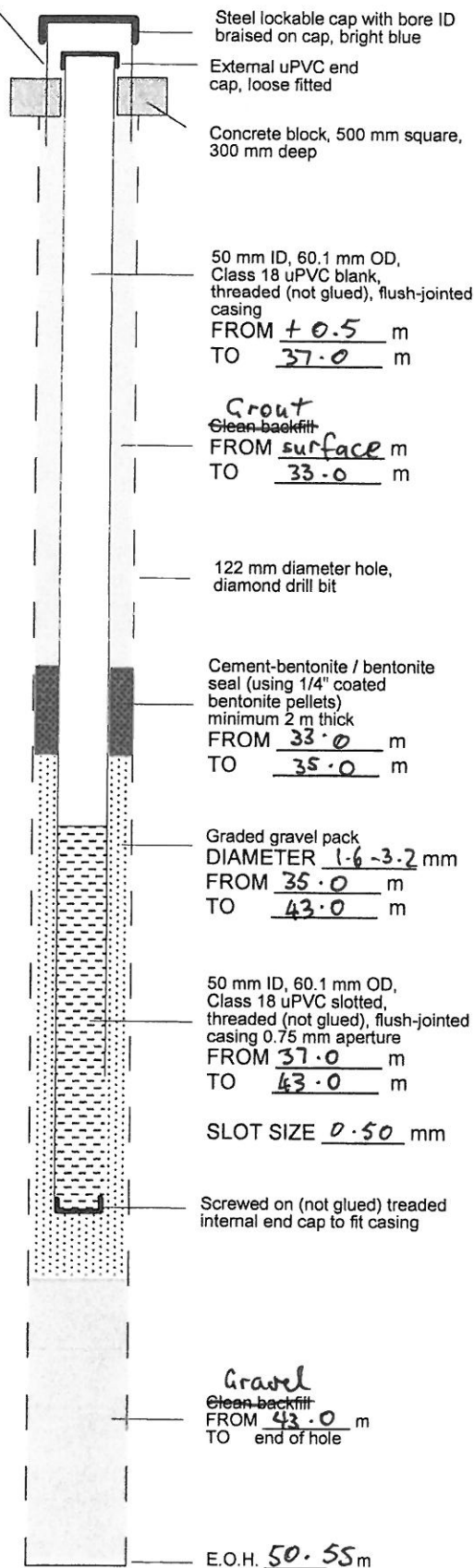
Rockwater Pty Ltd

Submitted to Arup, Fugro, Halcrow 13/11/11 MMahon

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



Not to scale

# COMPLETION DETAILS

LOCATION JPP  
HOLE ID AD-28

CO-ORDS mE mN  
RL MAHD  
BORE TYPE MONITORING

DEEP ☒ FAUNA ☐  
SHALLOW ☐ PASS ☐

STYGO HABITAT PRESENT  
YES ☐ NO ☐

DRILLING  
DATE 07/11/11 commence  
DATE complete  
CONTRACTOR HAGSTROM  
DRILLER  
CREW  
RIG TYPE  
ABANDONED/BACKFILLED no yes  
DRILL METHOD  
DRILL DEPTH m from natural surface  
HOLE DIAMETER mm TYPE  
CUT WATER m  
SWL m

BORE CONSTRUCTION  
DATE commence  
DATE complete  
DESIGNED BY  
SUPERVISED BY  
CONSTRUCTED BY

CASED DEPTH m below natural surface  
TOP OF MAIN CASING m above natural surface

SURFACE CASING left-in ☐ removed ☐  
m below natural surface  
m above natural surface

MAIN BORE CASING m depth from  
m depth to  
ID OD  
m material  
m total length

SLOT INTERVAL m depth from  
m depth to  
SLOT SIZE mm

ANNULUS  
GRAVEL PACK  
BACKFILL  
CEMENT  
BENTONITE

HEADWORKS  
TYPE standpipe ☐ surface casing ☐  
MATERIAL m below natural surface  
m above natural surface

SECURITY  
OTHER DETAILS

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL  
Project: #68 Geotech Drilling - Construction of Monitoring Bores  
Date: Nov  
August 2011  
Drg. No.: 368-0-2A/11/XX

AD-28  
**MONITORING BORE CONSTRUCTION**

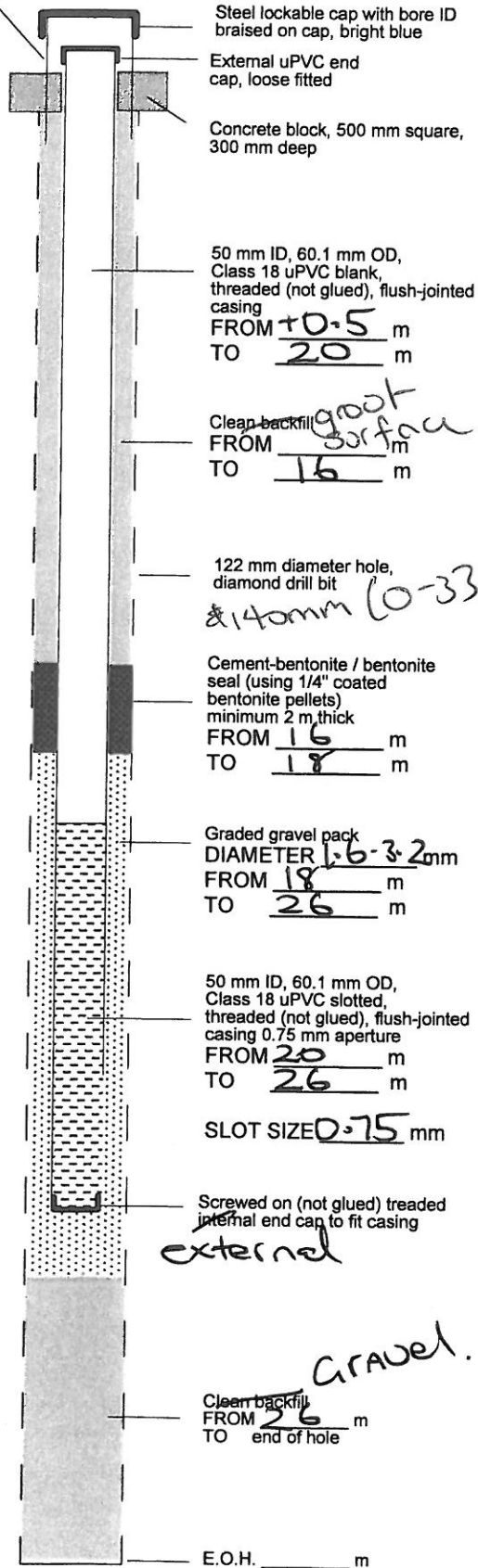
Submitted to Arup, Fugro, Hagstrom 10/11/11 A Mahon

Rockwater Pty Ltd

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



Not to scale

E.O.H. \_\_\_\_\_ m

# COMPLETION DETAILS

LOCATION	JPP	
HOLE ID	AE-10	
CO-ORDS	mE	mN
RL	mAH	
BORE TYPE	Monitoring	
DEEP	<input type="checkbox"/>	FAUNA
SHALLOW	<input checked="" type="checkbox"/>	PASS
STYGO HABITAT PRESENT	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>
<b>DRILLING</b>		
DATE	30/8/11	commence
DATE		complete
CONTRACTOR	Flagstrom	
DRILLER	Rig 7	
CREW	Scott Hydrapower	
RIG TYPE		
ABANDONED/BACKFILLED	no	yes
DRILL METHOD	from natural surface	
HOLE DIAMETER	mm	TYPE
CUT WATER	m	
SWL	m	
<b>BORE CONSTRUCTION</b>		
DATE		commence
DATE		complete
DESIGNED BY		
SUPERVISED BY		
CONSTRUCTED BY		
CASED DEPTH	m	below natural surface
TOP OF MAIN CASING	m	above natural surface
SURFACE CASING	left-in	<input type="checkbox"/> removed <input type="checkbox"/> material
	m	below natural surface
	m	above natural surface
MAIN BORE CASING	m	depth from
	m	depth to
	ID	OD
		material
	m	total length
SLOT INTERVAL	m	depth from
	m	depth to
SLOT SIZE	mm	
ANNULUS		
GRAVEL PACK		
BACKFILL		
CEMENT		
BENTONITE		
HEADWORKS		
TYPE	standpipe	<input type="checkbox"/> surface casing <input type="checkbox"/>
MATERIAL		
	m	below natural surface
	m	above natural surface
SECURITY		
OTHER DETAILS	hydrocarbons used	

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL  
 Project: #68 Geotech Drilling - Construction of Monitoring Bores  
 Date: August 2011  
 Drg. No.: 368-0-2A/11/XX

# MONITORING BORE CONSTRUCTION

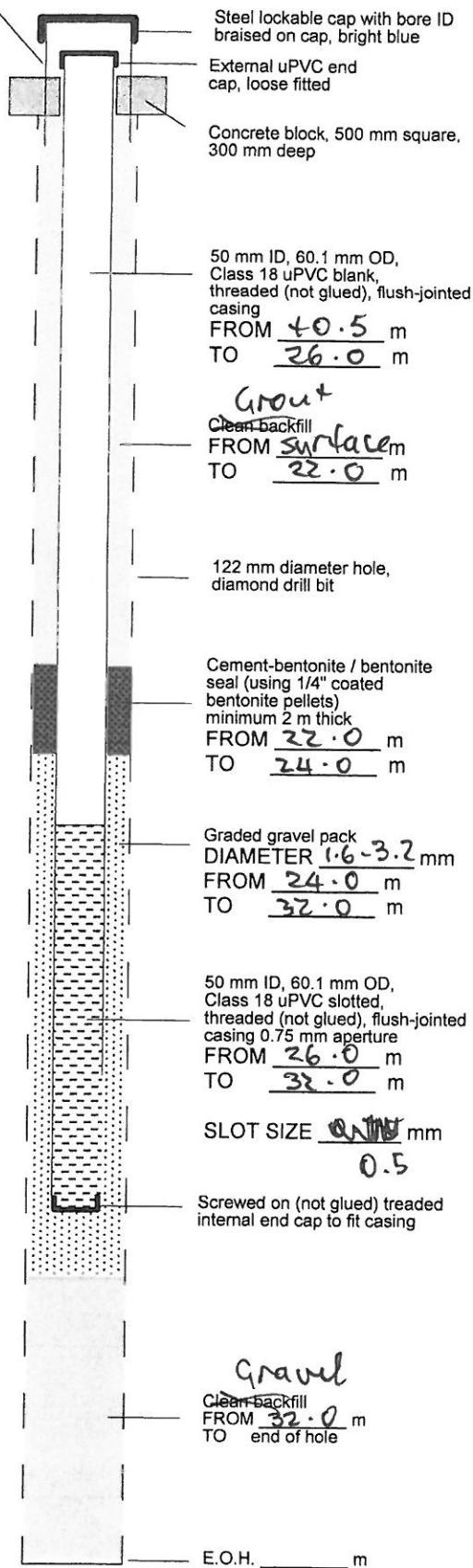
AE-10



# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



Not to scale

E.O.H. \_\_\_\_\_ m

# COMPLETION DETAILS

LOCATION	5 PP	
HOLE ID	AP-12	
CO-ORDS	mE	mN
RL	mAH	
BORE TYPE	MONITORING	
DEEP	<input type="checkbox"/>	FAUNA
SHALLOW	<input checked="" type="checkbox"/>	PASS
STYGO HABITAT PRESENT	YES <input type="checkbox"/>	NO <input type="checkbox"/>
<b>DRILLING</b>		
DATE	commence	
DATE	complete	
CONTRACTOR		
DRILLER		
CREW		
RIG TYPE		
ABANDONED/BACKFILLED	no <input type="checkbox"/>	yes <input type="checkbox"/>
DRILL METHOD		
DRILL DEPTH	m	from natural surface
HOLE DIAMETER	mm	TYPE
CUT WATER	m	
SWL	m	
<b>BORE CONSTRUCTION</b>		
DATE	commence	
DATE	complete	
DESIGNED BY		
SUPERVISED BY		
CONSTRUCTED BY		
CASED DEPTH	m	below natural surface
TOP OF MAIN CASING	m	above natural surface
SURFACE CASING	left-in <input type="checkbox"/>	removed <input type="checkbox"/>
	m	below natural surface
	m	above natural surface
MAIN BORE CASING	m	depth from
	m	depth to
	ID	OD
	m	material
	m	total length
SLOT INTERVAL	m	depth from
	m	depth to
SLOT SIZE	mm	
ANNULUS		
GRAVEL PACK		
BACKFILL		
CEMENT		
BENTONITE		
HEADWORKS		
TYPE	standpipe <input type="checkbox"/>	surface casing <input type="checkbox"/>
MATERIAL	m	below natural surface
	m	above natural surface
SECURITY		
<b>OTHER DETAILS</b>		

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: Nov August 2011

Drg. No.: 368-0-2A/11/XX

## MONITORING BORE CONSTRUCTION

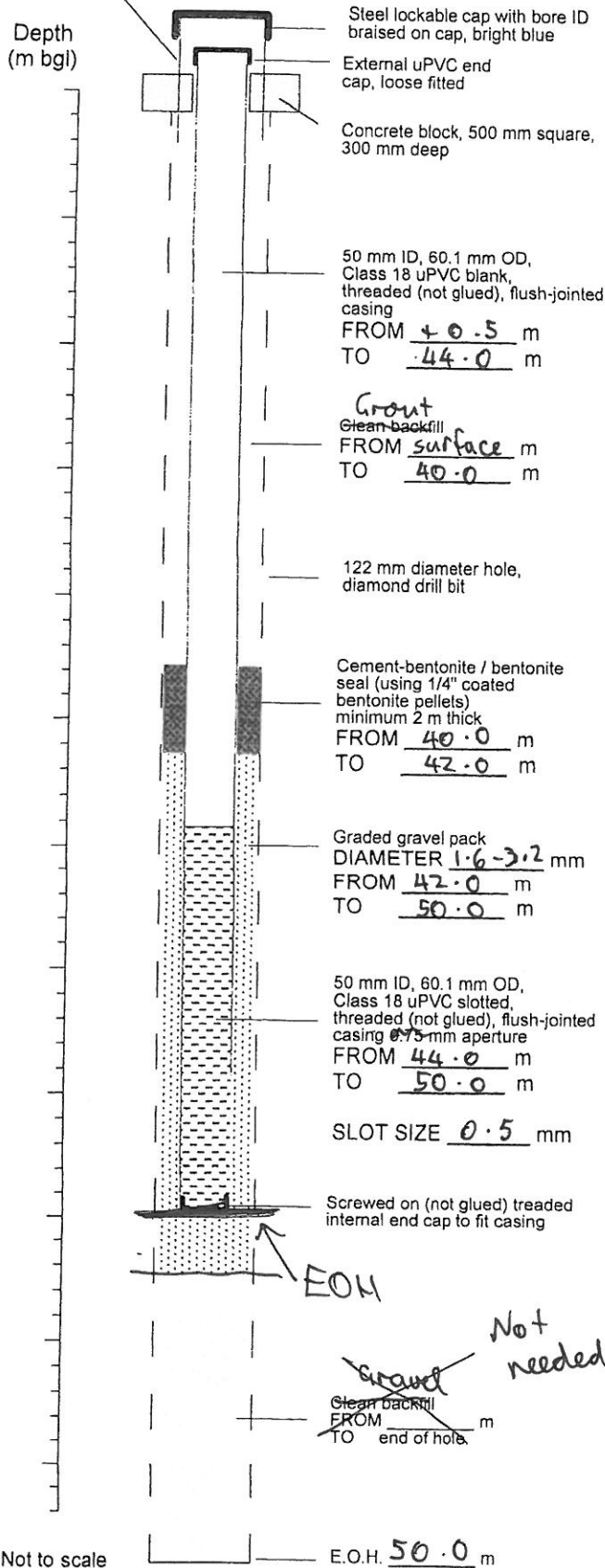
AP-12

Rockwater Pty Ltd

Submitted to Arup, Fugro, Hargreaves 02/11/11 4 Mahon

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue



# COMPLETION DETAILS

LOCATION JPP  
HOLE ID AP-14

CO-ORDS mE mN  
RL mAHD  
BORE TYPE MONITORING

DEEP ☒ FAUNA ☐  
SHALLOW ☐ PASS ☐

STYGO HABITAT PRESENT  
YES ☐ NO ☒

DRILLING  
DATE                      commence  
DATE                      complete  
CONTRACTOR                       
DRILLER                       
CREW                       
RIG TYPE                       
ABANDONED/BACKFILLED no yes  
DRILL METHOD                       
DRILL DEPTH                      m from natural surface  
HOLE DIAMETER                      mm TYPE                       
CUT WATER                      m  
SWL                      m

BORE CONSTRUCTION  
DATE                      commence  
DATE                      complete  
DESIGNED BY                       
SUPERVISED BY                       
CONSTRUCTED BY                     

CASED DEPTH                      m below natural surface  
TOP OF MAIN CASING                      m above natural surface

SURFACE CASING left-in ☐ removed ☐  
                     m material  
                     m below natural surface  
                     m above natural surface

MAIN BORE CASING                      m depth from  
                     m depth to  
                     ID                      OD  
                     material  
                     m total length

SLOT INTERVAL                      m depth from  
                     m depth to  
SLOT SIZE                      mm

ANNULUS  
GRAVEL PACK                       
BACKFILL                       
CEMENT                       
BENTONITE                     

HEADWORKS  
TYPE standpipe ☐ surface casing ☐  
                     m below natural surface  
                     m above natural surface

SECURITY                     

OTHER DETAILS                     

I:\368-0-2A\Data\Bore Design\To Construct.grf

Client: WEL  
Project: #68 Geotech Drilling - Construction of Monitoring Bores  
Date: Nov August 2011  
Drg. No.: 368-0-2A/11/XX

AP-14  
**MONITORING BORE CONSTRUCTION**

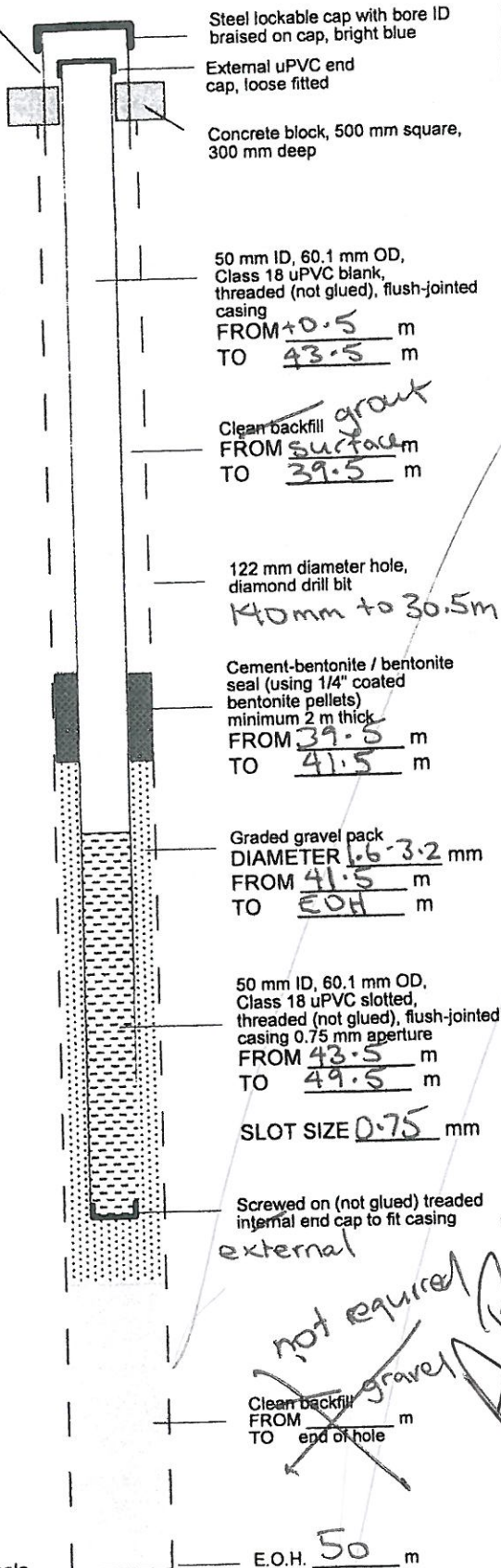
Submitted to Arup, Fugro, Hagsstrom 15/11/11 AM/hon

Rockwater Pty Ltd

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



Not to scale

# COMPLETION DETAILS

LOCATION  
HOLE ID

James Price Point  
AP-16

CO-ORDS

mE mN

RL

mAHD

BORE TYPE

Monitoring

DEEP  
SHALLOW

☒ FAUNA  
☐ PASS

☒

STYGO HABITAT PRESENT

YES 0.28.5m

☒ NO

Slotted uPVC

DRILLING

DATE

2/9/11

commence

DATE

complete

CONTRACTOR

HAGSTROM

DRILLER

Rica

CREW

RIG TYPE

ABANDONED/BACKFILLED

no ☒ yes

DRILL METHOD

Direct Core

DRILL DEPTH

50 m

from natural surface

HOLE DIAMETER

120 & 140 mm

TYPE

PQ & PWT

CUT WATER

0 m

SWL

0 m

BORE CONSTRUCTION

DATE

commence

DATE

complete

DESIGNED BY

CASPER KIELICZ Rockwater

SUPERVISED BY

CONSTRUCTED BY

CASED DEPTH

m below natural surface

TOP OF MAIN CASING

m above natural surface

SURFACE CASING

left-in

☐ removed

☐

material

m

below natural surface

m

above natural surface

MAIN BORE CASING

m

depth from

m

depth to

m

ID

m

material

m

total length

SLOT INTERVAL

m

depth from

m

depth to

SLOT SIZE

mm

ANNULUS

GRAVEL PACK

BACKFILL

CEMENT

BENTONITE

HEADWORKS

TYPE

standpipe

☐

surface casing

☐

MATERIAL

m

below natural surface

m

above natural surface

SECURITY

OTHER DETAILS

Decontaminated site

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: August 2011

Drg. No.: 368-0-2A/11/XX

MONITORING BORE CONSTRUCTION

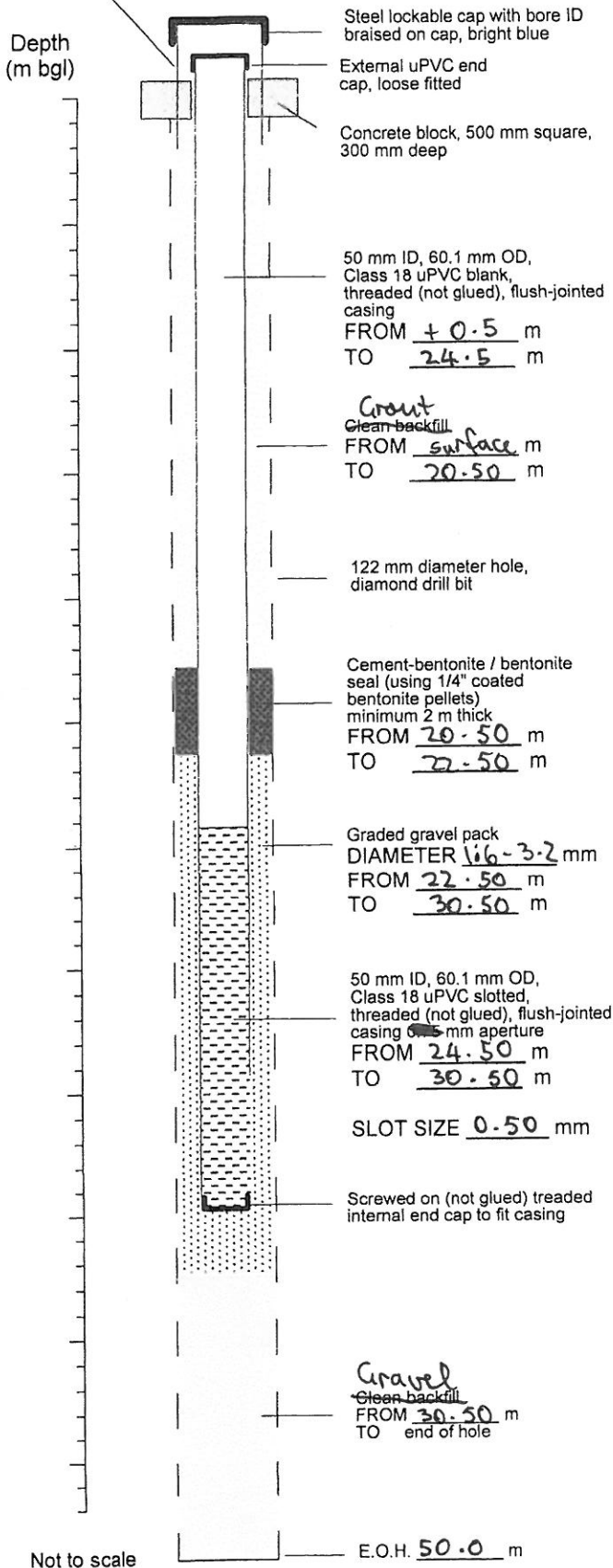
AP-16

Rockwater Pty Ltd



# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue



# COMPLETION DETAILS

LOCATION JRP AP-20

HOLE ID AP-20

CO-ORDS mE mN

RL mAHD

BORE TYPE MONITORING

DEEP ☐ FAUNA ☐

SHALLOW ☒ PASS ☐

STYGO HABITAT PRESENT

YES ☐ NO ☒

DRILLING

DATE                      commence

DATE                      complete

CONTRACTOR HAGSTROM

DRILLER                     

CREW                     

RIG TYPE                     

ABANDONED/BACKFILLED no yes

DRILL METHOD                      m from natural surface

DRILL DEPTH                      m TYPE                     

HOLE DIAMETER                      mm

CUT WATER                      m

SWL                      m

BORE CONSTRUCTION

DATE                      commence

DATE                      complete

DESIGNED BY                     

SUPERVISED BY                     

CONSTRUCTED BY                     

CASED DEPTH                      m below natural surface

TOP OF MAIN CASING                      m above natural surface

SURFACE CASING left-in ☐ removed ☐

                     m material

                     m below natural surface

                     m above natural surface

MAIN BORE CASING                      m depth from

                     m depth to

                     ID                      OD

                     material

                     m total length

SLOT INTERVAL                      m depth from

                     m depth to

SLOT SIZE                      mm

ANNULUS

GRAVEL PACK                     

BACKFILL                     

CEMENT                     

BENTONITE                     

HEADWORKS

TYPE standpipe ☐ surface casing ☐

MATERIAL                      m below natural surface

                     m above natural surface

SECURITY                     

OTHER DETAILS                     

I:\368-0-2A\Data\Bore Design\To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: Nov August 2011

Drg. No.: 368-0-2A/11/XX

AP-20

**MONITORING BORE CONSTRUCTION**

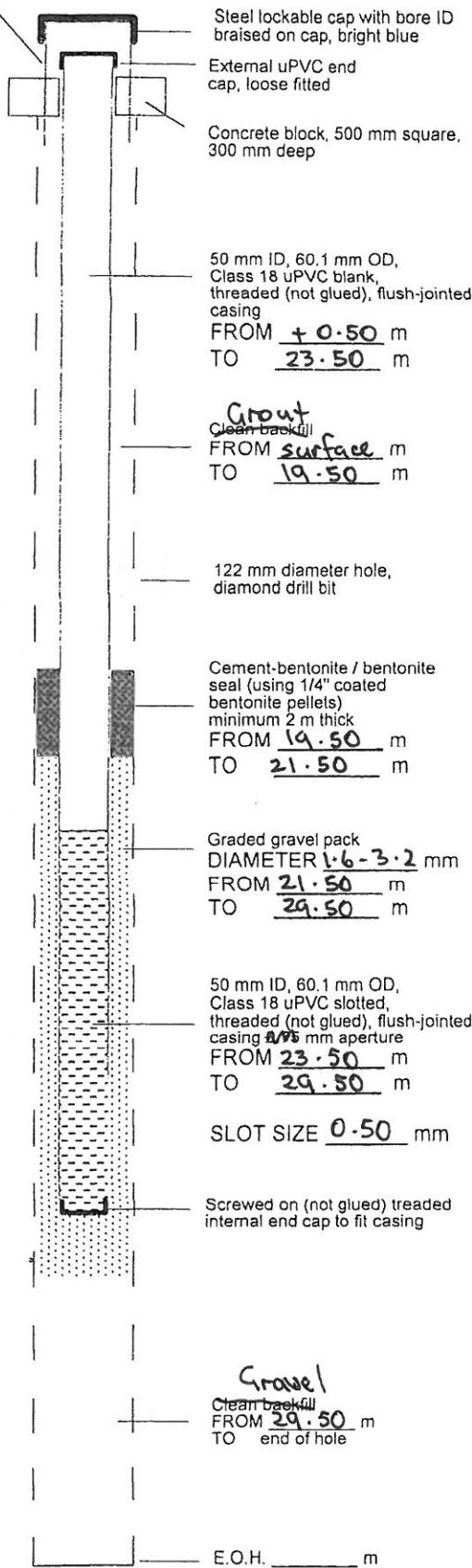
Submitted to Arup, Fugro, Hagstrom

4/11/11 Mahon Rockwater Pty Ltd

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



# COMPLETION DETAILS

LOCATION JPP  
HOLE ID AP - 24

CO-ORDS \_\_\_\_\_ mE \_\_\_\_\_ mN  
RL \_\_\_\_\_ mAH  
BORE TYPE MONITORING

DEEP ☐ FAUNA ☐  
SHALLOW ☒ PASS ☐

STYGO HABITAT PRESENT  
YES ☐ NO ☒

DRILLING  
DATE \_\_\_\_\_ commence  
DATE \_\_\_\_\_ complete  
CONTRACTOR HAGSTROM  
DRILLER \_\_\_\_\_  
CREW \_\_\_\_\_  
RIG TYPE \_\_\_\_\_  
ABANDONED/BACKFILLED no \_\_\_\_\_ yes \_\_\_\_\_  
DRILL METHOD \_\_\_\_\_  
DRILL DEPTH \_\_\_\_\_ m from natural surface  
HOLE DIAMETER \_\_\_\_\_ mm TYPE \_\_\_\_\_  
CUT WATER \_\_\_\_\_ m  
SWL \_\_\_\_\_ m

BORE CONSTRUCTION  
DATE \_\_\_\_\_ commence  
DATE \_\_\_\_\_ complete  
DESIGNED BY \_\_\_\_\_  
SUPERVISED BY \_\_\_\_\_  
CONSTRUCTED BY \_\_\_\_\_

CASED DEPTH \_\_\_\_\_ m below natural surface  
TOP OF MAIN CASING \_\_\_\_\_ m above natural surface

SURFACE CASING left-in ☐ removed ☐  
material \_\_\_\_\_  
\_\_\_\_\_ m below natural surface  
\_\_\_\_\_ m above natural surface

MAIN BORE CASING \_\_\_\_\_ m depth from  
\_\_\_\_\_ m depth to  
\_\_\_\_\_ ID \_\_\_\_\_ OD  
\_\_\_\_\_ material  
\_\_\_\_\_ m total length

SLOT INTERVAL \_\_\_\_\_ m depth from  
\_\_\_\_\_ m depth to

SLOT SIZE \_\_\_\_\_ mm

ANNULUS  
GRAVEL PACK \_\_\_\_\_  
BACKFILL \_\_\_\_\_  
CEMENT \_\_\_\_\_  
BENTONITE \_\_\_\_\_

HEADWORKS  
TYPE standpipe ☐ surface casing ☐  
MATERIAL \_\_\_\_\_  
\_\_\_\_\_ m below natural surface  
\_\_\_\_\_ m above natural surface

SECURITY \_\_\_\_\_

OTHER DETAILS \_\_\_\_\_

I:\368-0-2A\Data\Bore Design\To Construct.grf

Client: WEL  
Project: #68 Geotech Drilling - Construction of Monitoring Bores  
Date: Nov  
August 2011  
Drg. No.: 368-0-2A/11/XX

AP - 24  
MONITORING BORE CONSTRUCTION

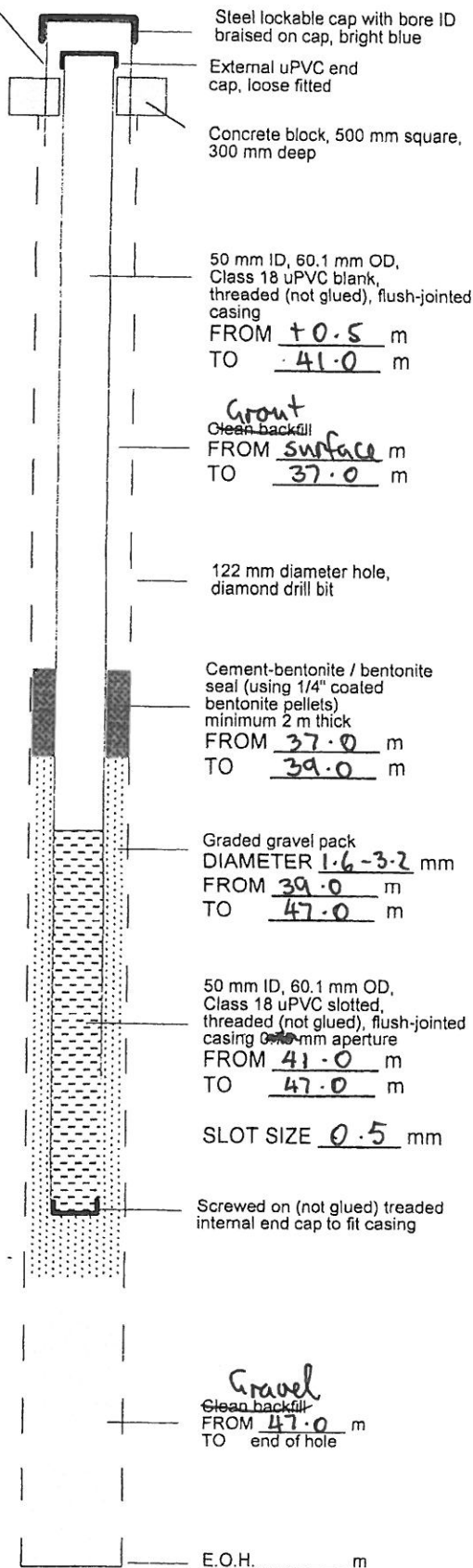
Submitted to Arup, Fugro, Hagstrom 29/11/11 AMoham

Rockwater Pty Ltd

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



# COMPLETION DETAILS

LOCATION JPP  
HOLE ID AP-28

CO-ORDS \_\_\_\_\_ mE \_\_\_\_\_ mN  
RL \_\_\_\_\_ mAHD

BORE TYPE MONITORING

DEEP ☒ FAUNA ☐  
SHALLOW ☐ PASS ☐

STYGO HABITAT PRESENT  
YES ☐ NO ☒

DRILLING  
DATE \_\_\_\_\_ commence  
DATE \_\_\_\_\_ complete  
CONTRACTOR \_\_\_\_\_  
DRILLER \_\_\_\_\_  
CREW \_\_\_\_\_  
RIG TYPE \_\_\_\_\_

ABANDONED/BACKFILLED ☐ no ☐ yes

DRILL METHOD \_\_\_\_\_  
DRILL DEPTH \_\_\_\_\_ m from natural surface  
HOLE DIAMETER \_\_\_\_\_ mm TYPE \_\_\_\_\_  
CUT WATER \_\_\_\_\_ m  
SWL \_\_\_\_\_ m

BORE CONSTRUCTION  
DATE \_\_\_\_\_ commence  
DATE \_\_\_\_\_ complete

DESIGNED BY \_\_\_\_\_  
SUPERVISED BY \_\_\_\_\_  
CONSTRUCTED BY \_\_\_\_\_

CASED DEPTH \_\_\_\_\_ m below natural surface  
TOP OF MAIN CASING \_\_\_\_\_ m above natural surface

SURFACE CASING left-in ☐ removed ☐  
material \_\_\_\_\_  
\_\_\_\_\_ m below natural surface  
\_\_\_\_\_ m above natural surface

MAIN BORE CASING \_\_\_\_\_ m depth from  
\_\_\_\_\_ m depth to  
\_\_\_\_\_ ID \_\_\_\_\_ OD  
\_\_\_\_\_ material  
\_\_\_\_\_ m total length

SLOT INTERVAL \_\_\_\_\_ m depth from  
\_\_\_\_\_ m depth to

SLOT SIZE \_\_\_\_\_ mm

ANNULUS  
GRAVEL PACK  
BACKFILL  
CEMENT  
BENTONITE

HEADWORKS  
TYPE standpipe ☐ surface casing ☐  
MATERIAL \_\_\_\_\_ m below natural surface  
\_\_\_\_\_ m above natural surface

SECURITY \_\_\_\_\_

OTHER DETAILS \_\_\_\_\_

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL  
Project: #68 Geotech Drilling - Construction of Monitoring Bores  
Date: Nov  
August 2011  
Drg. No.: 368-0-2A/11/XX

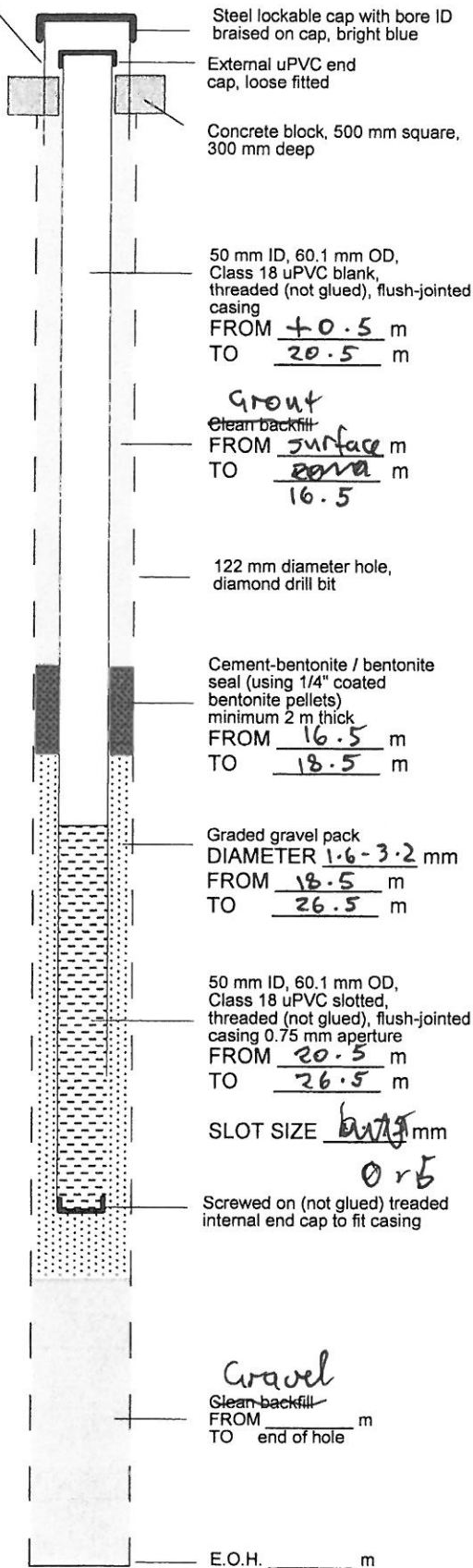
AP-28  
**MONITORING BORE CONSTRUCTION**

Submitted to Fugro, Arup, Magstrom 15/11/11 Mahon Rockwater Pty Ltd

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



# COMPLETION DETAILS

LOCATION JPP  
HOLE ID AP-32 Revised

CO-ORDS mE mN  
RL MAHD  
BORE TYPE MONITORING

DEEP ☐ FAUNA ☐  
SHALLOW ☒ PASS ☐

STYGO HABITAT PRESENT  
YES ☐ NO ☒

DRILLING  
DATE 03/11/11 commence  
DATE 03/11/11 complete  
CONTRACTOR HAGSTROM  
DRILLER   
CREW   
RIG TYPE   
ABANDONED/BACKFILLED no yes  
DRILL METHOD   
DRILL DEPTH  m from natural surface  
HOLE DIAMETER  mm TYPE   
CUT WATER  m  
SWL  m

BORE CONSTRUCTION  
DATE  commence  
DATE  complete  
DESIGNED BY   
SUPERVISED BY   
CONSTRUCTED BY

CASED DEPTH  m below natural surface  
TOP OF MAIN CASING  m above natural surface

SURFACE CASING left-in ☐ removed ☐  
 m material  
 m below natural surface  
 m above natural surface

MAIN BORE CASING  m depth from  
 m depth to  
 ID  OD  
 material  
 m total length

SLOT INTERVAL  m depth from  
 m depth to  
SLOT SIZE  mm

ANNULUS  
GRAVEL PACK   
BACKFILL   
CEMENT   
BENTONITE

HEADWORKS  
TYPE standpipe ☐ surface casing ☐  
MATERIAL  m below natural surface  
 m above natural surface

SECURITY

OTHER DETAILS

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: Nov  
August 2011

Drg. No.: 368-0-2A/11/XX

Submitted to Anup, Fugro, Hagstrom

AP-32  
MONITORING BORE CONSTRUCTION  
Revised

06/11/11

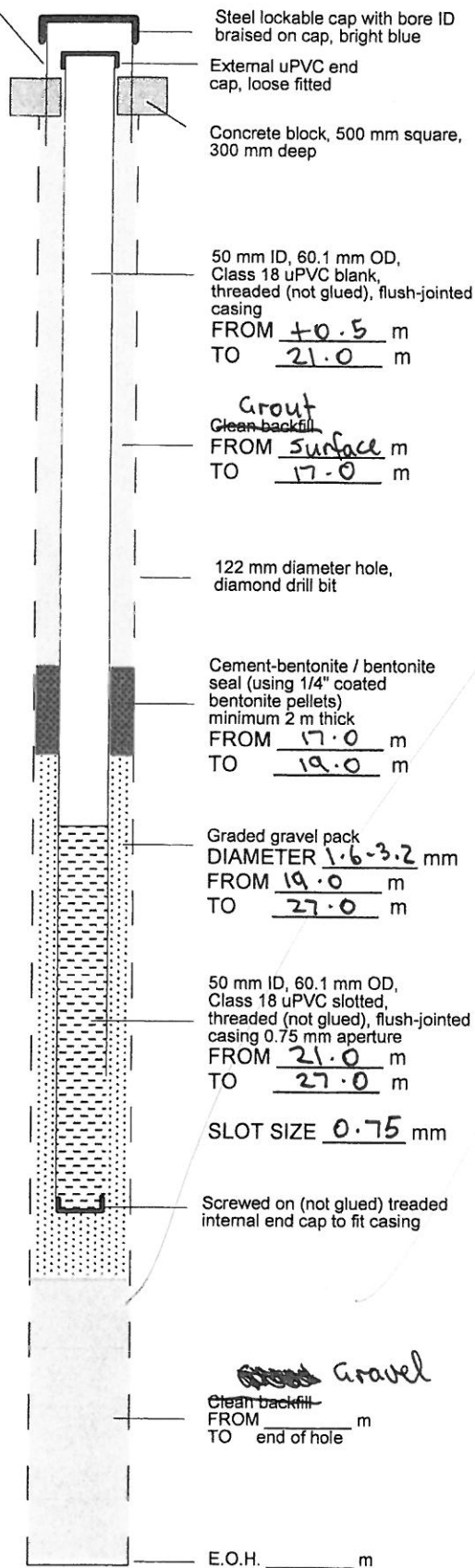
A Mahon

Rockwater Pty Ltd

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



Not to scale

# COMPLETION DETAILS

LOCATION JPP

HOLE ID AP-32

CO-ORDS mE mN

RL mAHD

BORE TYPE MONITORING

DEEP ☐ FAUNA ☐

SHALLOW ☒ PASS ☐

STYGO HABITAT PRESENT

YES ☐ NO ☒

DRILLING

DATE 03/11/11 commence

DATE \_\_\_\_\_ complete

CONTRACTOR MAGSTROM

DRILLER \_\_\_\_\_

CREW \_\_\_\_\_

RIG TYPE \_\_\_\_\_

ABANDONED/BACKFILLED no yes

DRILL METHOD \_\_\_\_\_

DRILL DEPTH \_\_\_\_\_ m from natural surface

HOLE DIAMETER \_\_\_\_\_ mm TYPE \_\_\_\_\_

CUT WATER \_\_\_\_\_ m

SWL \_\_\_\_\_ m

BORE CONSTRUCTION

DATE \_\_\_\_\_ commence

DATE \_\_\_\_\_ complete

DESIGNED BY \_\_\_\_\_

SUPERVISED BY \_\_\_\_\_

CONSTRUCTED BY \_\_\_\_\_

CASED DEPTH \_\_\_\_\_ m below natural surface

TOP OF MAIN CASING \_\_\_\_\_ m above natural surface

SURFACE CASING left-in ☐ removed ☐

\_\_\_\_\_ m below natural surface

\_\_\_\_\_ m above natural surface

MAIN BORE CASING \_\_\_\_\_ m depth from

\_\_\_\_\_ m depth to

\_\_\_\_\_ ID \_\_\_\_\_ OD

\_\_\_\_\_ material

\_\_\_\_\_ m total length

SLOT INTERVAL \_\_\_\_\_ m depth from

\_\_\_\_\_ m depth to

SLOT SIZE \_\_\_\_\_ mm

ANNULUS

GRAVEL PACK

BACKFILL

CEMENT

BENTONITE

HEADWORKS

TYPE standpipe ☐ surface casing ☐

MATERIAL \_\_\_\_\_ m below natural surface

\_\_\_\_\_ m above natural surface

SECURITY \_\_\_\_\_

OTHER DETAILS \_\_\_\_\_

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: Nov  
August 2011

Drg. No.: 368-0-2A/11/XX

AP-32

**MONITORING BORE CONSTRUCTION**

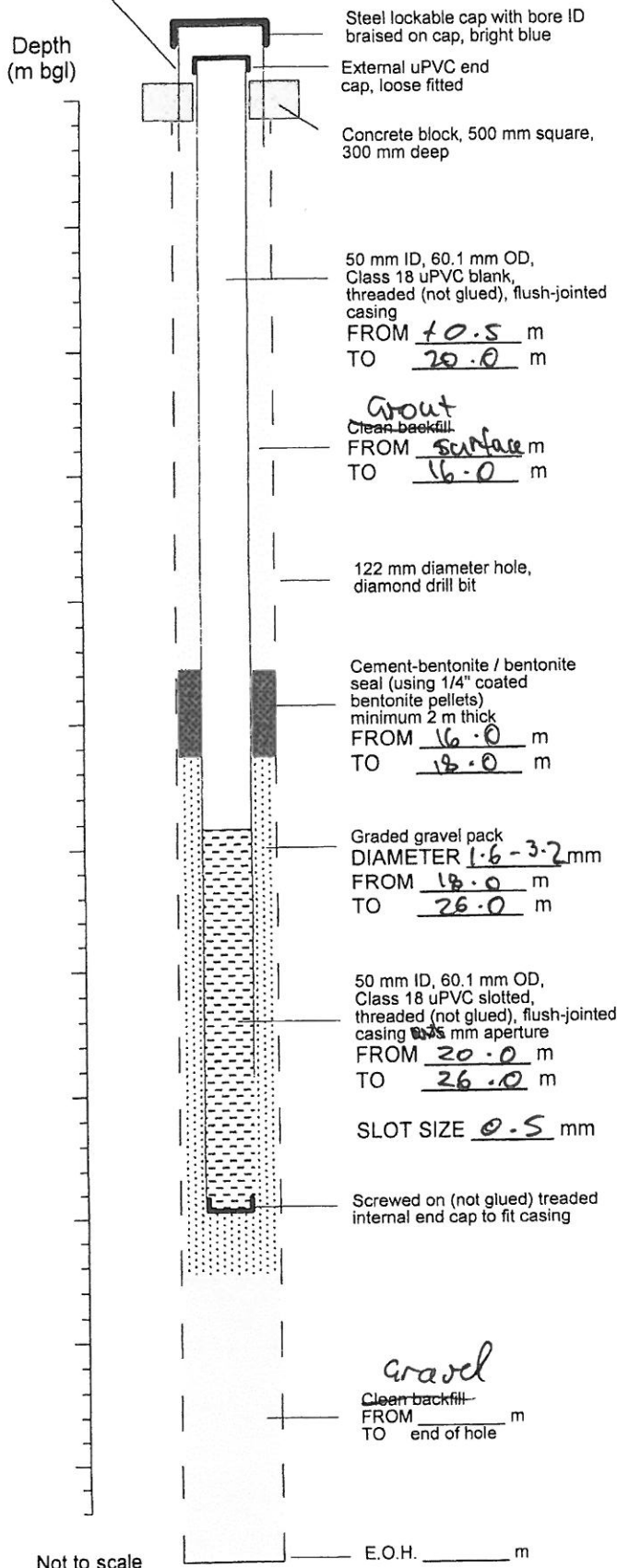
Submitted to Arup, Fugro, Magstrom 5/11/11

Rockwater Pty Ltd



# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue



# COMPLETION DETAILS

LOCATION JPP  
HOLE ID AP-36 Revised

CO-ORDS mE mN  
RL mAHD  
BORE TYPE \_\_\_\_\_

DEEP ☐ FAUNA ☐  
SHALLOW ☒ PASS ☐

STYGO HABITAT PRESENT  
YES ☐ NO ☒

DRILLING  
DATE \_\_\_\_\_ commence  
DATE \_\_\_\_\_ complete  
CONTRACTOR HAGSTROM  
DRILLER \_\_\_\_\_  
CREW \_\_\_\_\_  
RIG TYPE \_\_\_\_\_

ABANDONED/BACKFILLED no yes  
DRILL METHOD \_\_\_\_\_  
DRILL DEPTH \_\_\_\_\_ m from natural surface  
HOLE DIAMETER \_\_\_\_\_ mm TYPE \_\_\_\_\_  
CUT WATER \_\_\_\_\_ m  
SWL \_\_\_\_\_ m

BORE CONSTRUCTION  
DATE \_\_\_\_\_ commence  
DATE \_\_\_\_\_ complete  
DESIGNED BY \_\_\_\_\_  
SUPERVISED BY \_\_\_\_\_  
CONSTRUCTED BY \_\_\_\_\_

CASED DEPTH \_\_\_\_\_ m below natural surface  
TOP OF MAIN CASING \_\_\_\_\_ m above natural surface

SURFACE CASING left-in ☐ removed ☐  
material \_\_\_\_\_  
\_\_\_\_\_ m below natural surface  
\_\_\_\_\_ m above natural surface

MAIN BORE CASING \_\_\_\_\_ m depth from  
\_\_\_\_\_ m depth to  
\_\_\_\_\_ ID \_\_\_\_\_ OD  
\_\_\_\_\_ material  
\_\_\_\_\_ m total length

SLOT INTERVAL \_\_\_\_\_ m depth from  
\_\_\_\_\_ m depth to

SLOT SIZE \_\_\_\_\_ mm

ANNULUS  
GRAVEL PACK \_\_\_\_\_  
BACKFILL \_\_\_\_\_  
CEMENT \_\_\_\_\_  
BENTONITE \_\_\_\_\_

HEADWORKS  
TYPE standpipe ☐ surface casing ☐  
MATERIAL \_\_\_\_\_  
\_\_\_\_\_ m below natural surface  
\_\_\_\_\_ m above natural surface

SECURITY \_\_\_\_\_

OTHER DETAILS \_\_\_\_\_

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL  
Project: #68 Geotech Drilling - Construction of Monitoring Bores  
Date: Nov  
August 2011  
Drg. No.: 368-0-2A/11/XX

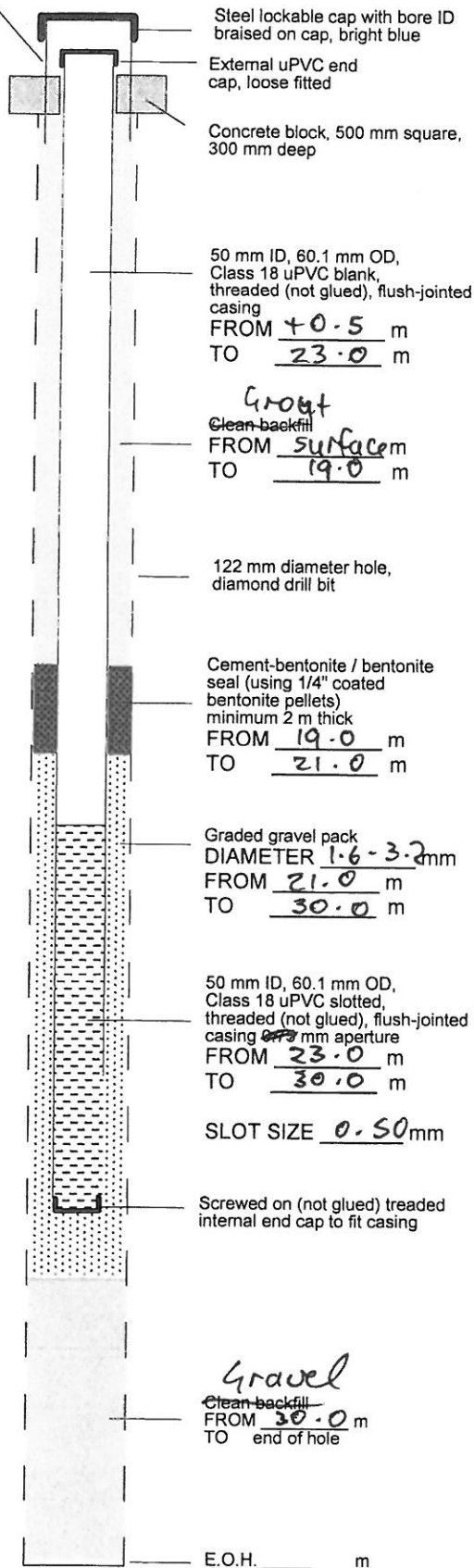
## MONITORING BORE CONSTRUCTION

AP-36  
Resubmitted to Fugro, Arup, Hagstrom 11/11/11 Mark Rockwater Pty Ltd

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



# COMPLETION DETAILS

LOCATION 5PP  
HOLE ID AP-36

CO-ORDS mE mN  
RL mAHD  
BORE TYPE MONITORING

DEEP ☐ FAUNA ☐  
SHALLOW ☒ PASS ☐

STYGO HABITAT PRESENT  
YES ☐ NO ☒

DRILLING  
DATE                      commence  
DATE                      complete  
CONTRACTOR HAGSTROM  
DRILLER                       
CREW                       
RIG TYPE                       
ABANDONED/BACKFILLED no yes  
DRILL METHOD                       
DRILL DEPTH                      m from natural surface  
HOLE DIAMETER                      mm TYPE                       
CUT WATER                      m  
SWL                      m

BORE CONSTRUCTION  
DATE                      commence  
DATE                      complete  
DESIGNED BY                       
SUPERVISED BY                       
CONSTRUCTED BY                     

CASED DEPTH                      m below natural surface  
TOP OF MAIN CASING                      m above natural surface

SURFACE CASING left-in ☐ removed ☐  
                     m material  
                     m below natural surface  
                     m above natural surface

MAIN BORE CASING                      m depth from  
                     m depth to  
                     ID                      OD  
                     material  
                     m total length

SLOT INTERVAL                      m depth from  
                     m depth to  
SLOT SIZE                      mm

ANNULUS  
GRAVEL PACK                       
BACKFILL                       
CEMENT                       
BENTONITE                     

HEADWORKS  
TYPE standpipe ☐ surface casing ☐  
MATERIAL                      m below natural surface  
                     m above natural surface

SECURITY                     

OTHER DETAILS                     

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL  
Project: #68 Geotech Drilling - Construction of Monitoring Bores  
Date: Nov August 2011  
Drg. No.: 368-0-2A/11/XX.

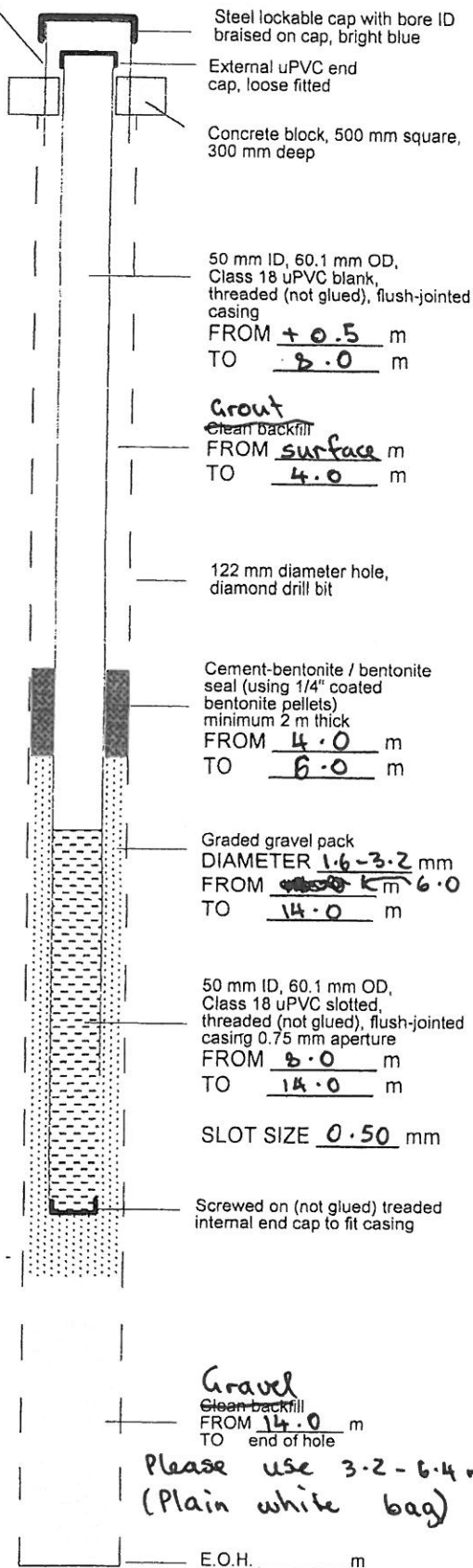
AP-36  
**MONITORING BORE CONSTRUCTION**

Submitted to Fugro, Arup, Hagstrom 10/11/11 Rockwater Pty Ltd

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



Not to scale

# COMPLETION DETAILS

LOCATION JPR  
HOLE ID F-14

CO-ORDS mE mN  
RL MAHD  
BORE TYPE MONITORING

DEEP ☐ PAUNA  
SHALLOW ☒ PASS

STYGO HABITAT PRESENT  
YES ☐ NO ☒

DRILLING  
DATE \_\_\_\_\_ commence  
DATE \_\_\_\_\_ complete  
CONTRACTOR MAGSTROM  
DRILLER \_\_\_\_\_  
CREW \_\_\_\_\_  
RIG TYPE \_\_\_\_\_  
ABANDONED/BACKFILLED ☐ no ☐ yes  
DRILL METHOD \_\_\_\_\_  
DRILL DEPTH \_\_\_\_\_ m from natural surface  
HOLE DIAMETER \_\_\_\_\_ mm TYPE \_\_\_\_\_  
CUT WATER \_\_\_\_\_ m  
SWL \_\_\_\_\_ m

BORE CONSTRUCTION  
DATE \_\_\_\_\_ commence  
DATE \_\_\_\_\_ complete

DESIGNED BY \_\_\_\_\_  
SUPERVISED BY \_\_\_\_\_  
CONSTRUCTED BY \_\_\_\_\_

CASED DEPTH \_\_\_\_\_ m below natural surface  
TOP OF MAIN CASING \_\_\_\_\_ m above natural surface

SURFACE CASING left-in ☐ removed ☐  
material  
\_\_\_\_\_ m below natural surface  
\_\_\_\_\_ m above natural surface

MAIN BORE CASING \_\_\_\_\_ m depth from  
\_\_\_\_\_ m depth to  
\_\_\_\_\_ ID \_\_\_\_\_ OD  
\_\_\_\_\_ material  
\_\_\_\_\_ m total length

SLOT INTERVAL \_\_\_\_\_ m depth from  
\_\_\_\_\_ m depth to

SLOT SIZE \_\_\_\_\_ mm

ANNULUS  
GRAVEL PACK  
BACKFILL  
CEMENT  
BENTONITE

HEADWORKS  
TYPE standpipe ☐ surface casing ☐  
MATERIAL \_\_\_\_\_ m below natural surface  
\_\_\_\_\_ m above natural surface

SECURITY \_\_\_\_\_

OTHER DETAILS \_\_\_\_\_

I:\368-0-2A\Data\Bore Design\To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: Nov  
~~August~~ 2011

Org. No.: 368-0-2A/11/XX

Submitted to Arup, Fugro, Hagstrom

F-14  
**MONITORING BORE CONSTRUCTION**

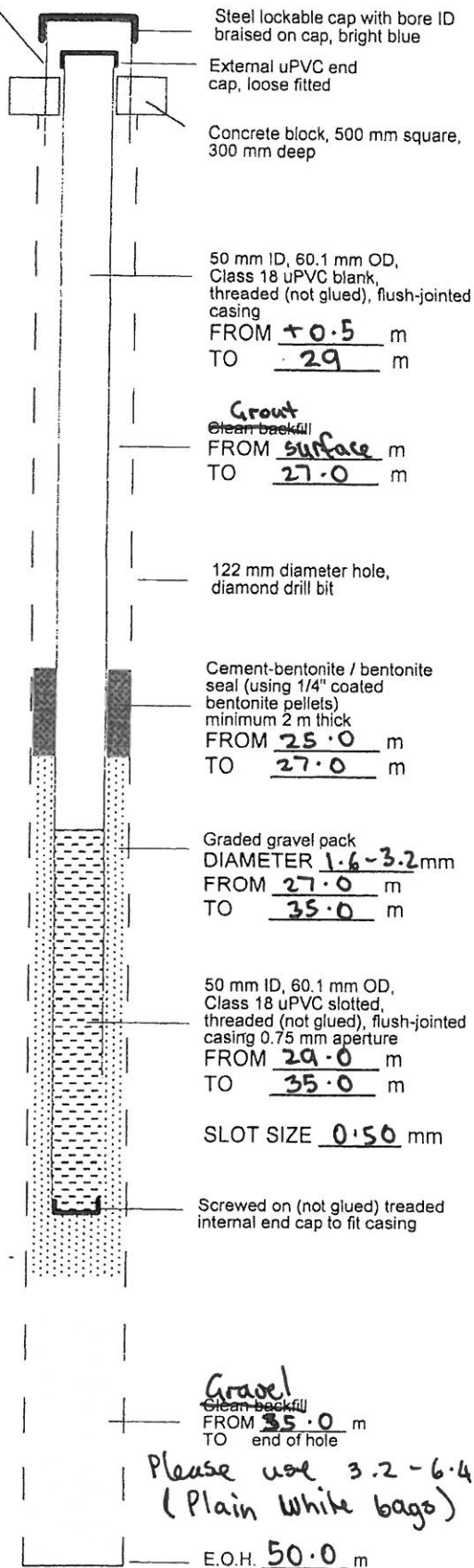
19/11/11 AMahon

Rockwater Pty Ltd

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



Not to scale

# COMPLETION DETAILS

LOCATION JPP  
HOLE ID I-16

CO-ORDS mE mN  
RL mAHD  
BORE TYPE MONITORING

DEEP ☒ FAUNA ☐  
SHALLOW ☐ PASS ☐

STYGO HABITAT PRESENT  
YES ☐ NO ☒

DRILLING  
DATE                      commence  
DATE                      complete  
CONTRACTOR HAGSTROM  
DRILLER                       
CREW                       
RIG TYPE                       
ABANDONED/BACKFILLED no yes  
DRILL METHOD                       
DRILL DEPTH                      m from natural surface  
HOLE DIAMETER                      mm TYPE                       
CUT WATER                      m  
SWL                      m

BORE CONSTRUCTION  
DATE                      commence  
DATE                      complete  
DESIGNED BY                       
SUPERVISED BY                       
CONSTRUCTED BY                     

CASED DEPTH                      m below natural surface  
TOP OF MAIN CASING                      m above natural surface

SURFACE CASING left-in ☐ removed ☐  
material                       
                     m below natural surface  
                     m above natural surface

MAIN BORE CASING                      m depth from  
                     m depth to  
                     ID                      OD  
                     material  
                     m total length

SLOT INTERVAL                      m depth from  
                     m depth to  
SLOT SIZE                      mm

ANNULUS  
GRAVEL PACK                       
BACKFILL                       
CEMENT                       
BENTONITE                     

HEADWORKS  
TYPE standpipe ☐ surface casing ☐  
MATERIAL                      m below natural surface  
                     m above natural surface

SECURITY                     

OTHER DETAILS                     

I:\368-0-2A\Data\Bore Design\To Construct.grf

Client: WEL  
Project: #68 Geotech Drilling - Construction of Monitoring Bores  
Date: Nov  
August 2011  
Org. No.: 368-0-2A/11/XX

I-16  
**MONITORING BORE CONSTRUCTION**

Submitted to Arup, Fugro, Hagstrom

19/11/11

Maher

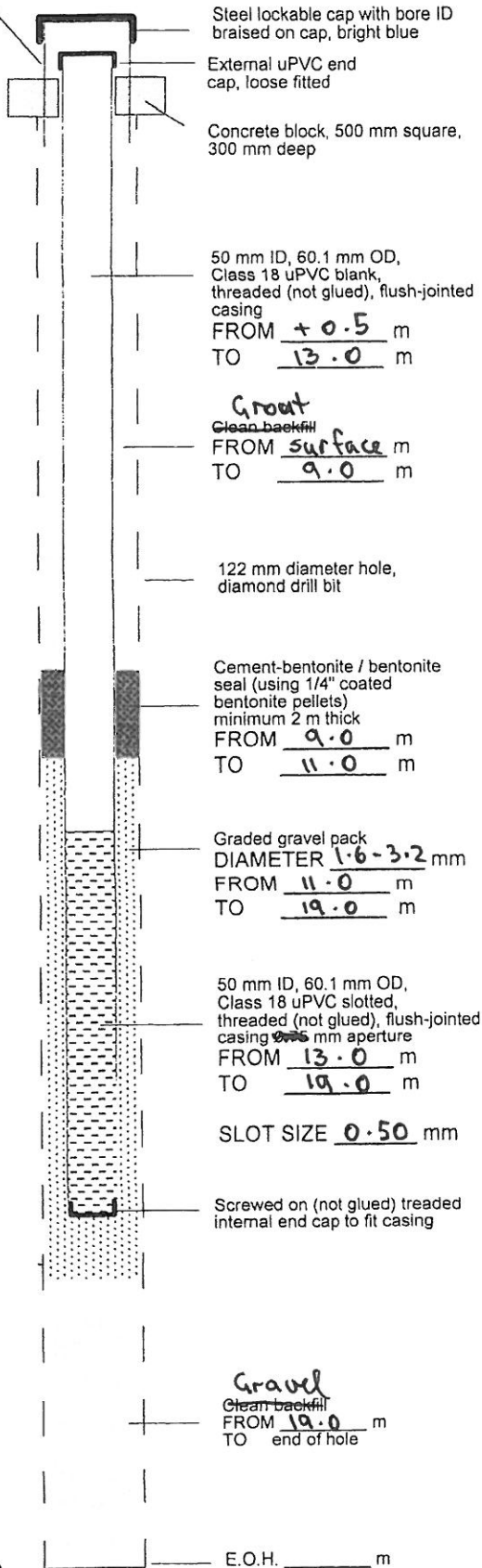
Rockwater Pty Ltd

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

ONLY USE  
YELLOW STANDPIPES  
(STEEL)

Depth  
(m bgl)



Not to scale

E.O.H. \_\_\_\_\_ m

# COMPLETION DETAILS

LOCATION JPP  
HOLE ID N-4

CO-ORDS mE mN  
RL mAHD  
BORE TYPE \_\_\_\_\_

DEEP ☐ FAUNA ☐  
SHALLOW ☒ PASS ☐

STYGO HABITAT PRESENT  
YES ☐ NO ☒

DRILLING  
DATE \_\_\_\_\_ commence  
DATE \_\_\_\_\_ complete  
CONTRACTOR HAGSTROM  
DRILLER \_\_\_\_\_  
CREW \_\_\_\_\_  
RIG TYPE \_\_\_\_\_  
ABANDONED/BACKFILLED ☐ no ☐ yes  
DRILL METHOD \_\_\_\_\_  
DRILL DEPTH \_\_\_\_\_ m from natural surface  
HOLE DIAMETER \_\_\_\_\_ mm TYPE \_\_\_\_\_  
CUT WATER \_\_\_\_\_ m  
SWL \_\_\_\_\_ m

BORE CONSTRUCTION  
DATE \_\_\_\_\_ commence  
DATE \_\_\_\_\_ complete  
DESIGNED BY \_\_\_\_\_  
SUPERVISED BY \_\_\_\_\_  
CONSTRUCTED BY \_\_\_\_\_

CASED DEPTH \_\_\_\_\_ m below natural surface  
TOP OF MAIN CASING \_\_\_\_\_ m above natural surface

SURFACE CASING left-in ☐ removed ☐  
material \_\_\_\_\_  
\_\_\_\_\_ m below natural surface  
\_\_\_\_\_ m above natural surface

MAIN BORE CASING \_\_\_\_\_ m depth from  
\_\_\_\_\_ m depth to  
\_\_\_\_\_ ID \_\_\_\_\_ OD  
\_\_\_\_\_ material  
\_\_\_\_\_ m total length

SLOT INTERVAL \_\_\_\_\_ m depth from  
\_\_\_\_\_ m depth to  
SLOT SIZE \_\_\_\_\_ mm

ANNULUS  
GRAVEL PACK \_\_\_\_\_  
BACKFILL \_\_\_\_\_  
CEMENT \_\_\_\_\_  
BENTONITE \_\_\_\_\_

HEADWORKS  
TYPE standpipe ☐ surface casing ☐  
MATERIAL \_\_\_\_\_ m below natural surface  
\_\_\_\_\_ m above natural surface

SECURITY \_\_\_\_\_

OTHER DETAILS \_\_\_\_\_

I:\368-0-2A\Data\Bore Design\To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: Nov  
August 2011

Drg. No.: 368-0-2A/11/XX

Submitted to Arup, Fugro, Hagstrom

N-4  
MONITORING BORE CONSTRUCTION

25/11/11

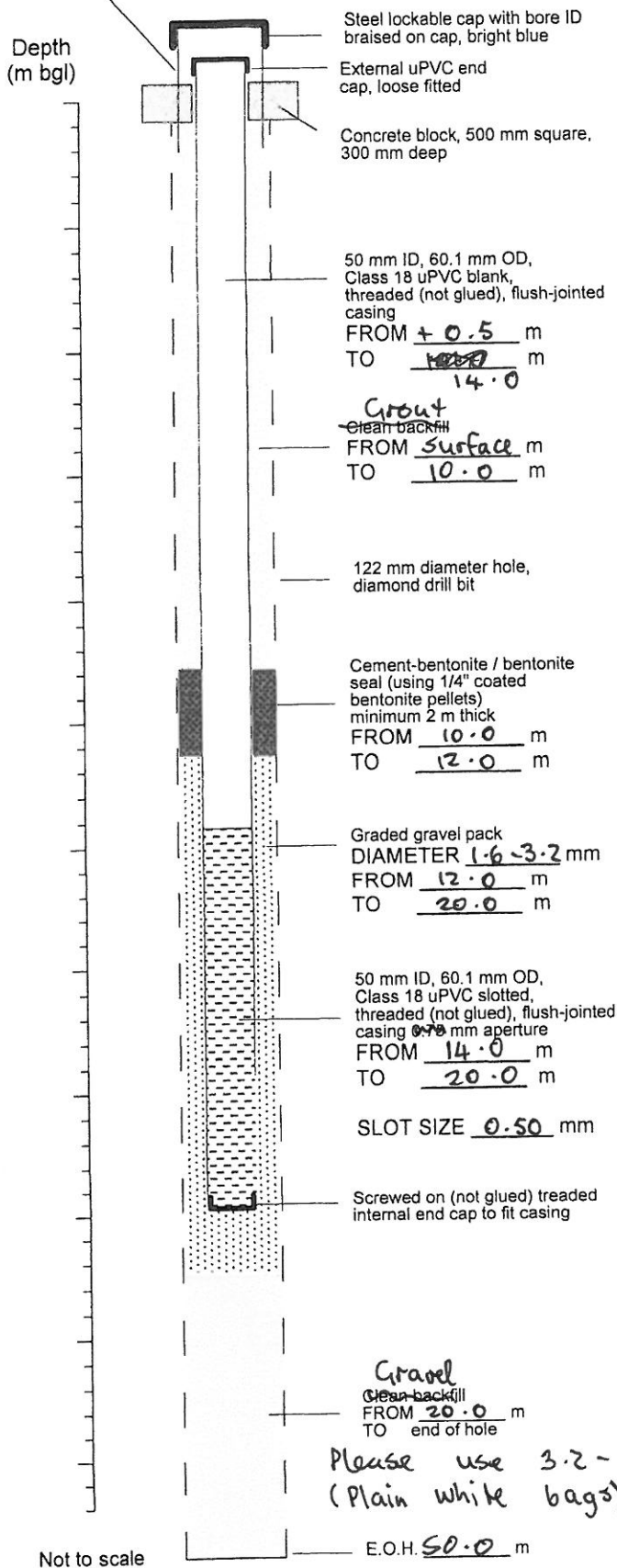
AMahon

Rockwater Pty Ltd



# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue



# COMPLETION DETAILS

LOCATION JPP

HOLE ID 0-10

CO-ORDS mE mN

RL MAHD

BORE TYPE MONITORING

DEEP ☐ FAUNA ☐

SHALLOW ☒ PASS ☐

STYGO HABITAT PRESENT

YES ☐ NO ☒

DRILLING

DATE                      commence

DATE                      complete

CONTRACTOR HAGSTROM

DRILLER                     

CREW                     

RIG TYPE                     

ABANDONED/BACKFILLED no yes

DRILL METHOD                     

DRILL DEPTH                      m from natural surface

HOLE DIAMETER                      mm TYPE                     

CUT WATER                      m

SWL                      m

BORE CONSTRUCTION

DATE                      commence

DATE                      complete

DESIGNED BY                     

SUPERVISED BY                     

CONSTRUCTED BY                     

CASED DEPTH                      m below natural surface

TOP OF MAIN CASING                      m above natural surface

SURFACE CASING left-in ☐ removed ☐

                     m material

                     m below natural surface

                     m above natural surface

MAIN BORE CASING                      m depth from

                     m depth to

                     ID                      OD

                     material

                     m total length

SLOT INTERVAL                      m depth from

                     m depth to

SLOT SIZE                      mm

ANNULUS

GRAVEL PACK                     

BACKFILL                     

CEMENT                     

BENTONITE                     

HEADWORKS

TYPE standpipe ☐ surface casing ☐

MATERIAL                      m below natural surface

                     m above natural surface

SECURITY                     

OTHER DETAILS                     

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: Nov August 2011

Drg. No.: 368-0-2A/11/XX

## MONITORING BORE CONSTRUCTION

0-10

Submitted to Arup, Fugro, Hagstrom

21/11/11

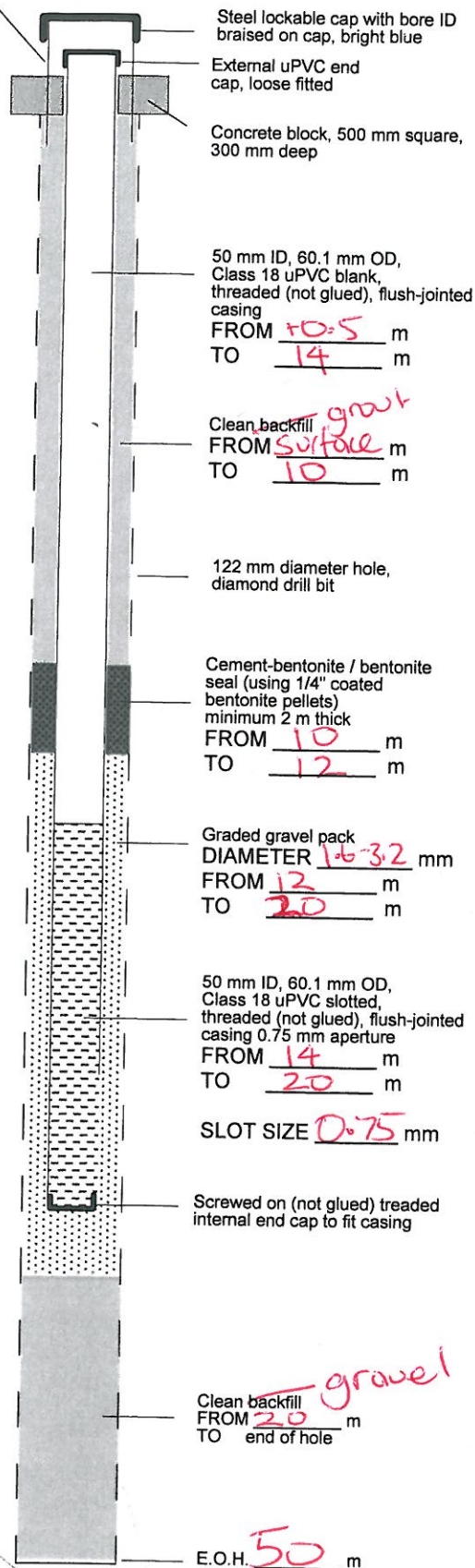
4 Mahon

Rockwater Pty Ltd

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



# COMPLETION DETAILS

LOCATION JAMES PRICE POINTS

HOLE ID P-17

CO-ORDS mE mN

RL mAHD

BORE TYPE

DEEP ☐ FAUNA ☐

SHALLOW ☒ PASS ☐

STYGO HABITAT PRESENT

YES ☐ NO ☒

DRILLING

DATE commence

DATE complete

CONTRACTOR

DRILLER

CREW

RIG TYPE

ABANDONED/BACKFILLED no yes

DRILL METHOD

DRILL DEPTH m from natural surface

HOLE DIAMETER mm TYPE

CUT WATER m

SWL m

BORE CONSTRUCTION

DATE commence

DATE complete

DESIGNED BY

SUPERVISED BY

CONSTRUCTED BY

CASED DEPTH m below natural surface

TOP OF MAIN CASING m above natural surface

SURFACE CASING left-in ☐ removed ☐

m below natural surface

m above natural surface

MAIN BORE CASING m depth from

m depth to

ID OD

m material

m total length

SLOT INTERVAL m depth from

m depth to

SLOT SIZE mm

ANNULUS

GRAVEL PACK

BACKFILL

CEMENT

BENTONITE

HEADWORKS

TYPE standpipe ☐ surface casing ☐

MATERIAL m below natural surface

m above natural surface

SECURITY

OTHER DETAILS

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: Oct August 2011

Drg. No.: 368-0-2A/11/XX

## MONITORING BORE CONSTRUCTION

P-17

Rockwater Pty Ltd

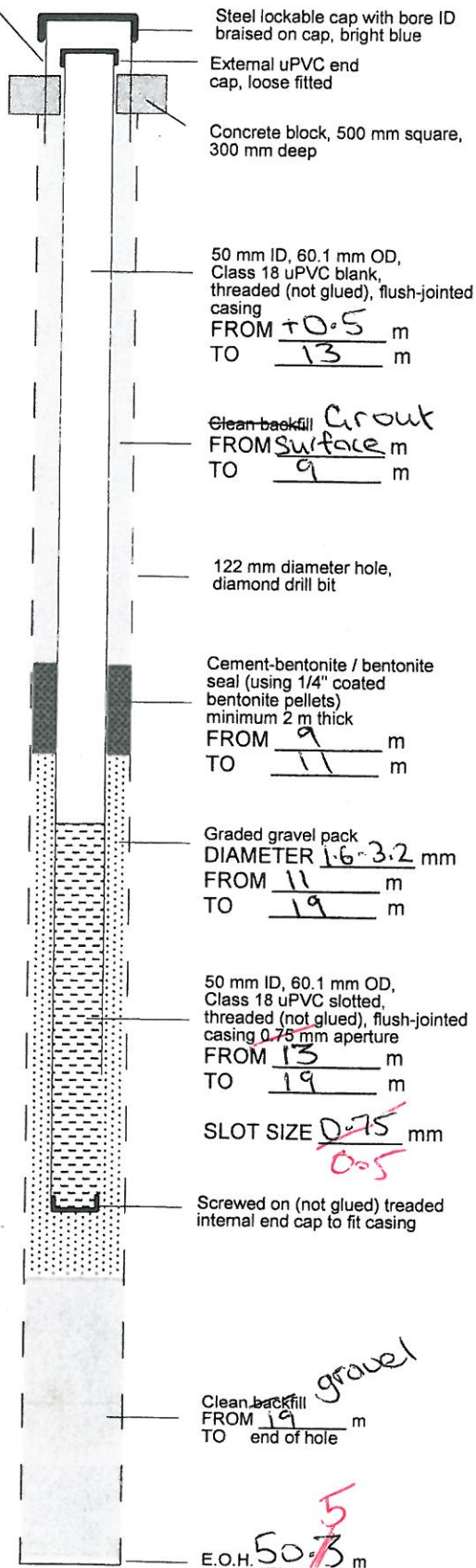
ISSUED TO FUCRO, MACSTROM, ARUP 3<sup>rd</sup> Oct 2011



# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



# COMPLETION DETAILS

LOCATION	JAMES PRICE POINT	
HOLE ID	P-21	
CO-ORDS	mE	mN
RL	MAHD	
BORE TYPE	Monitoring	
DEEP	<input type="checkbox"/>	FAUNA
SHALLOW	<input checked="" type="checkbox"/>	PASS
STYGO HABITAT PRESENT	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>
DRILLING		
DATE	27/09/11 commence	
DATE		
CONTRACTOR	HAGSTROM	
DRILLER		
CREW	RIG 7	
RIG TYPE	Scout Hydropower	
ABANDONED/BACKFILLED	no <input type="checkbox"/>	yes <input type="checkbox"/>
DRILL METHOD	Rotary Coring / Diamond	
DRILL DEPTH	m from natural surface	
HOLE DIAMETER	120 mm	TYPE RQ
CUT WATER	unknown m	
SWL	m	
BORE CONSTRUCTION		
DATE	2/10/11 commence	
DATE		
DESIGNED BY	CKASPEKIEWICZ ROCKWATER	
SUPERVISED BY	NATHAN FLUGER ROCKWATER	
CONSTRUCTED BY	HAGSTROM	
CASED DEPTH	19 m	below natural surface
TOP OF MAIN CASING	m	above natural surface
SURFACE CASING	left-in <input type="checkbox"/>	removed <input type="checkbox"/>
NA	m	material
	m	below natural surface
	m	above natural surface
MAIN BORE CASING	19 m	depth from
	50 m	depth to
	pvc	ID 57.5 OD
	m	material
	m	total length
SLOT INTERVAL	13 m	depth from
	19 m	depth to
SLOT SIZE	0.5 mm	
ANNULUS	10.8-19.8 (1.6-3.2)	
GRAVEL PACK	GRAVEL 19.8-EOH (1.6-0.4)	
BACKFILL	surface - 9m	
CEMENT	9-10.8m	
BENTONITE		
HEADWORKS		
TYPE	standpipe <input checked="" type="checkbox"/>	surface casing <input type="checkbox"/>
MATERIAL	steel	
	m	below natural surface
	m	above natural surface
SECURITY		
OTHER DETAILS	Decontam. sig	

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: Oct August 2011

Org. No.: 368-0-2A/11/XX

## MONITORING BORE CONSTRUCTION

P-21

Rockwater Pty Ltd

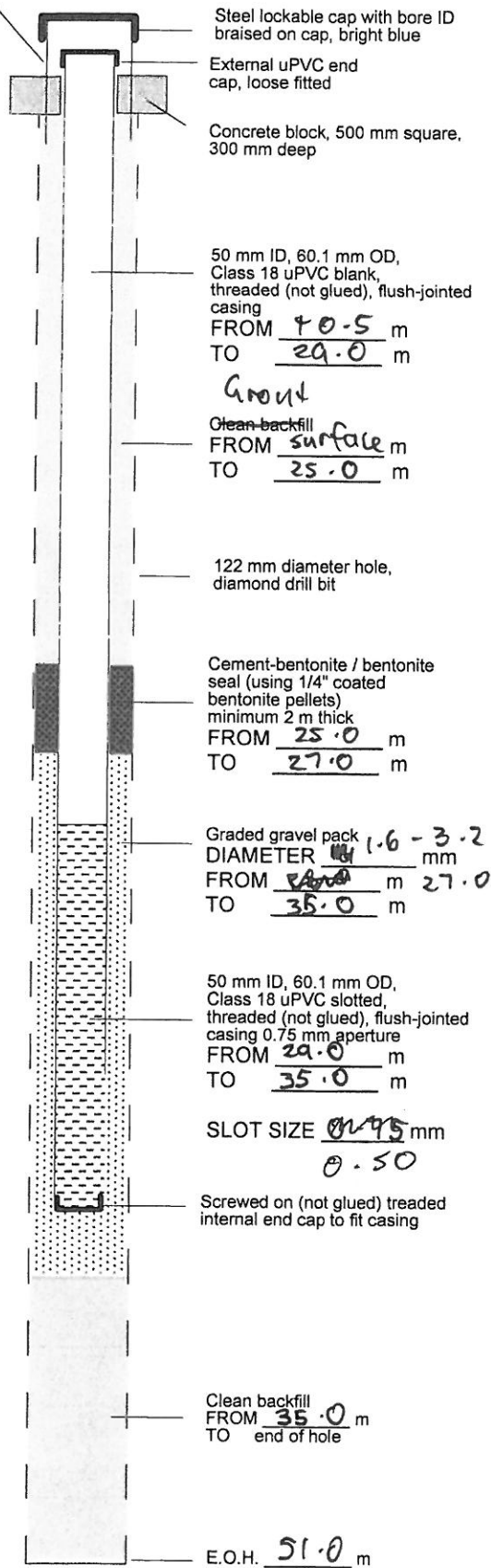
ISSUED TO FLURO. HAGSTROM. ARUP 1st Oct 2011 DMM



# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



Not to scale

E.O.H. 51.0 m

# COMPLETION DETAILS

LOCATION	JPP	
HOLE ID	P-25 Revised	
CO-ORDS	mE	mN
RL	mAH	
BORE TYPE	MONITORING	
DEEP	<input checked="" type="checkbox"/>	FAUNA
SHALLOW	<input type="checkbox"/>	PASS
STYGO HABITAT PRESENT	YES <input type="checkbox"/>	NO <input checked="" type="checkbox"/>
DRILLING		
DATE	03/11/11	commence
DATE	05/11/11	complete
CONTRACTOR	NAGSTROM	
DRILLER		
CREW		
RIG TYPE		
ABANDONED/BACKFILLED	no	yes
DRILL METHOD		
DRILL DEPTH	m	from natural surface
HOLE DIAMETER	mm	TYPE
CUT WATER	m	
SWL	m	
BORE CONSTRUCTION		
DATE	commence	
DATE	complete	
DESIGNED BY		
SUPERVISED BY		
CONSTRUCTED BY		
CASED DEPTH	m	below natural surface
TOP OF MAIN CASING	m	above natural surface
SURFACE CASING	left-in <input type="checkbox"/>	removed <input type="checkbox"/>
	m	below natural surface
	m	above natural surface
MAIN BORE CASING	m	depth from
	m	depth to
	ID	OD
		material
	m	total length
SLOT INTERVAL	m	depth from
	m	depth to
SLOT SIZE	mm	
ANNULUS		
GRAVEL PACK		
BACKFILL		
CEMENT		
BENTONITE		
HEADWORKS		
TYPE	standpipe <input type="checkbox"/>	surface casing <input type="checkbox"/>
MATERIAL	m	below natural surface
	m	above natural surface
SECURITY		
OTHER DETAILS		

I:\368-0-2A\Data\Bore Design\To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: 10 August 2011

Drg. No.: 368-0-2A/11/XX

P-25  
MONITORING BORE CONSTRUCTION

Revised

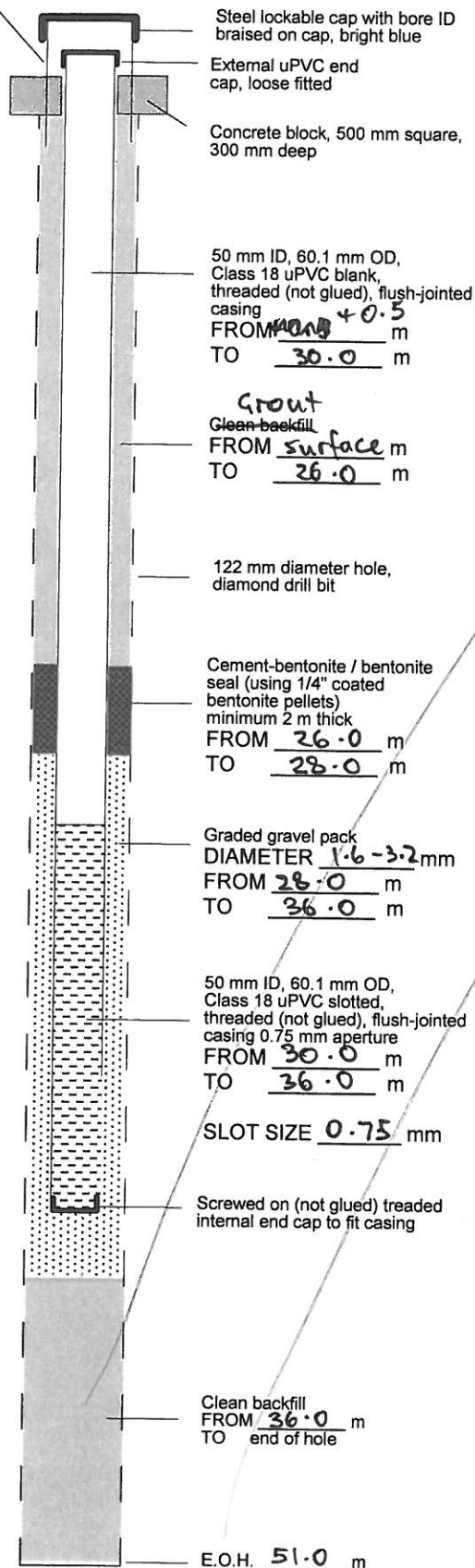
Rockwater Pty Ltd

submitted to Arup, Fugro, Nagstrom 06/11/11

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



Not to scale

# COMPLETION DETAILS

LOCATION	<u>JPP</u>		
HOLE ID	<u>P-25</u>		
CO-ORDS	<u>mE</u>	<u>mN</u>	
RL	<u>mAHD</u>		
BORE TYPE	<u>MONITORING</u>		
DEEP	<input checked="" type="checkbox"/>	FAUNA	<input type="checkbox"/>
SHALLOW	<input type="checkbox"/>	PASS	<input type="checkbox"/>
STYGO HABITAT PRESENT	YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>		
<b>DRILLING</b>			
DATE	<u>03/11/11</u> commence		
DATE			
CONTRACTOR	<u>HAGSTROM</u>		
DRILLER			
CREW			
RIG TYPE			
ABANDONED/BACKFILLED	<input type="checkbox"/> no	<input type="checkbox"/> yes	
DRILL METHOD			
DRILL DEPTH	<u>m</u>	from natural surface	
HOLE DIAMETER	<u>mm</u>	TYPE	
CUT WATER	<u>m</u>		
SWL	<u>m</u>		
<b>BORE CONSTRUCTION</b>			
DATE			
DATE			
DESIGNED BY			
SUPERVISED BY			
CONSTRUCTED BY			
CASED DEPTH	<u>m</u>	below natural surface	
TOP OF MAIN CASING	<u>m</u>	above natural surface	
SURFACE CASING	left-in <input type="checkbox"/>	removed <input type="checkbox"/>	
	<u>m</u>	material	
	<u>m</u>	below natural surface	
	<u>m</u>	above natural surface	
MAIN BORE CASING	<u>m</u>	depth from	
	<u>m</u>	depth to	
	<u>ID</u>	<u>OD</u>	
	<u>m</u>	material	
	<u>m</u>	total length	
SLOT INTERVAL	<u>m</u>	depth from	
	<u>m</u>	depth to	
SLOT SIZE	<u>mm</u>		
ANNULUS			
GRAVEL PACK			
BACKFILL			
CEMENT			
BENTONITE			
<b>HEADWORKS</b>			
TYPE	standpipe <input type="checkbox"/>	surface casing <input type="checkbox"/>	
MATERIAL	<u>m</u>	below natural surface	
	<u>m</u>	above natural surface	
SECURITY			
<b>OTHER DETAILS</b>			

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL  
 Project: #68 Geotech Drilling - Construction of Monitoring Bores  
 Date: Nov August 2011  
 Drg. No.: 368-0-2A/11/XX

## MONITORING BORE CONSTRUCTION

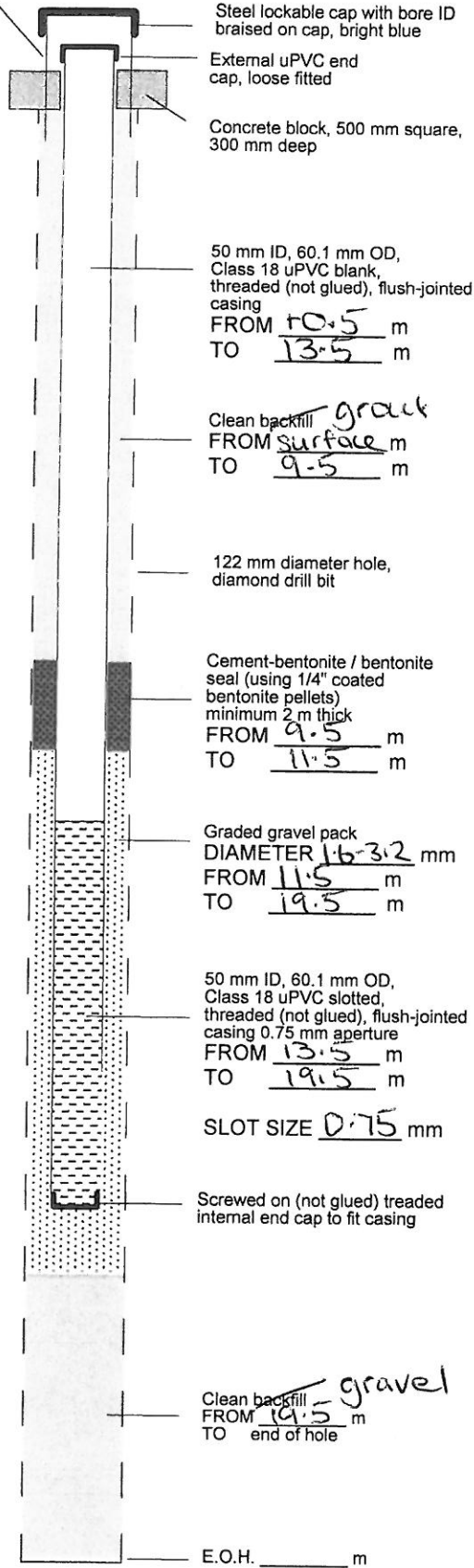
Submitted to Arup, Fugro, Hagstrom 05/11/11 P-25

Rockwater Pty Ltd

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



# COMPLETION DETAILS

LOCATION JAMES PRICE POINT

HOLE ID P-29

CO-ORDS mE mN

RL mAHD

BORE TYPE MONITORING

DEEP ☐ FAUNA ☐

SHALLOW ☒ PASS ☐

STYGO HABITAT PRESENT

YES ☐ NO ☒

DRILLING

DATE 28/9/11 commence

DATE \_\_\_\_\_ complete

CONTRACTOR HAGSTROM

DRILLER RIC I

CREW "

RIG TYPE \_\_\_\_\_

ABANDONED/BACKFILLED no yes

DRILL METHOD Rotary Coring (Diamond)

DRILL DEPTH \_\_\_\_\_ m from natural surface

HOLE DIAMETER 120 mm TYPE PC

CUT WATER unknown m

SWL \_\_\_\_\_ m

BORE CONSTRUCTION

DATE \_\_\_\_\_ commence

DATE \_\_\_\_\_ complete

DESIGNED BY Casper Kewitz Rockwater

SUPERVISED BY \_\_\_\_\_

CONSTRUCTED BY \_\_\_\_\_

CASED DEPTH \_\_\_\_\_ m below natural surface

TOP OF MAIN CASING \_\_\_\_\_ m above natural surface

SURFACE CASING left-in ☐ removed ☐

\_\_\_\_\_ m below natural surface

\_\_\_\_\_ m above natural surface

MAIN BORE CASING \_\_\_\_\_ m depth from

\_\_\_\_\_ m depth to

\_\_\_\_\_ ID \_\_\_\_\_ OD

\_\_\_\_\_ material

\_\_\_\_\_ m total length

SLOT INTERVAL \_\_\_\_\_ m depth from

\_\_\_\_\_ m depth to

SLOT SIZE \_\_\_\_\_ mm

ANNULUS

GRAVEL PACK

BACKFILL

CEMENT

BENTONITE

HEADWORKS

TYPE standpipe ☐ surface casing ☐

MATERIAL \_\_\_\_\_

\_\_\_\_\_ m below natural surface

\_\_\_\_\_ m above natural surface

SECURITY

OTHER DETAILS Decontam sig

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: oct August 2011

Drg. No.: 368-0-2A/11/XX

# MONITORING BORE CONSTRUCTION

P-29

Rockwater Pty Ltd

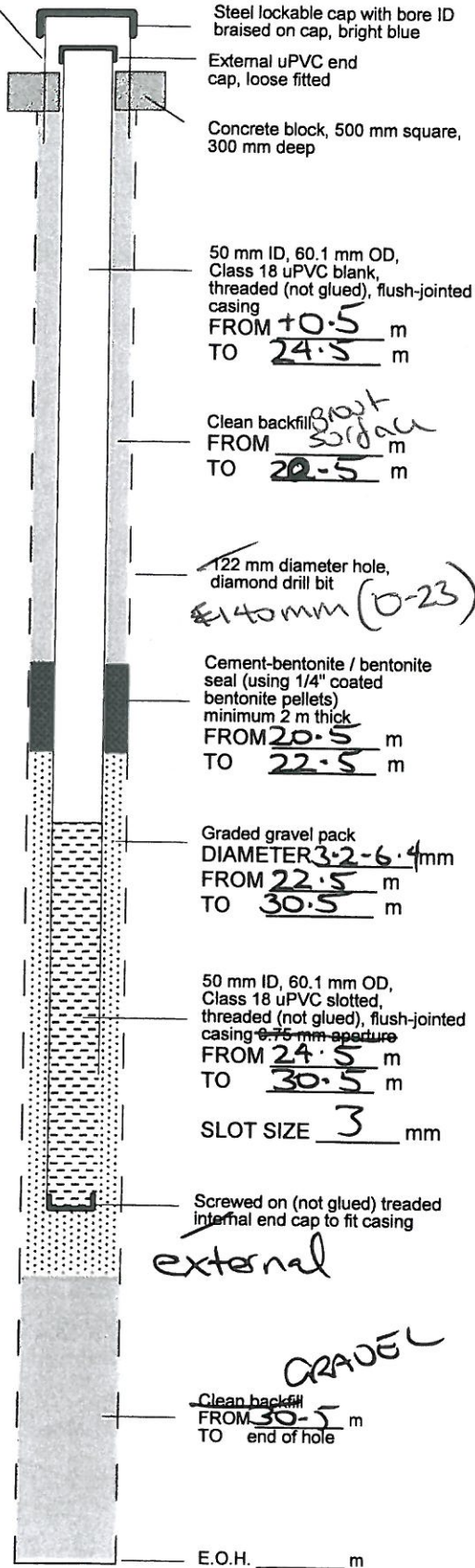
ISSUED TO - FUGRO, HAGSTROM, ARUP 1st OCT 2011



# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



# COMPLETION DETAILS

LOCATION	JPP		
HOLE ID	U-10		
CO-ORDS	mE	mN	
RL	mAHD		
BORE TYPE			
DEEP	<input type="checkbox"/>	FAUNA	<input checked="" type="checkbox"/>
SHALLOW	<input checked="" type="checkbox"/>	PASS	<input type="checkbox"/>
STYGO HABITAT PRESENT			
YES	<input checked="" type="checkbox"/>	NO	<input type="checkbox"/>
<b>DRILLING</b>			
DATE	30/8/11 commence		
DATE	4/9/11 complete		
CONTRACTOR	Hagstrom		
DRILLER			
CREW	Rig 9		
RIG TYPE	Delta 520		
ABANDONED/BACKFILLED	no	yes	
DRILL METHOD	Core		
DRILL DEPTH	50 m	from natural surface	
HOLE DIAMETER	120.140 mm	TYPE PQ & PWT	
CUT WATER	m		
SWL	m		
Feamed @ 140mm to 31.2m			
<b>BORE CONSTRUCTION</b>			
DATE	6/9/11 commence		
DATE			
DESIGNED BY	CRASPERICIOUS R/1011		
SUPERVISED BY			
CONSTRUCTED BY			
CASED DEPTH	m	below natural surface	
TOP OF MAIN CASING	m	above natural surface	
SURFACE CASING	left-in	<input checked="" type="checkbox"/>	removed material
	m	below natural surface	
	m	above natural surface	
MAIN BORE CASING	m	depth from	
	m	depth to	
	ID	OD	
	material		
	m	total length	
SLOT INTERVAL	m	depth from	
	m	depth to	
SLOT SIZE	mm		
ANNULUS			
GRAVEL PACK			
BACKFILL			
CEMENT			
BENTONITE			
<b>HEADWORKS</b>			
TYPE	standpipe	<input checked="" type="checkbox"/>	surface casing
MATERIAL	steel		
	0.7 m	below natural surface	
	m	above natural surface	
SECURITY	padlock		
<b>OTHER DETAILS</b>			
hydro carbons used			

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL  
Project: #68 Geotech Drilling - Construction of Monitoring Bores  
Date: August 2011  
Drg. No.: 368-0-2A/11/XX

## MONITORING BORE CONSTRUCTION

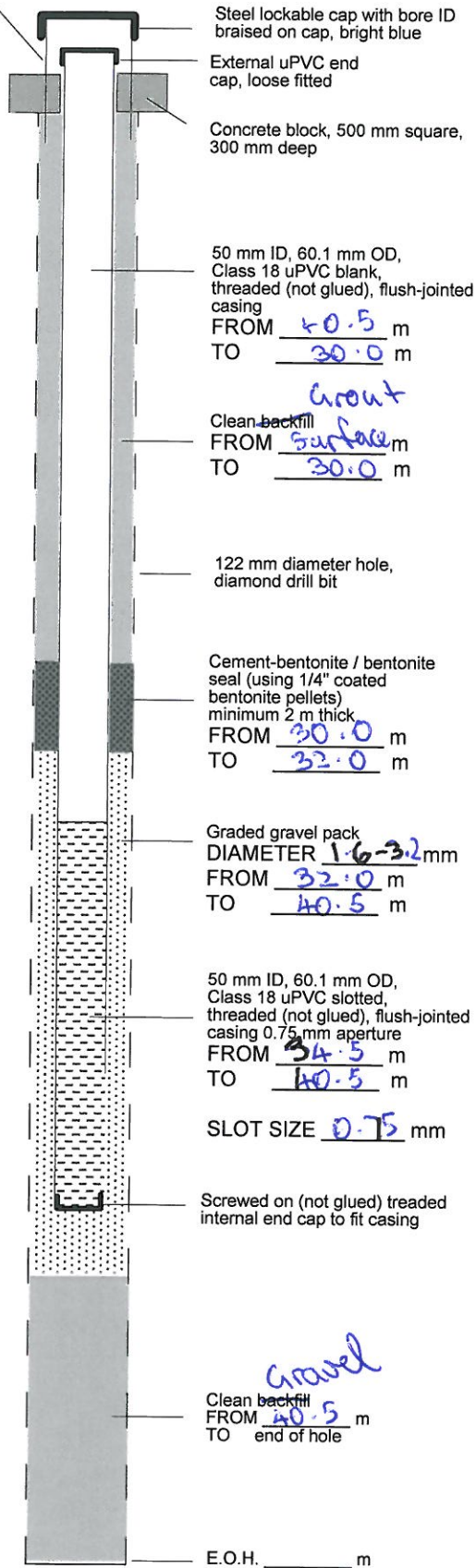
U-10



## TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



## COMPLETION DETAILS

LOCATION	James Price Point		
HOLE ID	U-16		
CO-ORDS	mE	mN	
RL	mAHD		
BORE TYPE	Monitoring		
DEEP	<input checked="" type="checkbox"/>	FAUNA	
SHALLOW		PASS	
STYGO HABITAT PRESENT	YES	NO	
DRILLING			
DATE	07/10/11	commence	
DATE		complete	
CONTRACTOR	HAGSTROM		
DRILLER			
CREW	Big 7		
RIG TYPE			
ABANDONED/BACKFILLED	no	yes	
DRILL METHOD	Rotary Coring / Diamond		
DRILL DEPTH	m	from natural surface	
HOLE DIAMETER	mm	TYPE	
CUT WATER	m		
SWL	m		
BORE CONSTRUCTION			
DATE		commence	
DATE		complete	
DESIGNED BY			
SUPERVISED BY			
CONSTRUCTED BY			
CASED DEPTH	m	below natural surface	
TOP OF MAIN CASING	m	above natural surface	
SURFACE CASING	left-in	removed	
		material	
	m	below natural surface	
	m	above natural surface	
MAIN BORE CASING	m	depth from	
	m	depth to	
	ID	OD	
		material	
	m	total length	
SLOT INTERVAL	m	depth from	
	m	depth to	
SLOT SIZE	mm		
ANNULUS			
GRAVEL PACK			
BACKFILL			
CEMENT			
BENTONITE			
HEADWORKS			
TYPE	standpipe	surface casing	
MATERIAL			
	m	below natural surface	
	m	above natural surface	
SECURITY			
OTHER DETAILS			

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: October August 2011

Drg. No.: 368-0-2A/11/XX

## MONITORING BORE CONSTRUCTION

U-16

Rockwater Pty Ltd

ISSUED TO FUGRO, ARUP & HAGSTROM

11/10/11

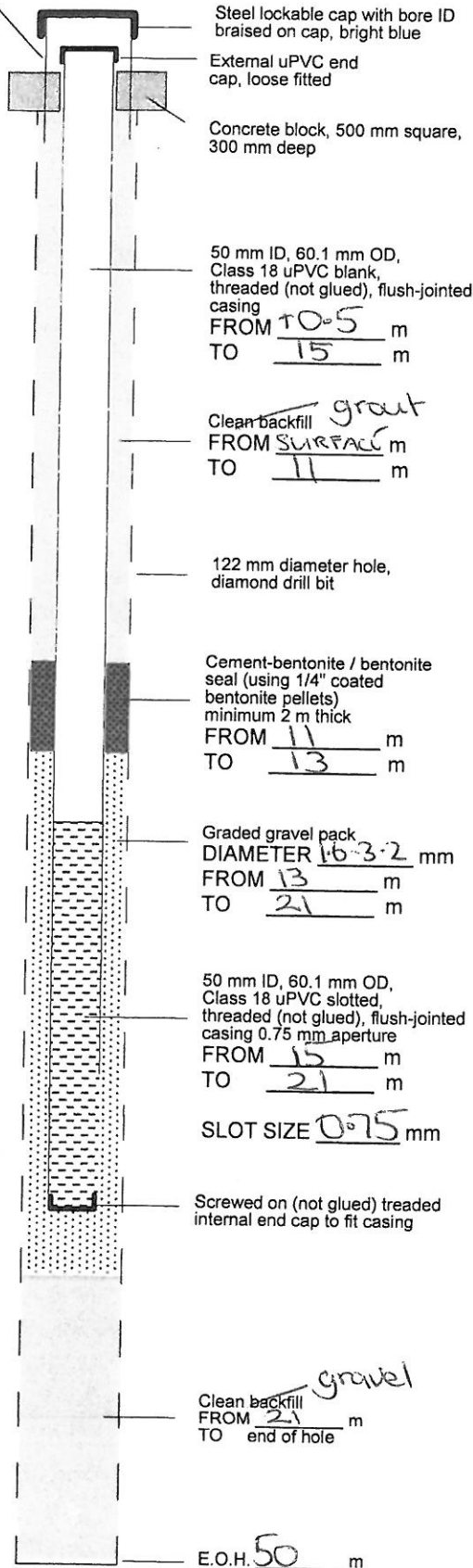
Mahon

# TO CONSTRUCT

# COMPLETION DETAILS

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue

Depth (m bgl)



Not to scale

E.O.H. 50 m

LOCATION

HOLE ID

JAMES PRICE POINT  
U-20

CO-ORDS

RL

BORE TYPE

mE mN

MAHD

MONITORING

DEEP

SHALLOW

FAUNA

PASS

STYGO HABITAT PRESENT

YES

NO

DRILLING

DATE

DATE

CONTRACTOR

DRILLER

CREW

RIG TYPE

ABANDONED/BACKFILLED

DRILL METHOD

DRILL DEPTH

HOLE DIAMETER

CUT WATER

SWL

3/10/11 commence

complete

HACSTROM

RIG 7

SCOUT HYDRA-PACK

no yes

ROTARY CORING / DIAMOND

m from natural surface

122 mm TYPE PQ

100/NA m

m

BORE CONSTRUCTION

DATE

DATE

commence

complete

DESIGNED BY

SUPERVISED BY

CONSTRUCTED BY

CASED DEPTH

TOP OF MAIN CASING

m below natural surface

m above natural surface

SURFACE CASING

left-in

removed

material

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

m

OTHER DETAILS

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: 05 August 2011

Drg. No.: 368-0-2A/11/XX

MONITORING BORE CONSTRUCTION

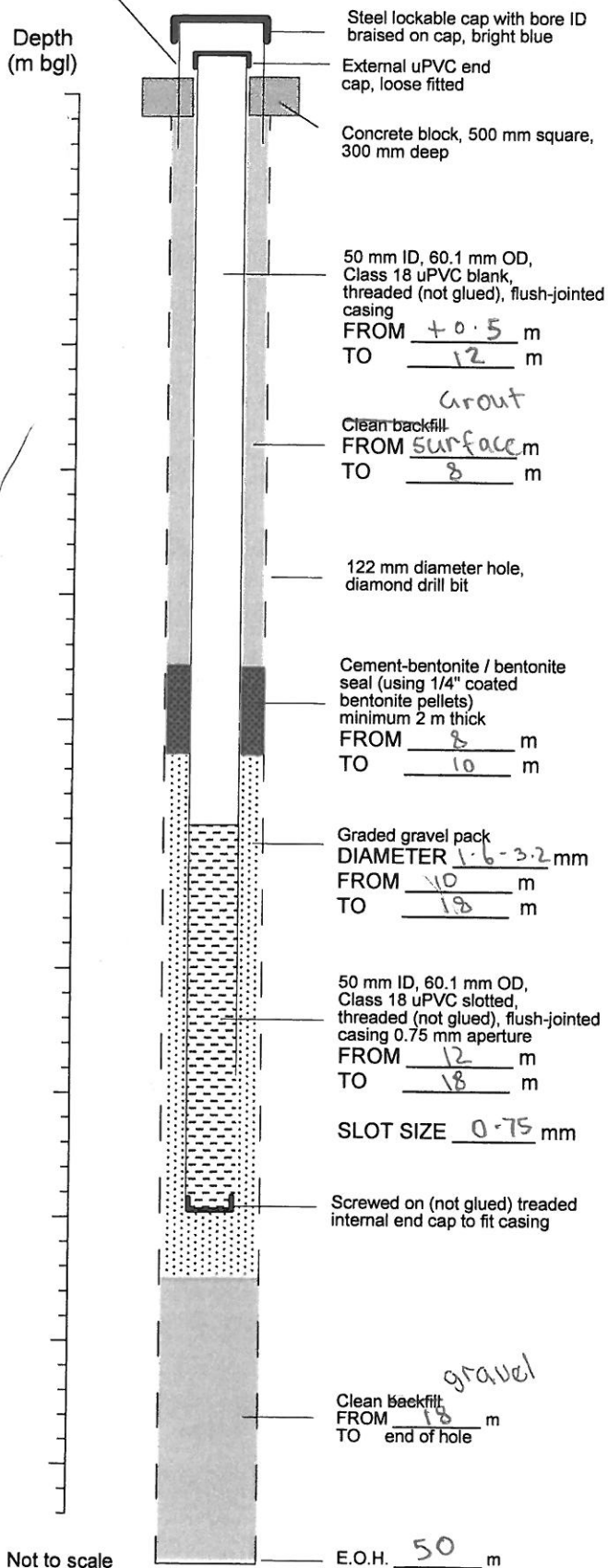
U-20

Rockwater Pty Ltd

ISSUED TO FUGRO, HACSTROM, ARUP 5th OCT 2011

# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue



I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: Oct August 2011

Drg. No.: 368-0-2A/11/XX

# COMPLETION DETAILS

LOCATION	JAMES PRICE POINT		
HOLE ID	U-31		
CO-ORDS	mE	mN	
RL	mAHD		
BORE TYPE	monitoring		
DEEP	<input type="checkbox"/>	FAUNA	<input type="checkbox"/>
SHALLOW	<input checked="" type="checkbox"/>	PASS	<input type="checkbox"/>
STYGO HABITAT PRESENT	YES <input type="checkbox"/>	NO	<input checked="" type="checkbox"/>
DRILLING			
DATE	3/10/11	commence	
DATE		complete	
CONTRACTOR	HAGSTROM		
DRILLER			
CREW	RIG 1		
RIG TYPE			
ABANDONED/BACKFILLED	no	yes	
DRILL METHOD	ROTARY CORING / DIAMOND		
DRILL DEPTH	m	from natural surface	
HOLE DIAMETER	122	mm	TYPE PQ
CUT WATER	-	m	
SWL		m	
BORE CONSTRUCTION			
DATE		commence	
DATE		complete	
DESIGNED BY			
SUPERVISED BY			
CONSTRUCTED BY			
CASED DEPTH	m	below natural surface	
TOP OF MAIN CASING	m	above natural surface	
SURFACE CASING	left-in <input type="checkbox"/>	removed	<input type="checkbox"/>
		material	
	m	below natural surface	
	m	above natural surface	
MAIN BORE CASING	m	depth from	
	m	depth to	
	ID		OD
		material	
	m	total length	
SLOT INTERVAL	m	depth from	
	m	depth to	
SLOT SIZE	mm		
ANNULUS			
GRAVEL PACK			
BACKFILL			
CEMENT			
BENTONITE			
HEADWORKS			
TYPE	standpipe <input type="checkbox"/>	surface casing	<input type="checkbox"/>
MATERIAL			
	m	below natural surface	
	m	above natural surface	
SECURITY			
OTHER DETAILS			

## MONITORING BORE CONSTRUCTION

U-31

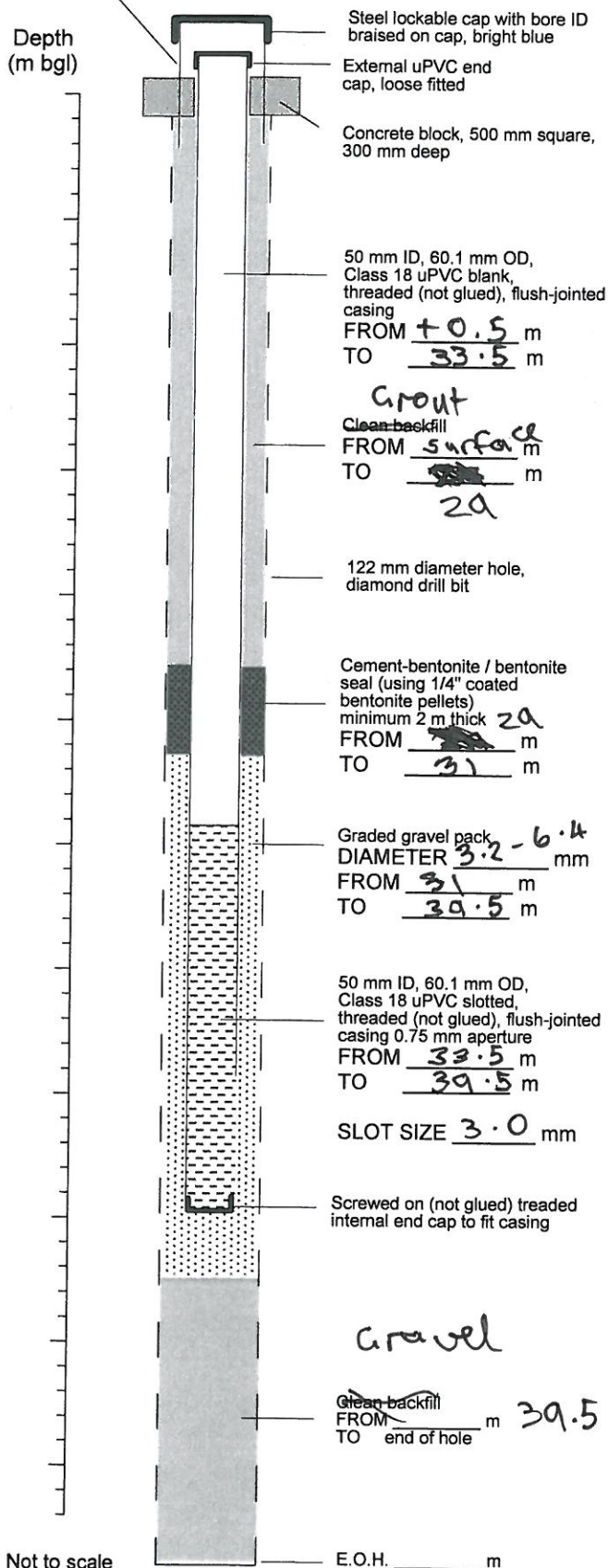
Rockwater Pty Ltd

ISSUED TO FUGRO, HAGSTROM, ARUP, 5<sup>th</sup> Oct 2011



# TO CONSTRUCT

DN100 mm SCH 30, galvanised steel pipe, 700 mm above ground to 400 mm below ground, bright blue



# COMPLETION DETAILS

LOCATION	JPP	
HOLE ID	V-25	
CO-ORDS	mE	mN
RL	mAHD	
BORE TYPE	MONITORING	
DEEP	<input checked="" type="checkbox"/>	FAUNA
SHALLOW	<input type="checkbox"/>	PASS
STYGO HABITAT PRESENT	YES	NO
YES	<input type="checkbox"/>	<input type="checkbox"/>
DRILLING		
DATE	commence	
DATE	complete	
CONTRACTOR		
DRILLER		
CREW		
RIG TYPE		
ABANDONED/BACKFILLED	no	yes
DRILL METHOD		
DRILL DEPTH	m	from natural surface
HOLE DIAMETER	mm	TYPE
CUT WATER	m	
SWL	m	
BORE CONSTRUCTION		
DATE	commence	
DATE	complete	
DESIGNED BY		
SUPERVISED BY		
CONSTRUCTED BY		
CASED DEPTH	m	below natural surface
TOP OF MAIN CASING	m	above natural surface
SURFACE CASING	left-in	<input type="checkbox"/> removed <input type="checkbox"/> material
	m	below natural surface
	m	above natural surface
MAIN BORE CASING	m	depth from
	m	depth to
	ID	OD
		material
	m	total length
SLOT INTERVAL	m	depth from
	m	depth to
SLOT SIZE	mm	
ANNULUS		
GRAVEL PACK		
BACKFILL		
CEMENT		
BENTONITE		
HEADWORKS		
TYPE	standpipe	<input type="checkbox"/> surface casing
MATERIAL		
	m	below natural surface
	m	above natural surface
SECURITY		
OTHER DETAILS		

I/368-0-2A/Data/Bore Design/To Construct.grf

Client: WEL

Project: #68 Geotech Drilling - Construction of Monitoring Bores

Date: Nov August 2011

Drg. No.: 368-0-2A/11/XX

## MONITORING BORE CONSTRUCTION

submitted to Arup, Fugro, Hochtief

02/11/11

V-25

Rockwater Pty Ltd



**APPENDIX IV**  
**BORE SCHEDULE**



Hole ID	Bore Type	RL Top of Casing	Easting	Northing	Casing Size (OD)	Casing Class	Slot Size	Slotted Interval	Drill Depth	Drill Dates	Hole Diameter	Casing Depth	Construction Dates	Annulus - Grout	Annulus - Bentonite Seal	Annulus - Gravel	Gravel Size	Backfill / Collapse	Steel Standpipe	SWL		
		(m AHD)	mE	mN	mm		mm	m bgl	m bgl		mm	m bgl		m bgl	m bgl	m bgl	mm	m bgl	m agl	m bts	Date	Time
AD-16	Deep / Stygo	23.9	411223	8063749	57.5	18	3.00	38.5 - 44.5	50	04/11/11 - 07/11/11	123	44.5	9/11/11	0.0 - 31.5	31.5 - 34.4	34.4 - EOH	3.2 - 6.4	nil	0.55	20.88	10/12/2011	14:20:00
AD-20	Shallow	23.2	411220	8063554	57.5	18	0.50	19.6 - 25.6	50	11/11/11 - 14/11/11	123	25.6	14/11/11	0.0 - 15.0	15.0 - 17.0	17.0 - 25.6 25.6 - 50.0	1.6 - 3.2 3.2 - 6.4	nil	0.805	20.28	12/12/2011	13:00:00
AD-28	Deep	21.5	411221	8063164	57.5	18	0.50	36.9 - 42.9	50.5	07/11/11 - 10/11/11	123	42.9	10/11/11	0.0 - 32.0	32.0 - 35.0	35.0 - 42.9 42.9 - 50.0	1.6 - 3.2 3.2 - 6.4	nil	0.57	18.56	14/12/2011	09:06:00
AE-10	Shallow	24.7	411227.8 <sup>d</sup>	8064055.3 <sup>d</sup>	57.5	18	0.75	21.2 - 27.2	50	29/08/11 - 13/09/11	123	26.6	15/09/11	0.0 - 15.3	15.3 - 17.4	17.4 - 26.6 26.6 - 50.0	1.6 - 3.2 3.2 - 6.4	nil	0.65	22	29/11/2011	08:56:00
AP-12	Shallow	29.0	411824	8063949	57.5	18	0.75	26.0 - 32.0	50	31/10/11 - 02/11/11	123	32.0	3/11/11	0.0 - 22.0	22.0 - 24.0	24.0 - 32.0 32.0 - 50.0	1.6 - 3.2 3.2 - 6.4	nil	0.535	25.7	7/12/2011	13:55:00
AP-14	Deep	30.1	411823	8063850	57.5	18	0.50	44.0 - 50.0	50.5	12/11/11 - 15/11/11	123	50.0	15/11/11	0.0 - 40.0	40.0 - 42.0	42.0 - 50.5	1.6 - 3.2	nil	0.98	26.68	8/12/2011	14:04:00
AP-20	Shallow	29.0	411822	8063550	57.5	18	0.50	24.7 - 30.7	50	8/11/11 - 11/11/11	123	30.7	13/11/11	0.0 - 20.5	20.5 - 22.5	22.5 - 30.7 30.7 - 50.0	1.6 - 3.2 3.2 - 6.4	nil	0.81	25.765	14/12/2011	11:40:00
AP-24	Shallow	27.9	411822	8063350	57.5	18	0.50	23.6 - 29.6	52.5	27/11/11 - 30/11/11	123	29.6	30/11/11	0.0 - 18.0	18.0 - 21.5	21.5 - 29.6 29.6 - 52.5	1.6 - 3.2 3.2 - 6.4	nil	0.78	24.55	13/12/2011	13:18:00
AP-28	Deep	26.7	411823	8063159	57.5	18	0.50	40.7 - 46.7	50	13/11/11 - 15/11/11	123	46.7	16/11/11	0.0 - 36.0	36.0 - 38.0	38.0 - 46.7 46.7 - 50.0	1.6 - 3.2 3.2 - 6.4	nil	0.51	23.27	13/12/2011	12:56:00
AP-32	Shallow	25.4	411825	8062943	57.5	18	0.50	20.5 - 26.5	48.5	03/11/11 - 07/11/11	123	26.5	7/11/11	0.0 - 16.5	16.5 - 18.5	18.5 - 26.5 26.5 - 48.5	1.6 - 3.2 3.2 - 6.4	nil	0.74	22.09	13/12/2011	11:20:00
AP-36	Shallow	24.7	411828	8062763	57.5	18	0.50	20.0 - 26.0	58.5	07/11/11 - 12/11/11	123	26.0	12/11/11	0.0 - 16.0	16.0 - 18.0	18.0 - 26.0 26.0 - 58.5	1.6 - 3.2 3.2 - 6.4	nil	0.805	21.37	14/12/2011	08:34:00
F-14	Shallow	11.4	410027	8063852	57.5	18	0.50	8.0 - 14.0	51	16/11/11 - 20/11/11	123	14.0	20/11/11	0.0 - 3.0	3.0 - 6.0	6.0 - 14.0 14.0 - 51.0	1.6 - 3.2 3.2 - 6.4	nil	0.73	9.23	9/12/2011	14:08:00
I-16	Deep	12.6	410178	8063746	57.5	18	0.50	29.0 - 35.0	50	17/11/2011 - 20/11/11	123	35.0	20/11/11	0.0 - 25.0	25.0 - 27.0	27.0 - 35.0 35.0 - 50.0	1.6 - 3.2 3.2 - 6.4	nil	0.95	10.35	9/12/2011	14:40:00
N-4	Shallow	16.0	410423	8064353	57.5	18	0.50	13.0 - 19.0	57	22/11/11 - 26/11/11	123	18.9	27/11/11	0.0 - 1.0	1.0 - 3.0	11.0 - 18.9 18.9 - 57.0	1.6 - 3.2 3.2 - 6.4	3.0 - 11.0	0.68	13.83	13/12/2011	13:54:00
O-10	Shallow	17.1	410470	8064057	57.5	18	0.50	14.2 - 20.2	51	18/11/11 - 22/11/11	123	20.2	23/11/11	0.0 - 7.0	7.0 - 11.9	11.9 - 20.2 20.2 - 51.0	1.6 - 3.2 3.2 - 6.4	nil	0.71	14.81	11/12/2011	12:05:00
P-17	Shallow	16.1	410525	8063705	57.5	18	0.75	14.0 - 20.0	50	30/09/11 - 06/10/11	123	20.0	7/10/11	0.0 - 10.0	10.0 - 12.0	12.0 - 20.0 20.0 - 46.2	1.6 - 3.2 3.2 - 6.4	46.2 - EOH	0.575	13.55	24/11/2011	07:20:00
P-21	Shallow	15.3	410524	8063502	57.5	18	0.75	13.0 - 19.0	50.5	28/09/11 - 01/10/11	123	19.0	2/10/11	0.0 - 9.0	9.0 - 11.0	11.0 - 19.0 19.0 - 50.5	1.6 - 3.2 3.2 - 6.4	nil	0.635	12.94	29/11/2011	08:07:00
P-25	Deep	14.7	410526	8063307	57.5	18	0.50	29.0 - 35.0	51	02/11/11 - 05/11/11	123	35.0	8/11/11	0.0 - 24.9	24.9 - 26.6	26.9 - 34.9 34.9 - 51.0	1.6 - 3.2 3.2 - 6.4	nil	0.8	12.11	12/12/2011	14:28:00
P-29	Shallow	13.6	410528	8063097	57.5	18	0.75	13.5 - 19.5	58.5	28/09/11 - 02/10/11	123	19.5	3/10/11	0.0 to 8.5	8.5 - 10.3	10.3 - 19.5 19.5 - 58.5	1.6 - 3.2 3.2 - 6.4	nil	0.52	11.24	29/11/2011	07:48:00
U-10	Shallow / Stygo	20.4	410770	8064054	57.5	18	3.00	24.5 - 30.5	50	29/08/11 - 04/09/11	123	30.5	6/09/11	0.0 - 20.5	20.5 - 22.5	22.5 - 50.0	3.2 - 6.4	nil	0.7	17.93	1/12/2011	07:51:00
U-16	Deep	19.0	410771	8063754	57.5	18	0.75	34.5 - 40.5	50	07/10/11 - 13/10/11	123	40.5	13/10/11	0.0 - 30.0	30.0 - 32.0	32.0 - 40.5 40.5 - 50.0	1.6 - 3.2 3.2 - 6.4	nil	0.55	16.4	4/12/2011	10:00:00
U-20	Shallow	18.7	410768	8063553	57.5	18	0.75	15.2 - 21.2	54	02/10/11 - 05/10/11	123	21.2	6/10/11	0.0 - 10.8	10.8 - 12.8	12.8 - 21.2 21.2 - 54	1.6 - 3.2 3.2 - 6.4	nil	0.96	16.23	29/11/2011	12:06:00
U-31	Shallow	15.7	410769	8063002	57.5	18	0.75	12.0 - 18.0	51.1	03/10/11 - 06/10/11	123	18.0	6/10/11	0.0 - 8.0	8.0 - 10.0	10.0 - 18.0 18.0 - 49.0	1.6 - 3.2 3.2 - 6.4	49.0 - EOH	0.84	13.165	11/12/2011	12:55:00
V-25	Deep / Stygo	18.0	410819	8063300	57.5	18	3.00	33.5 - 39.5	50	31/10/11 - 03/11/11	123	39.5	5/11/11	0.0 - 28.5	28.5 - 31.0	31.0 - 39.5 39.5 - 50.0	1.6 - 3.2 3.2 - 6.4	nil	0.77	15.24	10/12/2011	13:17:00
AD-10	Production	24.3	411215.3	8064057.2	114	12	0.70	27.1 - 45.1	50	16/07/11 - 20/07/11	216	45.1	20/07/11	0.0 - 0.5	12.4 - 14.2	0.5 - 12.4 14.2 - 45.1	1.6 - 3.2	45.1 - 50.0	0.3	20.94	1/10/2011	14:43:00
AP-10	Production	27.3	411787.7	8064053.6	114	12	0.70	24.0 - 42.0	50	18/07/11 - 23/07/11	216	42	23/07/11	0.0 - 0.5	16.0 - 18.0	0.5 - 16.0 18.0 - 42.0	1.6 - 3.2	42.0 - 50.0	0.6	23.95	8/11/2011	08:26:00
BH6X	Monitoring	8.9	410267	8062435	60.4	12	-	34.2 - 47.7	50.9	29/11/09 - 01/12/09	96	47.7	1/12/2009	0.0 - 0.5	31.0 - 34.2	35.7 - 47.7	-	47.7 - 50.9	0.615	6.84	14/12/2011	08:13:00
Bore X	Monitoring	-	409285	8066200	150	-	-	-	-	-	-	25.75	-	-	-	-	-	-	0.79	14.9	14/12/2011	-
Bore X1	Monitoring	-	416915	8062435	150	-	-	-	-	-	-	27.25	-	-	-	-	-	-	0.5	7.65	14/12/2011	-

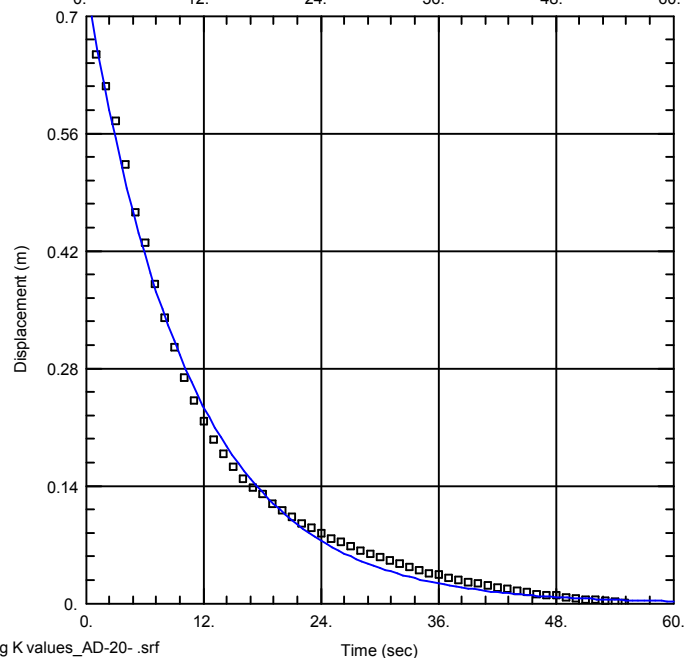
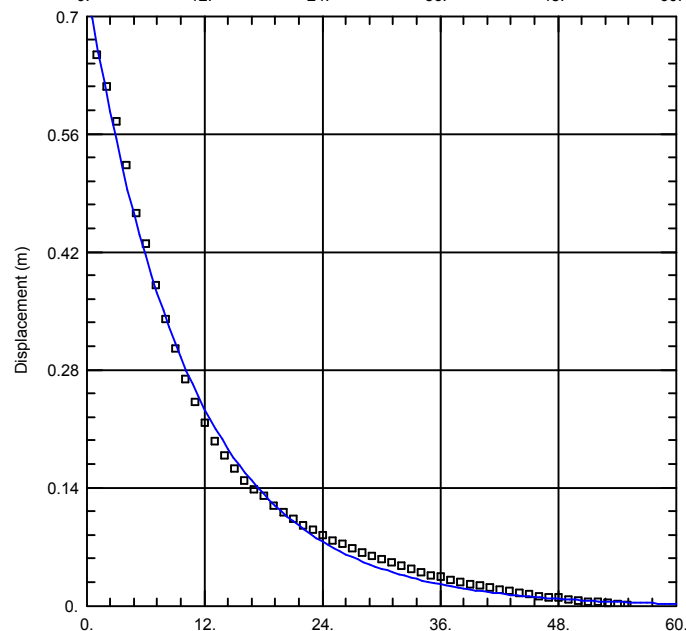
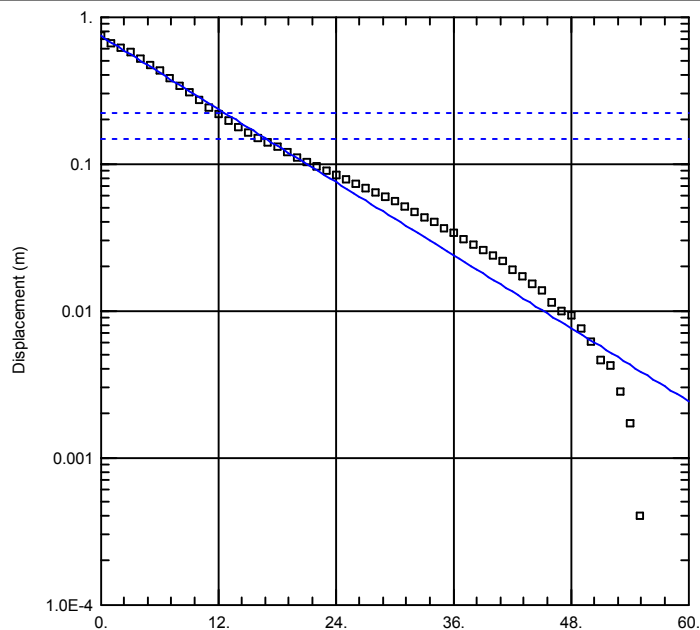
<sup>d</sup>Coordinates supplied by Fugro likely incorrect

**APPENDIX V**

**FALLING HEAD TESTS**

**DATA ANALYSIS**





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_AD-20-.srf

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

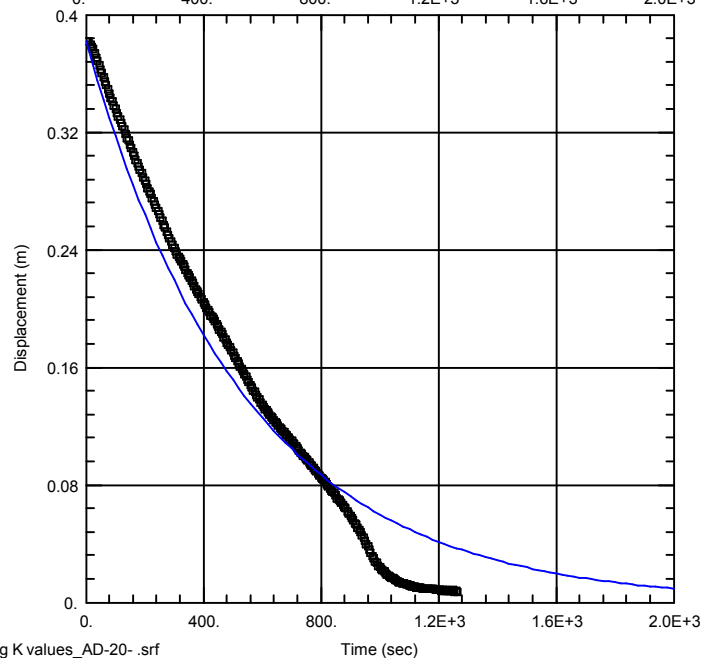
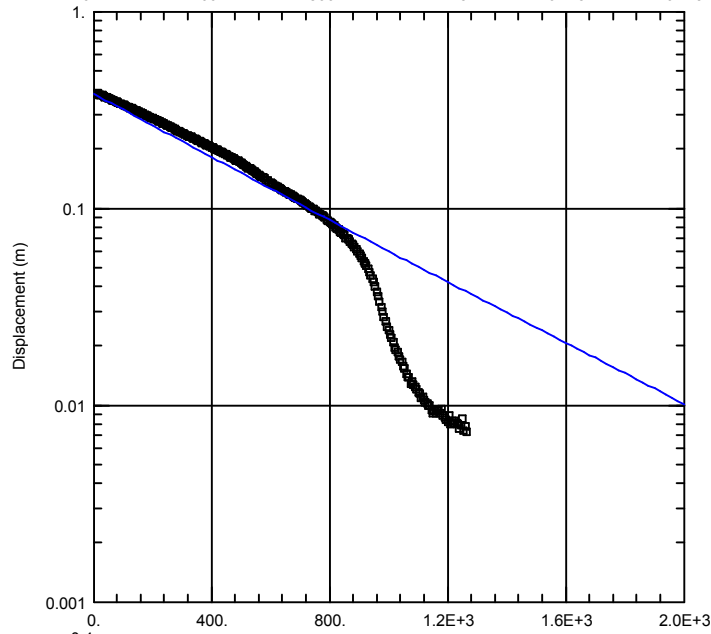
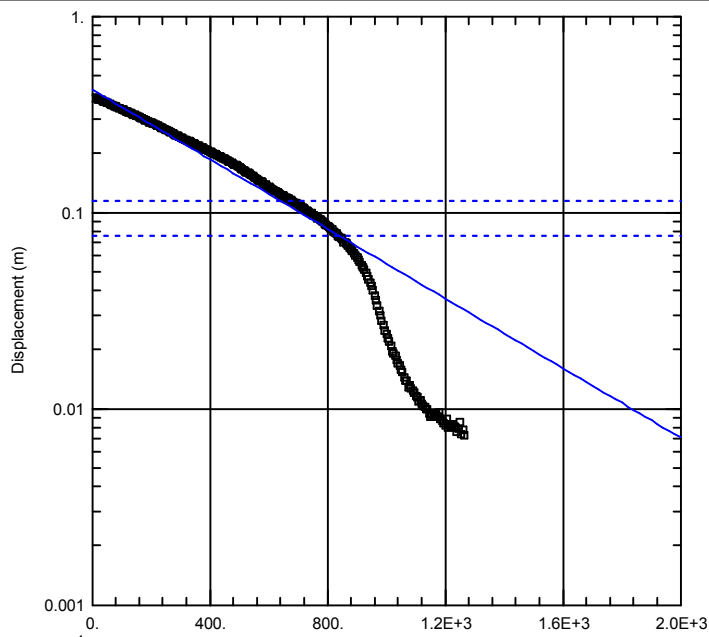
DATE: February 2012

Dwg. No: 368.0.2A/12/V-1

## FALLING-HEAD TEST RESULTS

AD-20





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_AD-20-.srf

Time (sec)

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

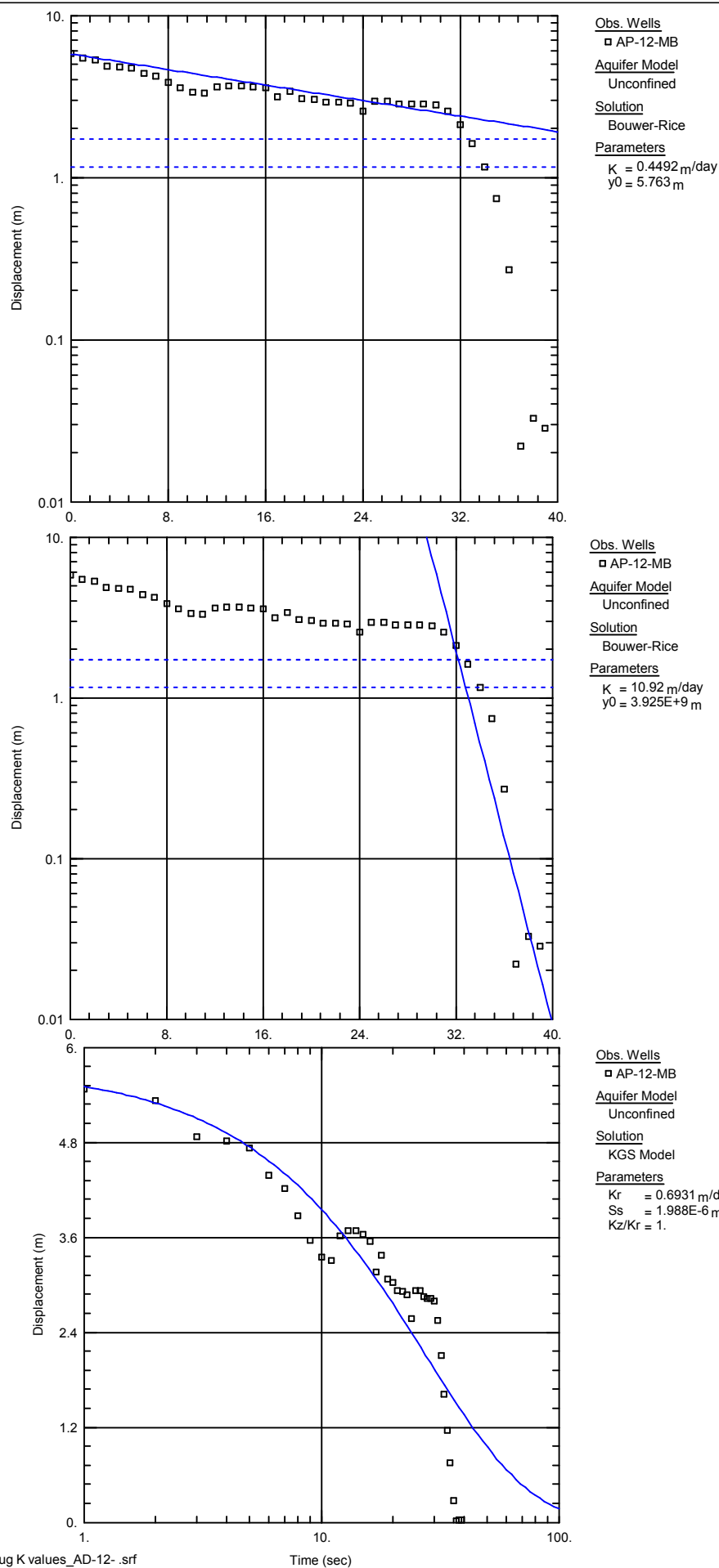
DATE: February 2012

Dwg. No: 368.0.2A/12/V-2

## FALLING-HEAD TEST RESULTS

AE-10





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_AD-12- .srf

Time (sec)

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

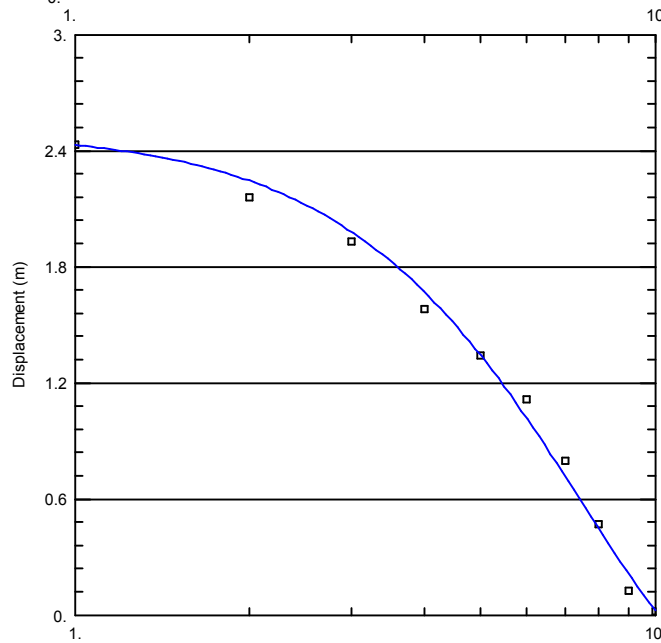
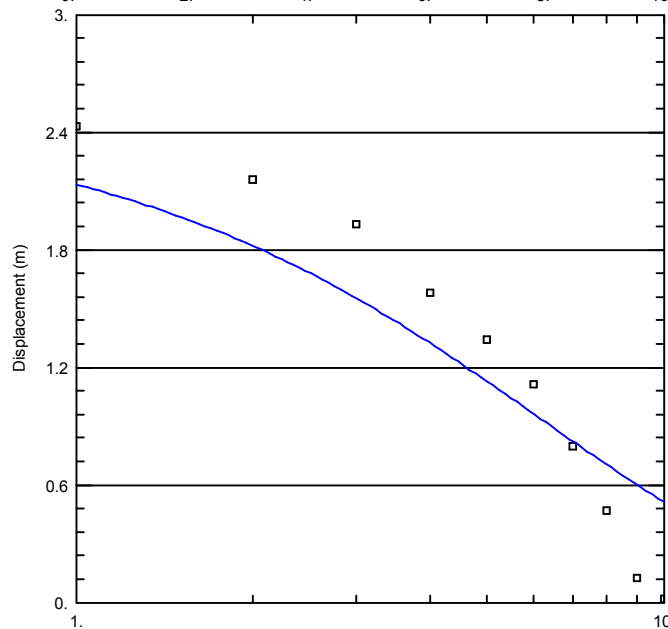
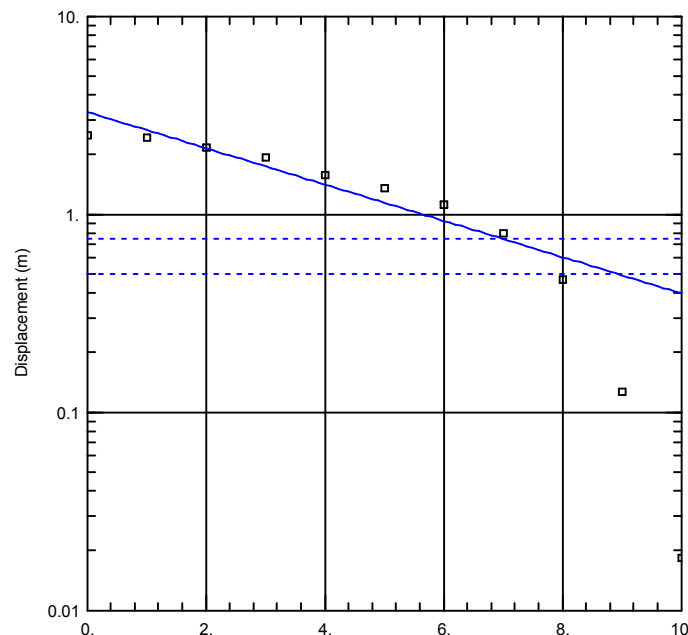
DATE: February 2012

Dwg. No: 368.0.2A/12/V-3

## FALLING-HEAD TEST RESULTS

AP-12





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_AD-14- .srf

Time (sec)

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

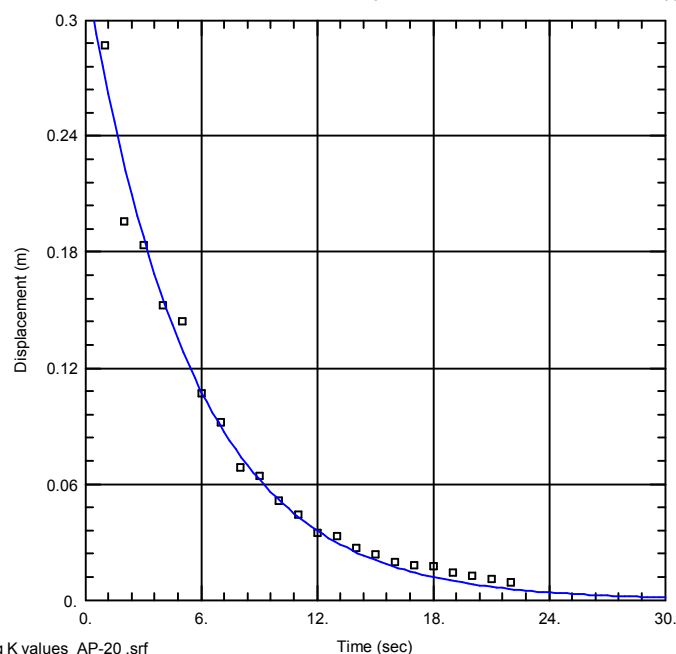
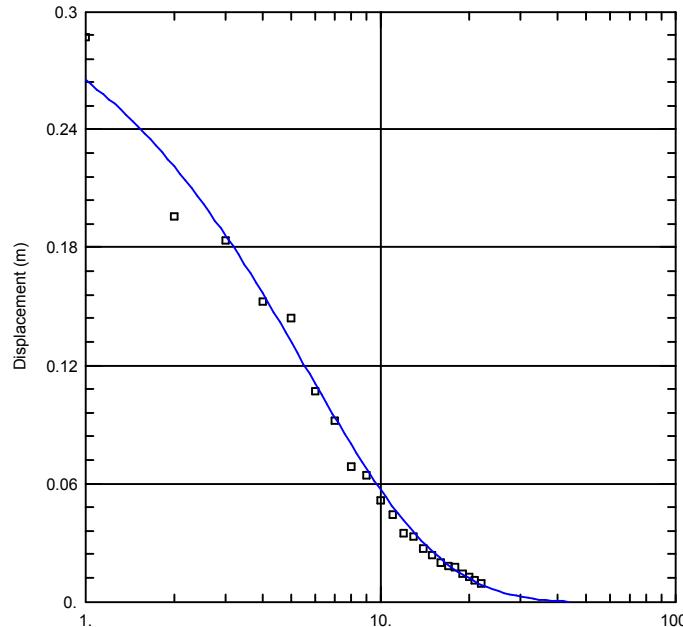
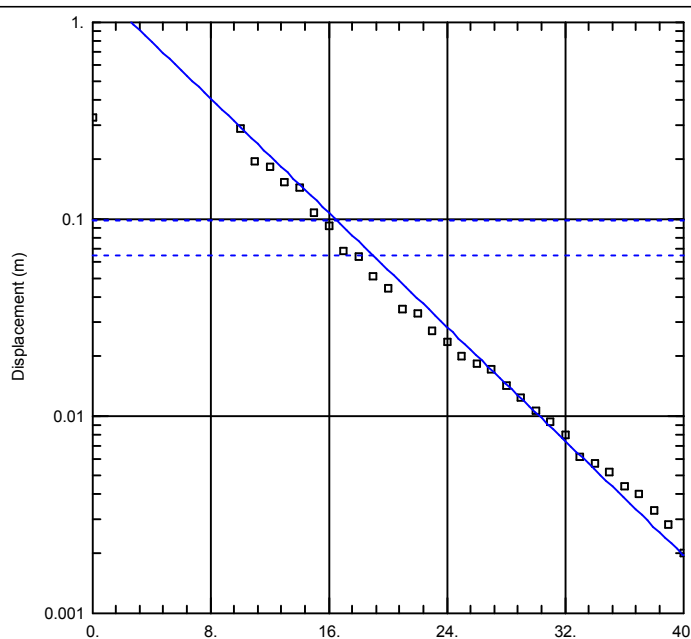
DATE: February 2012

Dwg. No: 368.0.2A/12/V-4

## FALLING-HEAD TEST RESULTS

AP-14





Obs. Wells  
 □ AP-20-MB

Aquifer Model  
 Unconfined

Solution  
 Springer-Gelhar  
 Critically damped when  $C(D)=1$

Parameters  
 $K = 2.618 \text{ m/day}$   
 $L_e = 0.1 \text{ m}$   
 $C(D) = 26.94$   
 $L = 0.0865 \text{ m}$

I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_AP-20 .srf

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

DATE: February 2012

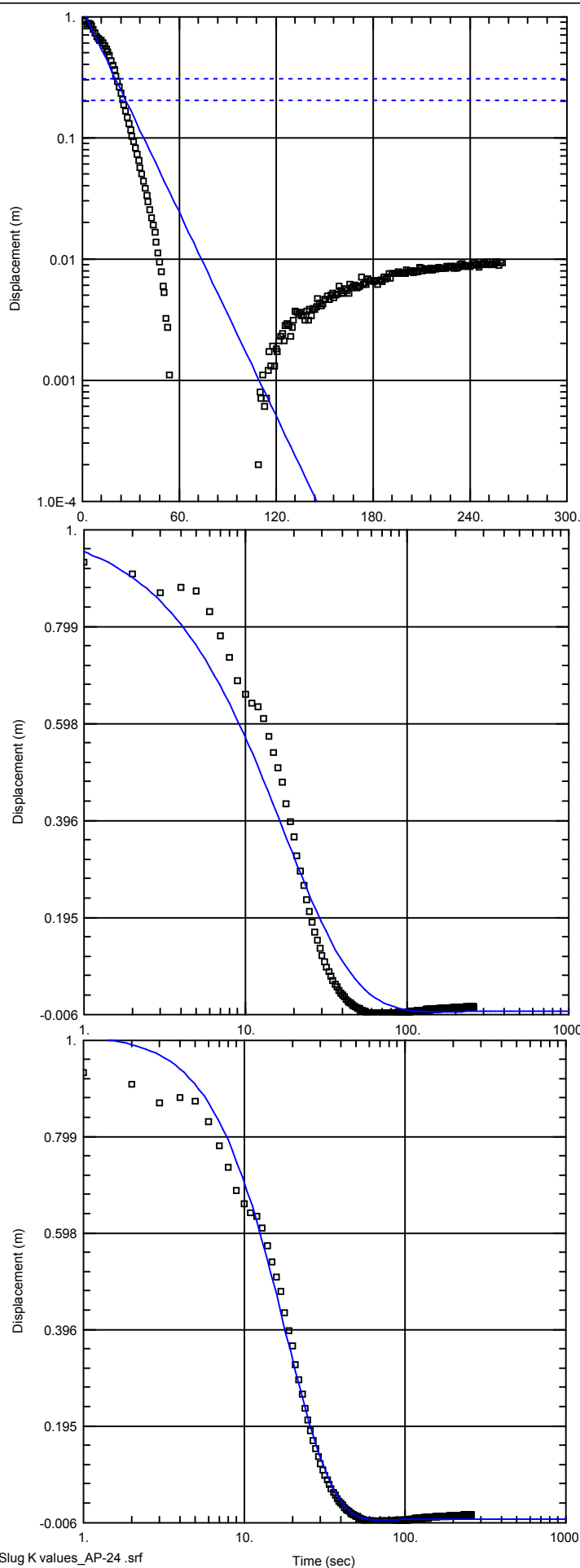
Dwg. No: 368.0.2A/12/V-5

## FALLING-HEAD TEST RESULTS

AP-20







Obs. Wells  
 □ AP-24-MB  
 Aquifer Model  
 Unconfined  
 Solution  
 Bouwer-Rice  
 Parameters  
 $K = 0.8884 \text{ m/day}$   
 $y_0 = 1.159 \text{ m}$

Obs. Wells  
 □ AP-24-MB  
 Aquifer Model  
 Unconfined  
 Solution  
 KGS Model  
 Parameters  
 $K_r = 0.9339 \text{ m/day}$   
 $S_s = 1.0\text{E-}12 \text{ m}^{-1}$   
 $K_z/K_r = 1$

Obs. Wells  
 □ AP-24-MB  
 Aquifer Model  
 Unconfined  
 Solution  
 Springer-Gelhar  
 Critically damped when  $C(D)=1$   
 Parameters  
 $K = 0.8143 \text{ m/day}$   
 $L_e = 863.7 \text{ m}$   
 $C(D) = 0.9026$   
 $L = -0.1796 \text{ m}$

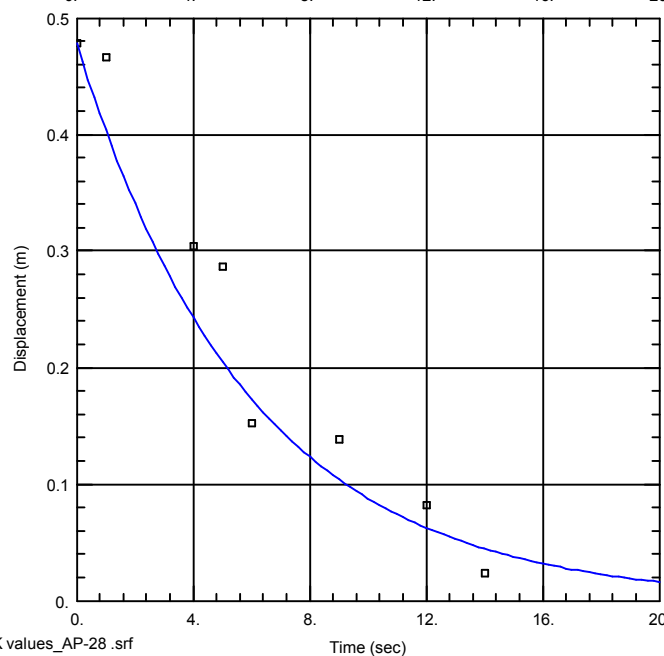
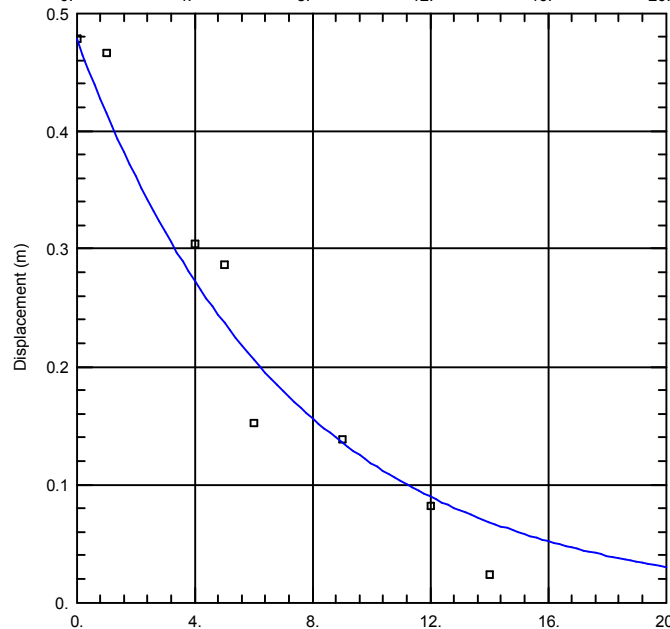
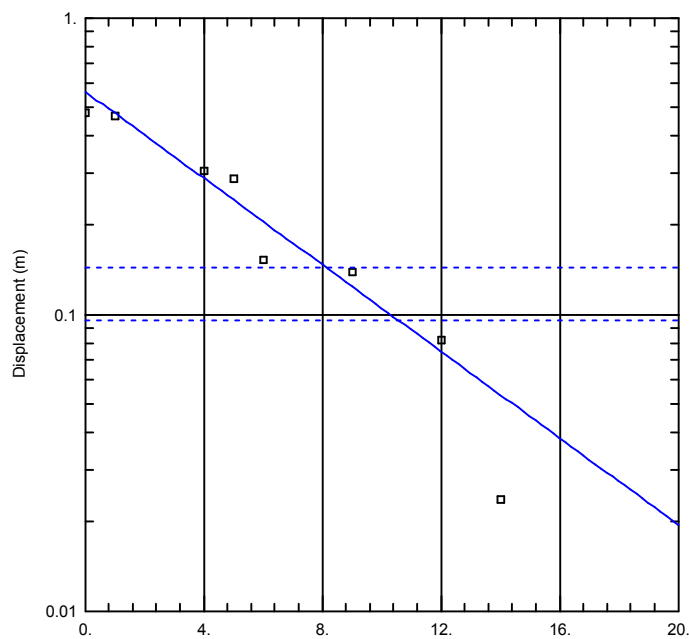
I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_AP-24 .srf

CLIENT: Woodside Energy Ltd  
 PROJECT: James Price Point  
 Monitoring Bore Completion Report  
 DATE: February 2012  
 Dwg. No: 368.0.2A/12/V-6

## FALLING-HEAD TEST RESULTS

AP-24





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_AP-28 .srf

Time (sec)

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

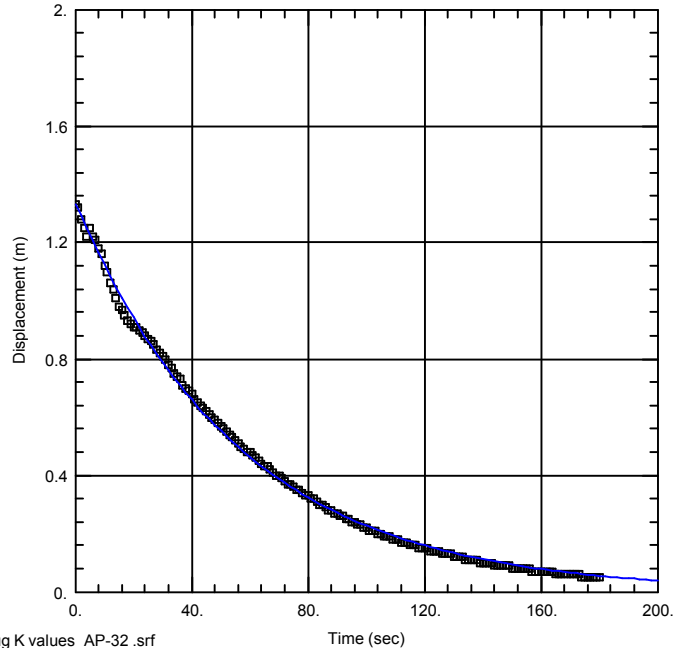
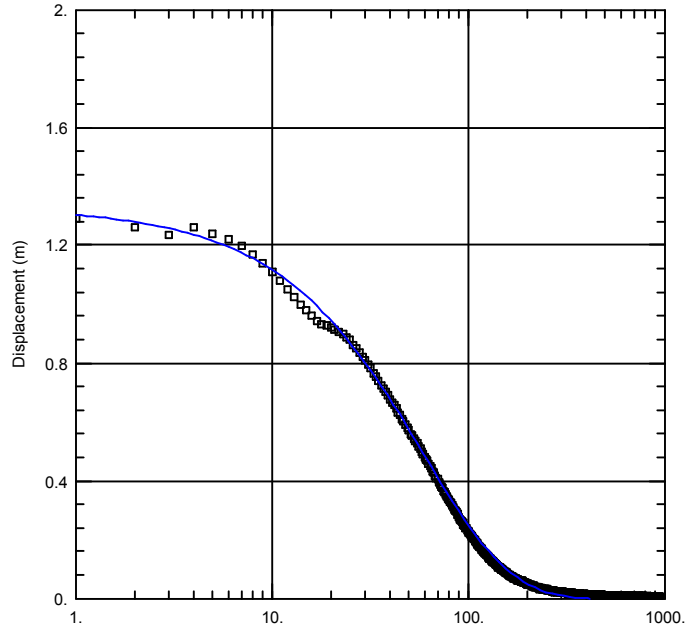
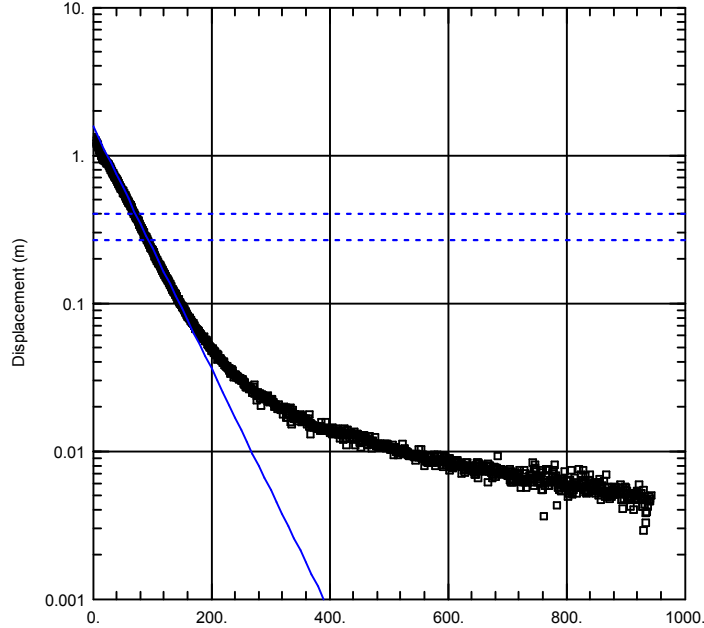
DATE: February 2012

Dwg. No: 368.0.2A/12/V-7

## FALLING-HEAD TEST RESULTS

AP-28





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_AP-32 .srf

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

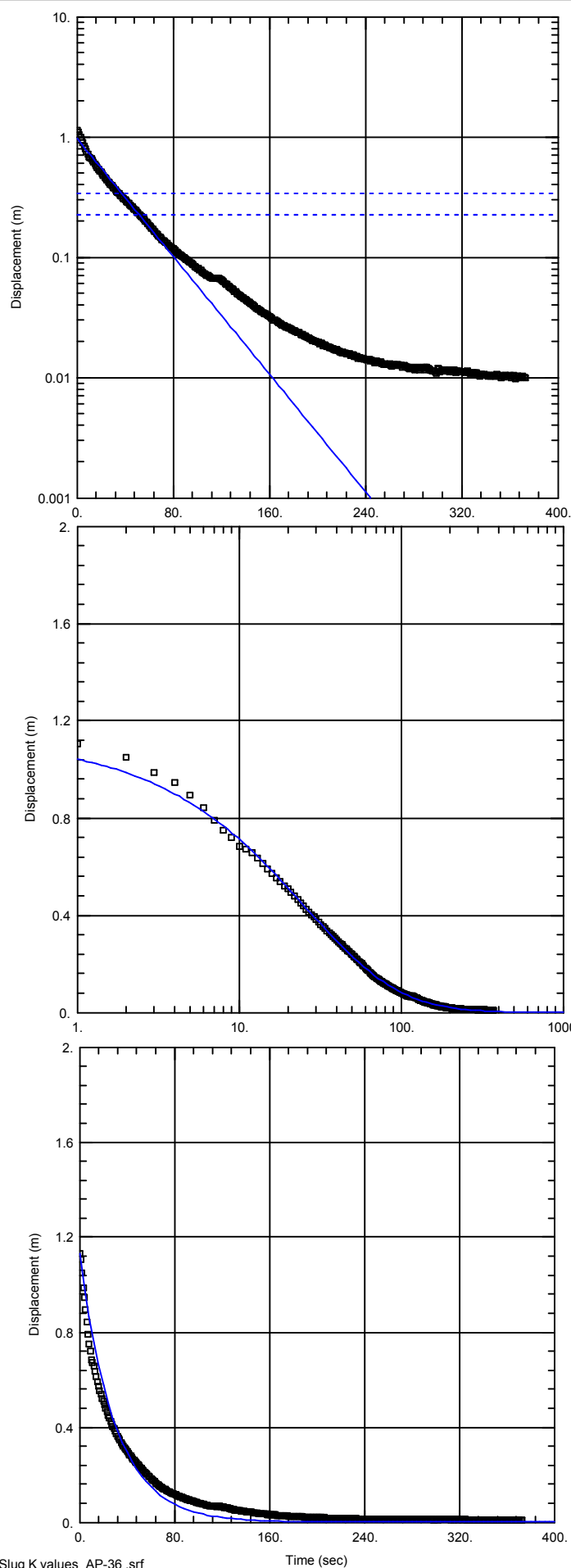
DATE: February 2012

Dwg. No: 368.0.2A/12/V-8

FALLING-HEAD TEST RESULTS

AP-32





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_AP-36 .srf

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

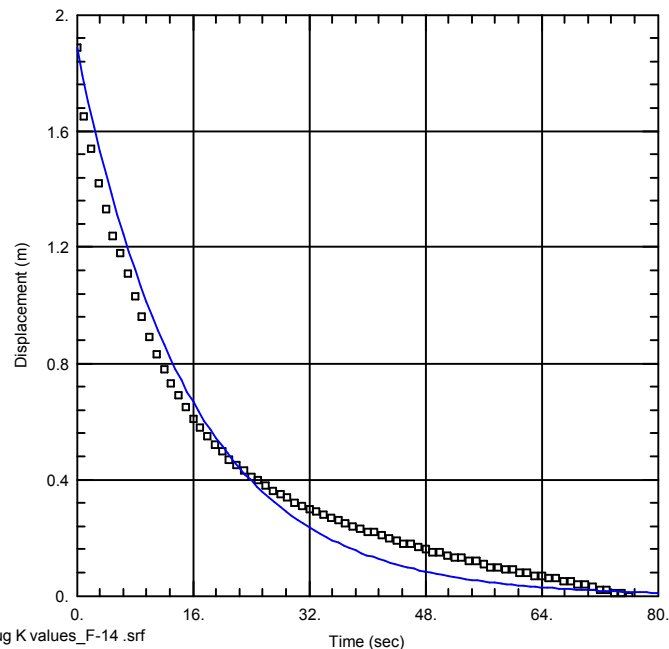
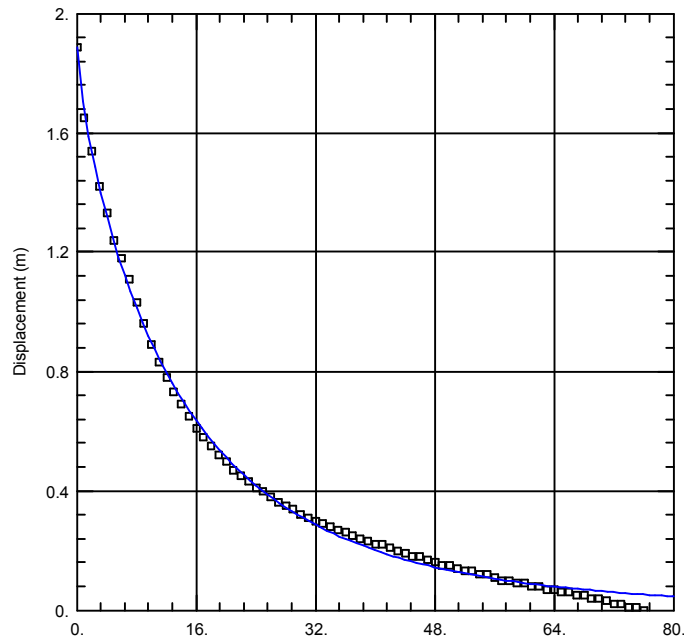
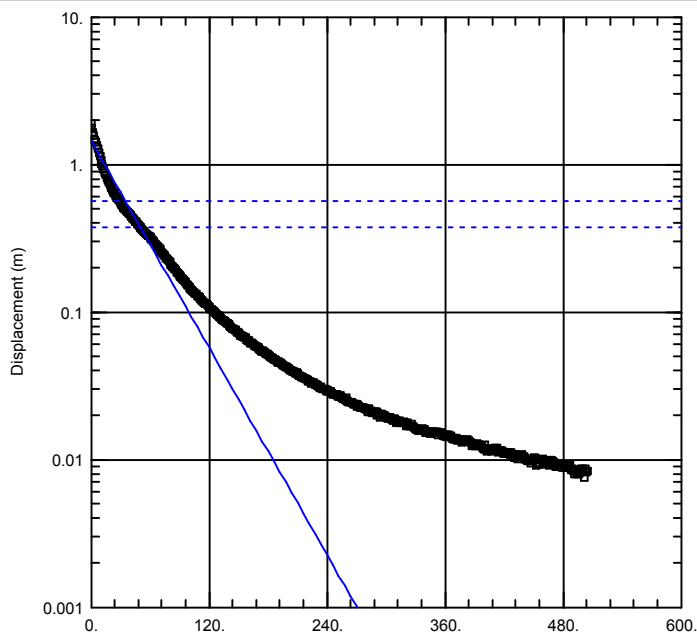
DATE: February 2012

Dwg. No: 368.0.2A/12/V-9

## FALLING-HEAD TEST RESULTS

AP-36





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_F-14 .srf

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

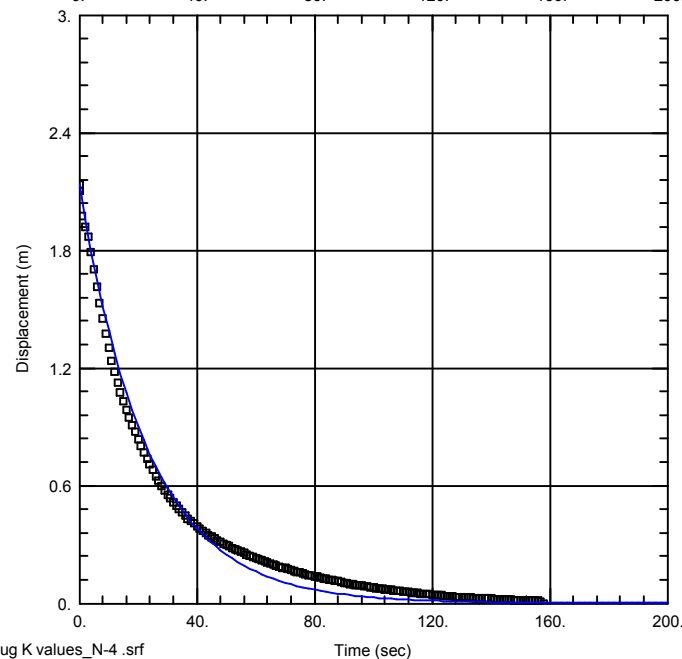
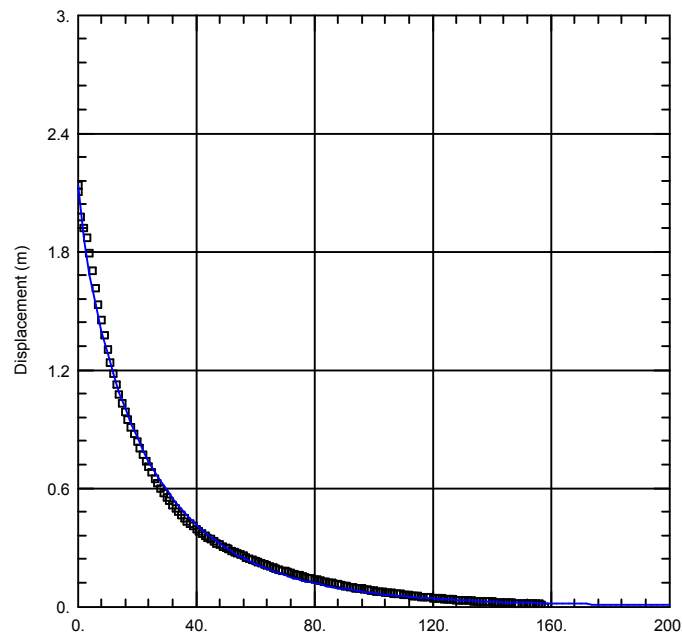
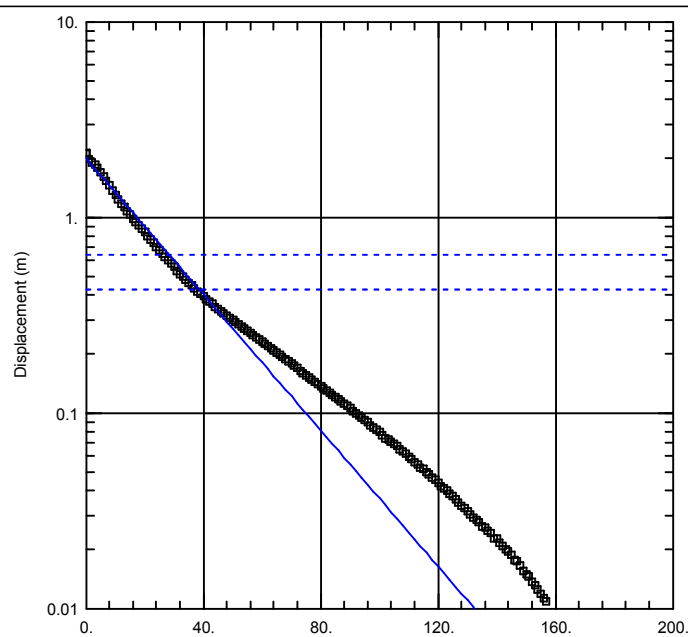
DATE: February 2012

Dwg. No: 368.0.2A/12/V-10

## FALLING-HEAD TEST RESULTS

F-14





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_N-4 .srf

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

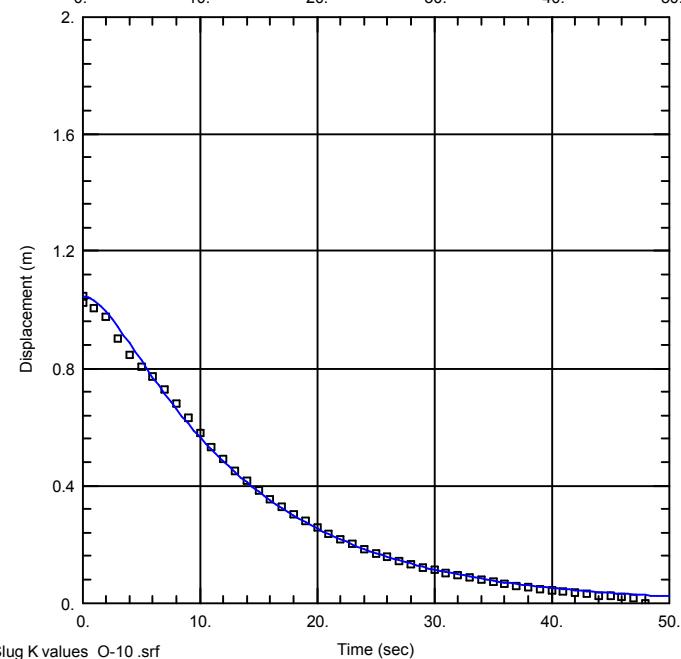
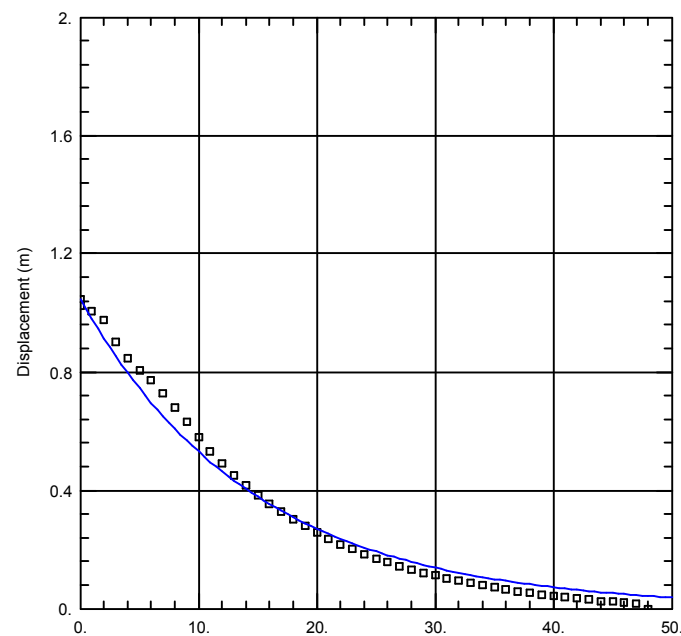
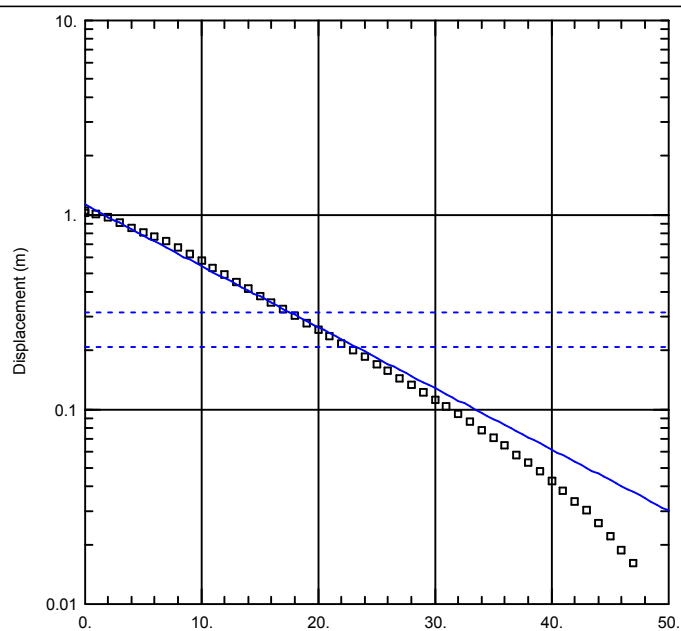
DATE: February 2012

Dwg. No: 368.0.2A/12/V-11

## FALLING-HEAD TEST RESULTS

N-4





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_O-10 .srf

Time (sec)

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

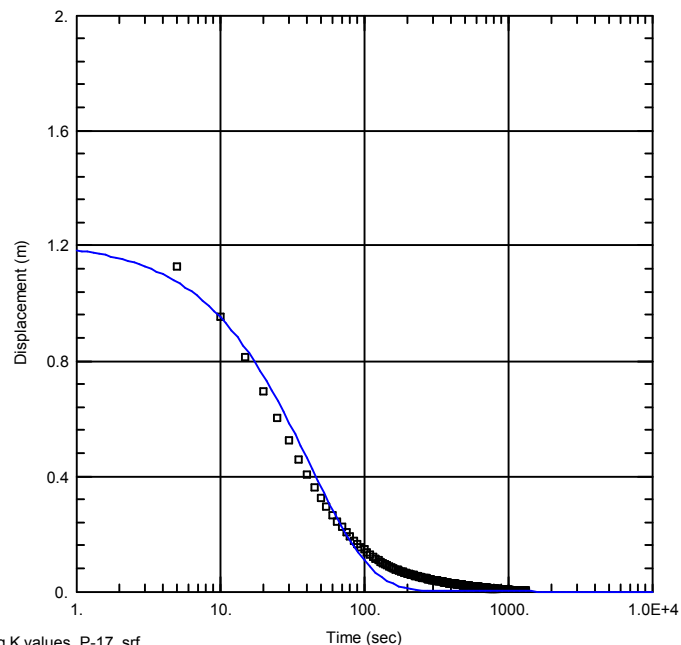
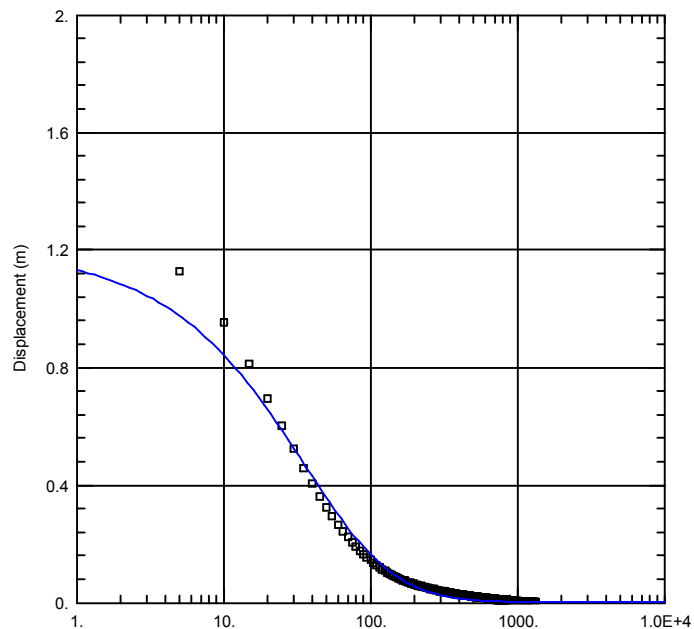
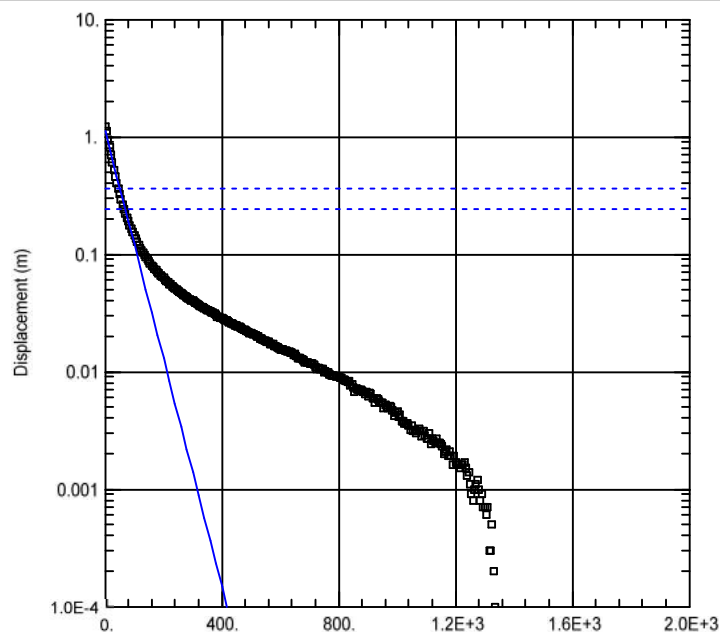
DATE: February 2012

Dwg. No: 368.0.2A/12/V-12

## FALLING-HEAD TEST RESULTS

O-10





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_P-17 .srf

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

DATE: February 2012

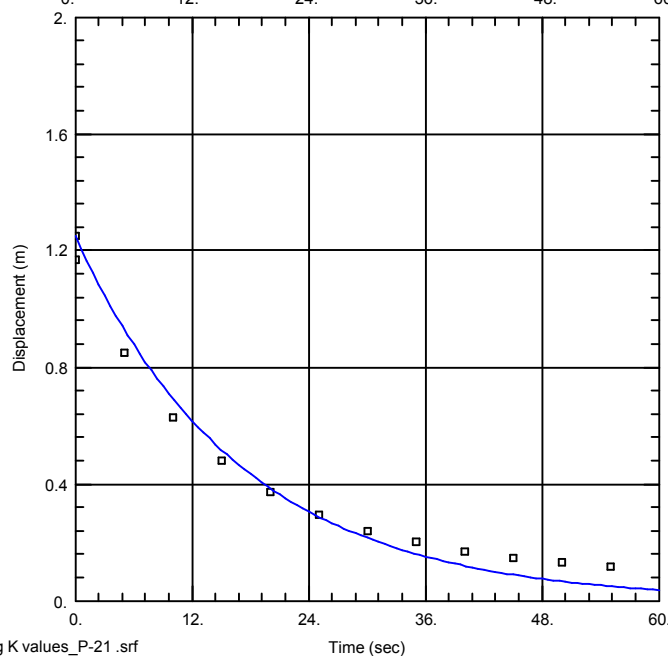
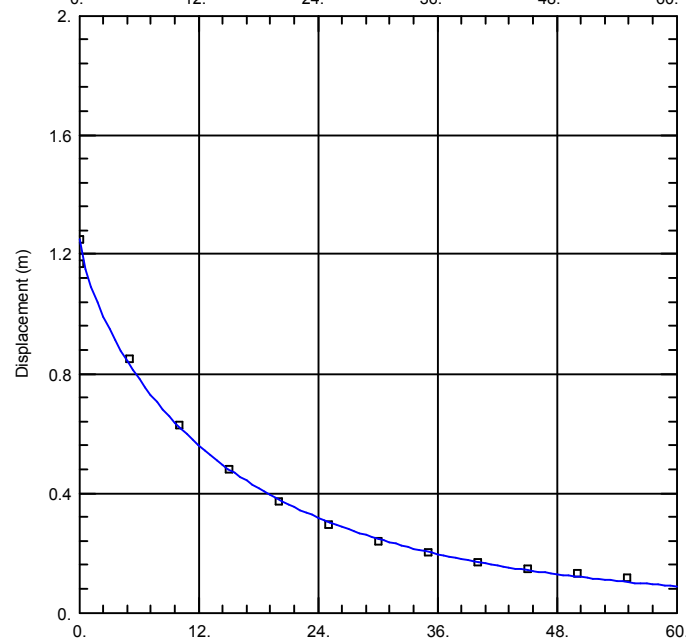
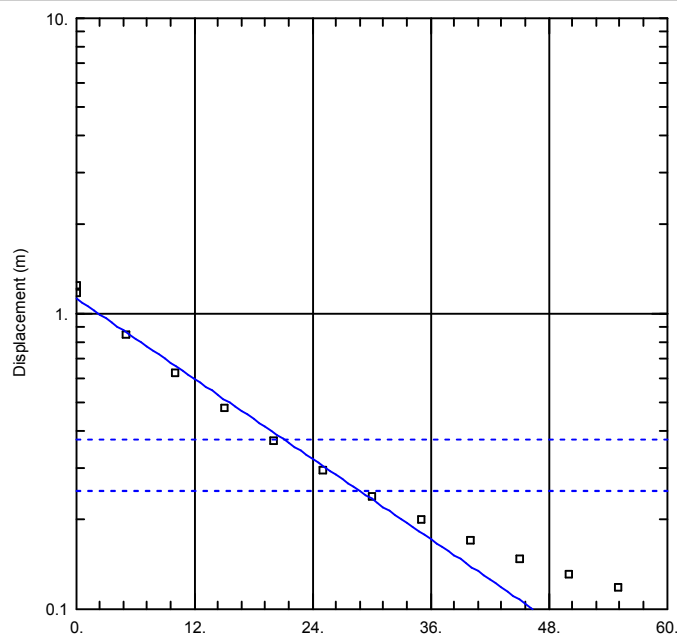
Dwg. No: 368.0.2A/12/V-13

## FALLING-HEAD TEST RESULTS

P-17







I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_P-21 .srf

Time (sec)

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

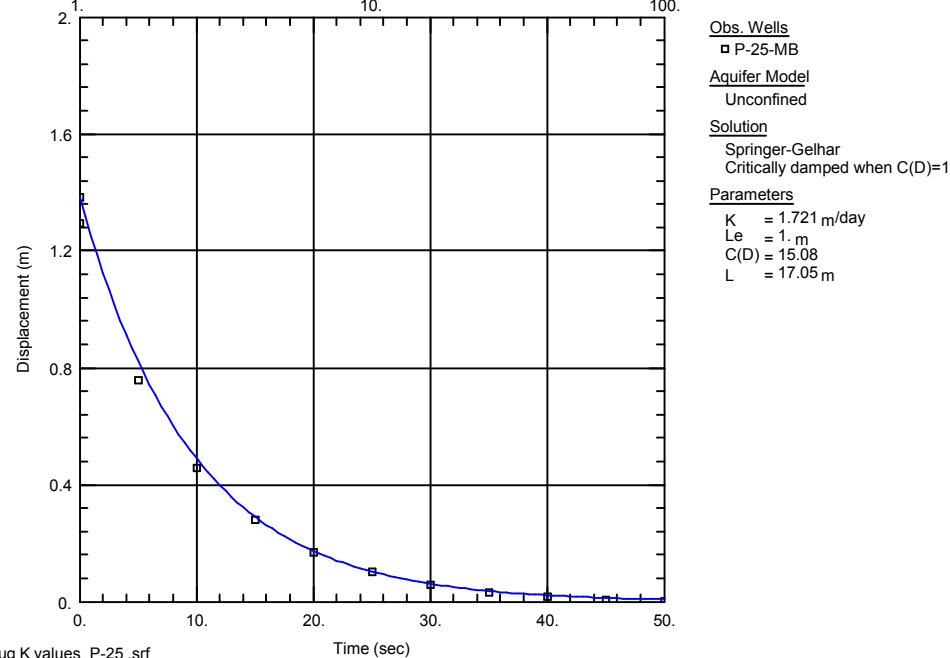
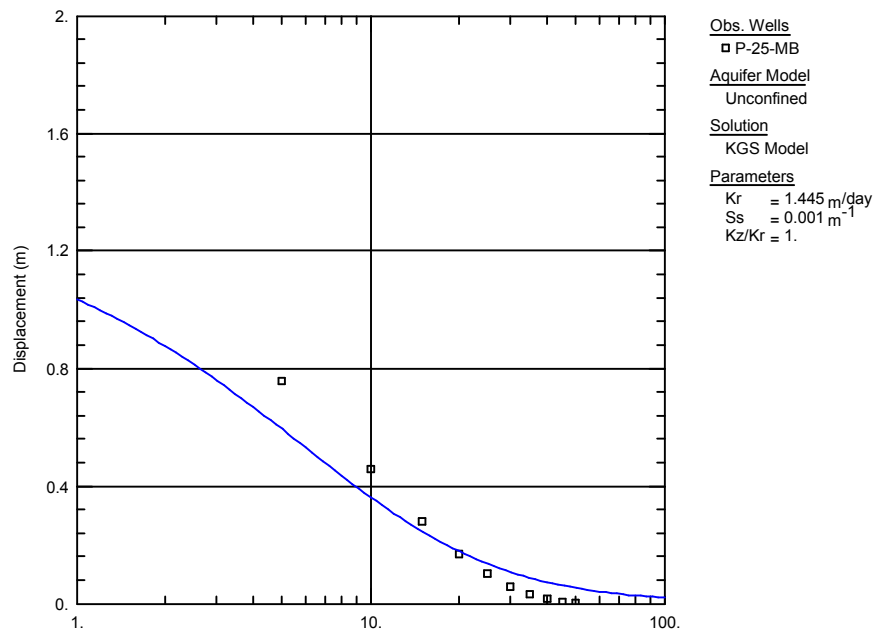
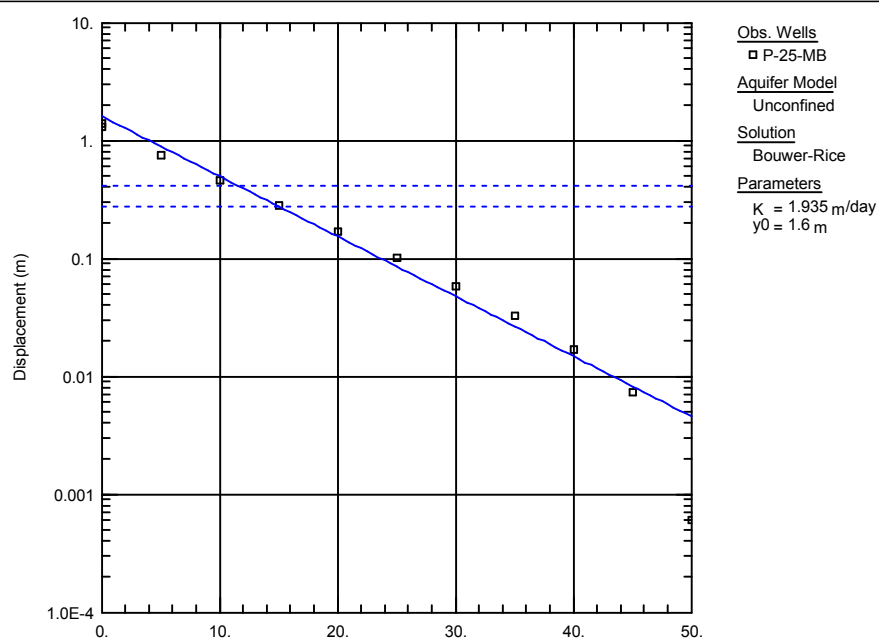
DATE: February 2012

Dwg. No: 368.0.2A/12/V-14

## FALLING-HEAD TEST RESULTS

P-21





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_P-25 .srf

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

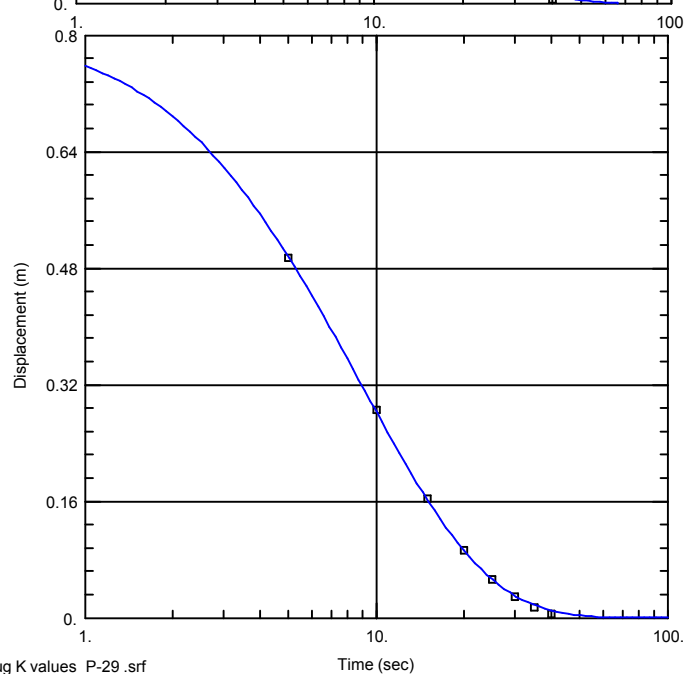
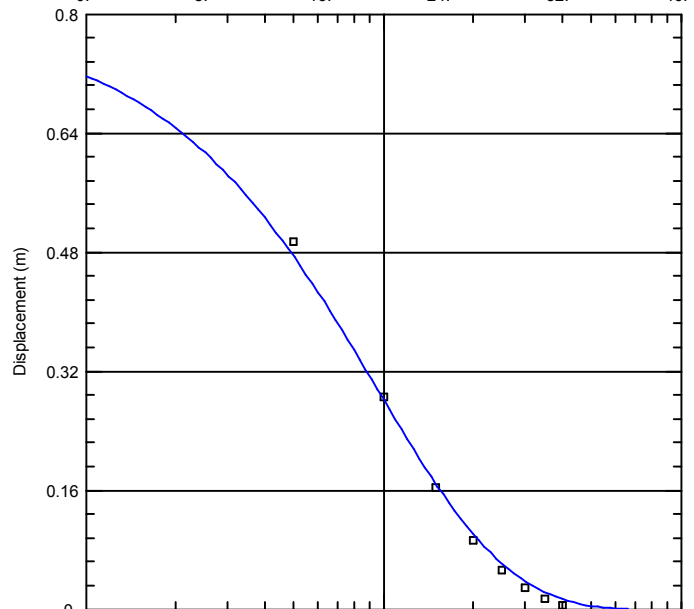
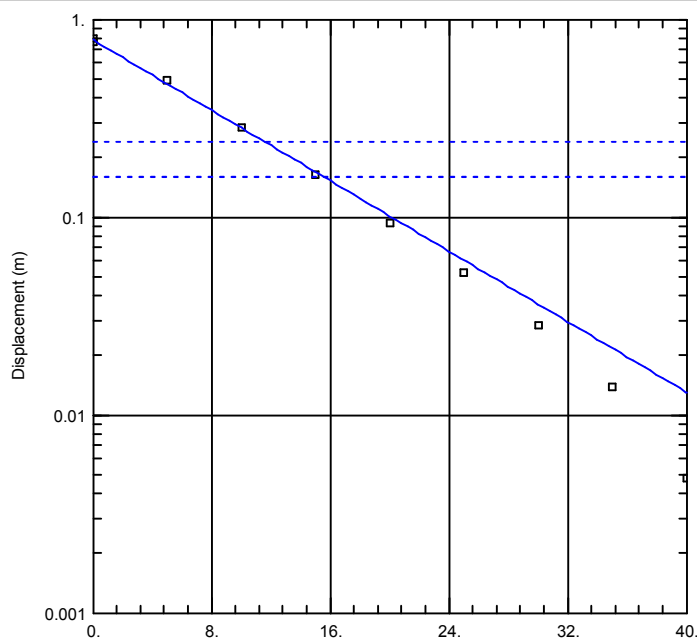
DATE: February 2012

Dwg. No: 368.0.2A/12/V-15

## FALLING-HEAD TEST RESULTS

P-25





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_P-29 .srf

Time (sec)

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

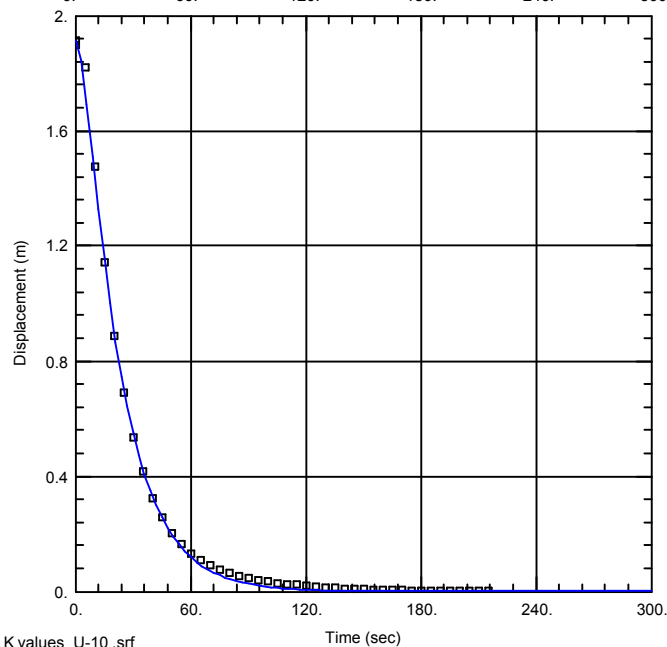
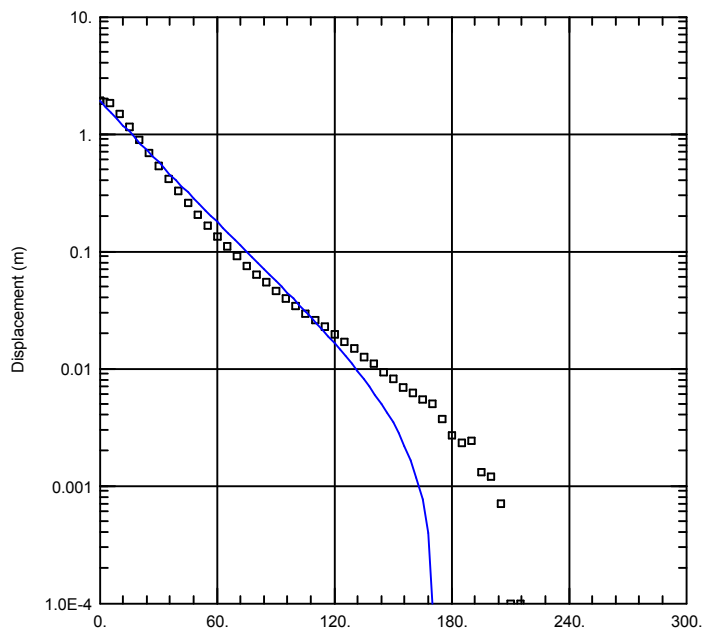
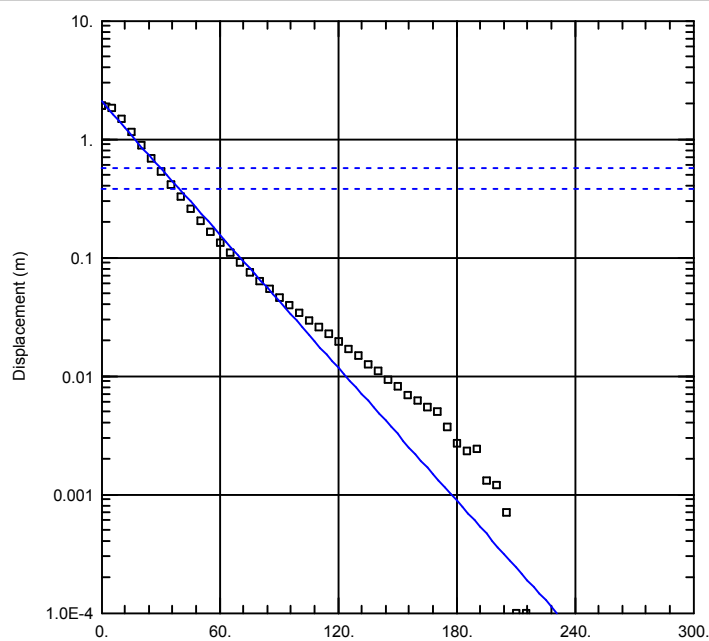
DATE: February 2012

Dwg. No: 368.0.2A/12/V-16

## FALLING-HEAD TEST RESULTS

P-29





I:\368-0-2A\Surfer\12-01\AQT plots\Slug K values\_U-10 .srf

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

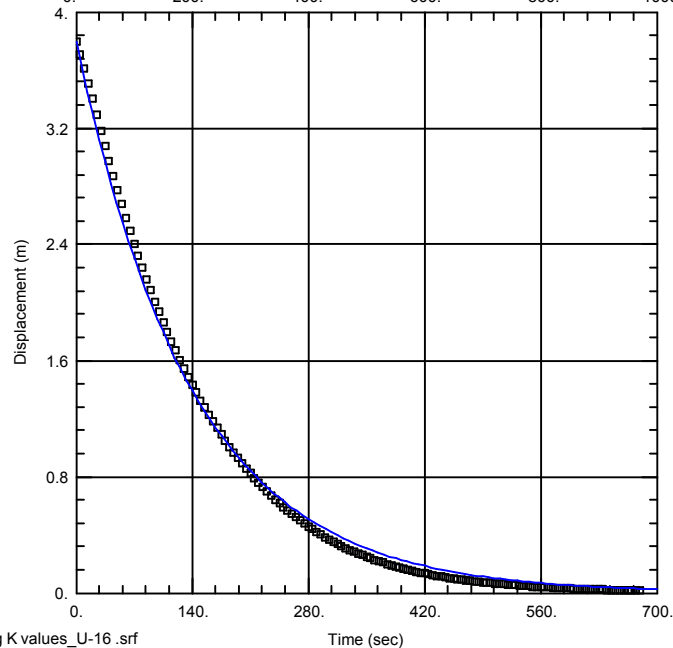
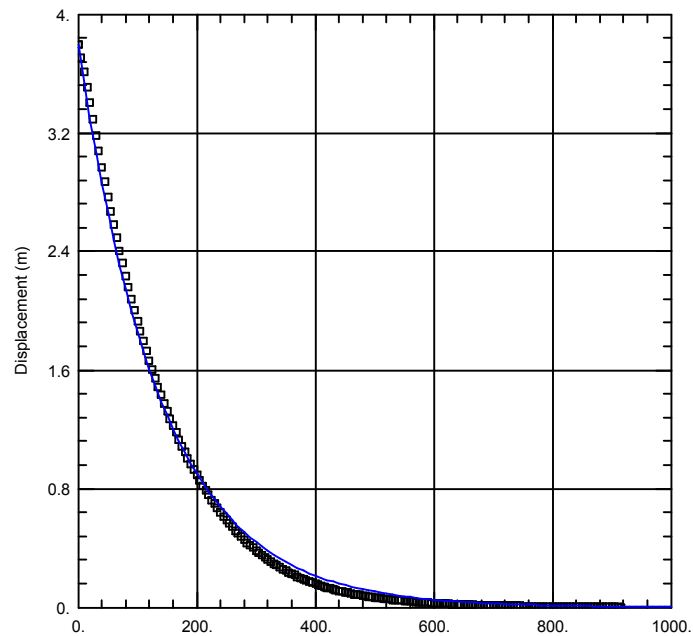
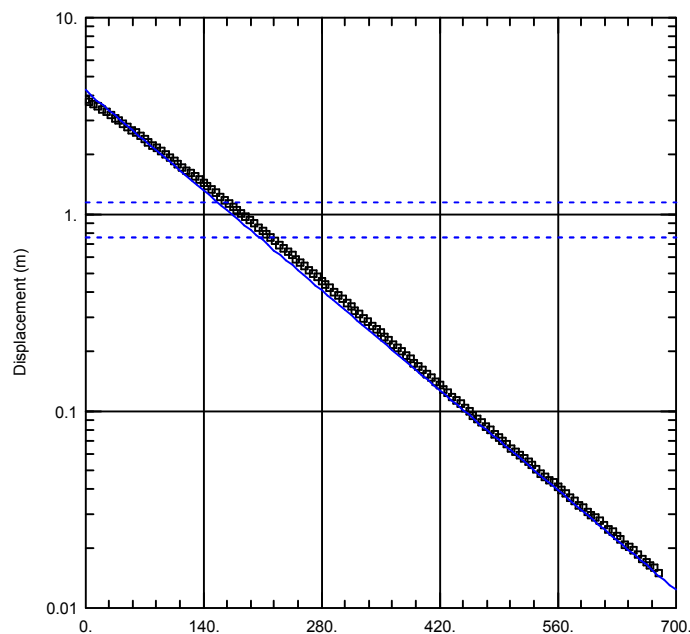
DATE: February 2012

Dwg. No: 368.0.2A/12/V-17

## FALLING-HEAD TEST RESULTS

U-10





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_U-16 .srf

Time (sec)

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

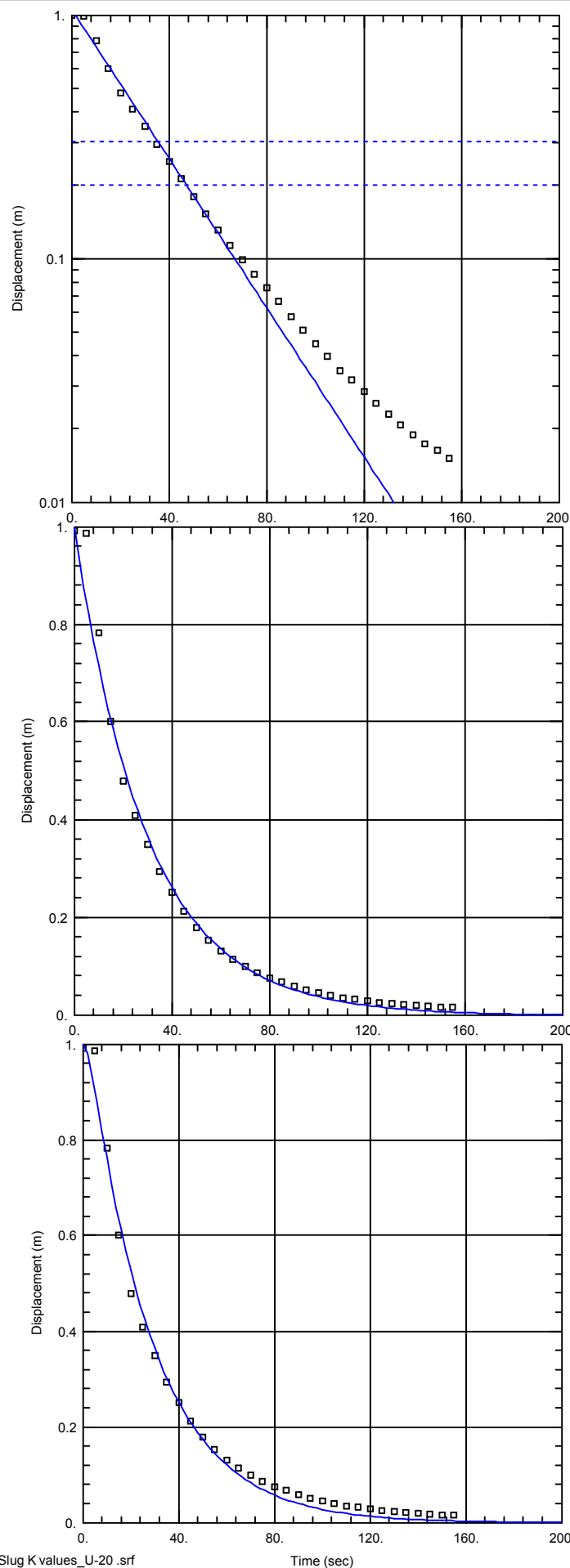
DATE: February 2012

Dwg. No: 368.0.2A/12/V-18

## FALLING-HEAD TEST RESULTS

U-16





Obs. Wells  
 □ U-20

Aquifer Model  
 Unconfined

Solution  
 Bouwer-Rice

Parameters  
 $K = 0.4862 \text{ m/day}$   
 $y_0 = 1.055 \text{ m}$

Obs. Wells  
 □ U-20

Aquifer Model  
 Unconfined

Solution  
 KGS Model

Parameters  
 $K_r = 0.5466 \text{ m/day}$   
 $S_s = 1.0\text{E-}12 \text{ m}^{-1}$   
 $K_z/K_r = 1.$

Obs. Wells  
 □ U-20

Aquifer Model  
 Unconfined

Solution  
 Spring-Gelhar  
 Critically damped when  $C(D)=1$

Parameters  
 $K = 0.4665 \text{ m/day}$   
 $L_e = 654.9 \text{ m}$   
 $C(D) = 1.809$   
 $L = -0.1796 \text{ m}$

I:\368-0-2A\Surfer\12-01\AQT plots\Slug K values\_U-20 .srf

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

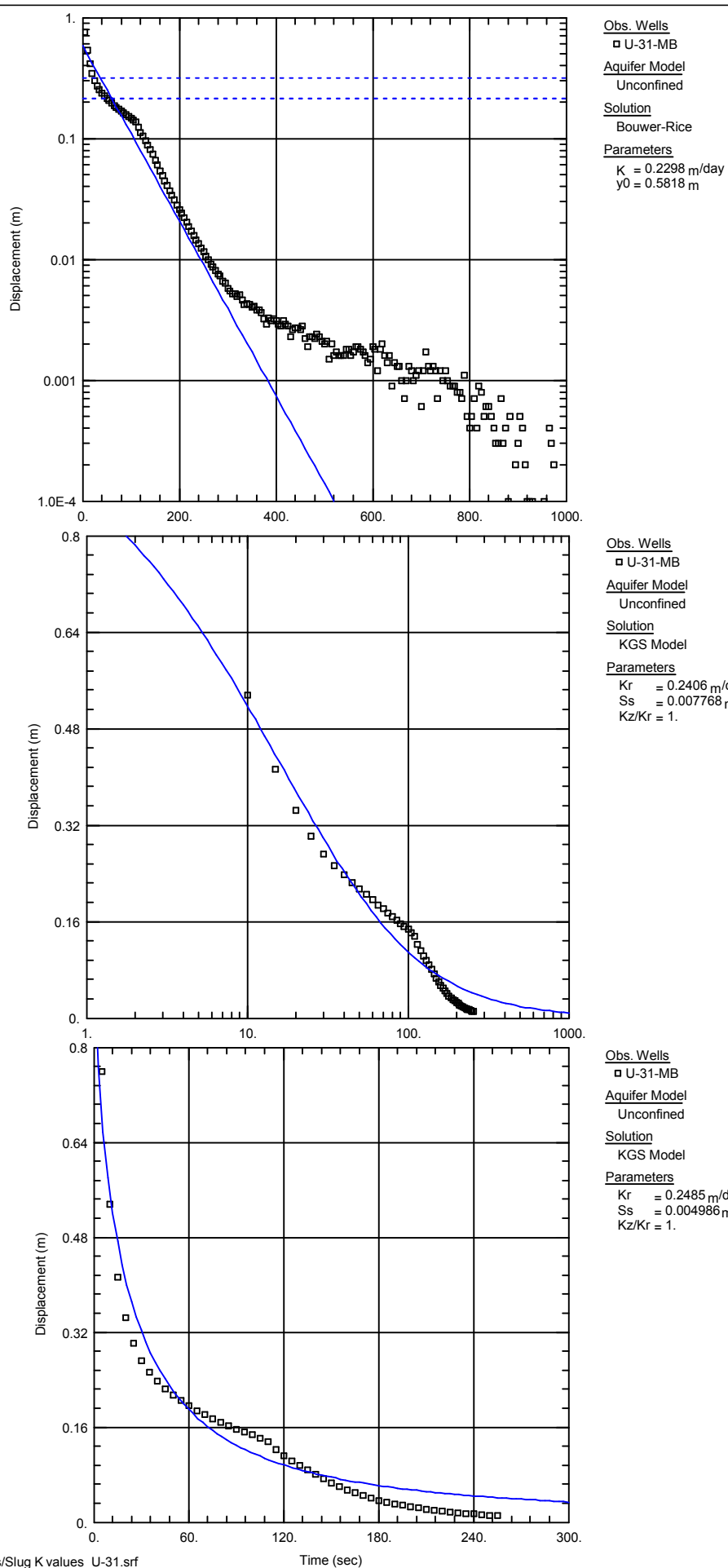
DATE: February 2012

Dwg. No: 368.0.2A/12/V-19

## FALLING-HEAD TEST RESULTS

U-20





I:/368-0-2A/Surfer/12-01/AQT plots/Slug K values\_U-31.srf

Time (sec)

CLIENT: Woodside Energy Ltd

PROJECT: James Price Point  
Monitoring Bore Completion Report

DATE: February 2012

Dwg. No: 368.0.2A/12/V-20

## FALLING-TEST RESULTS

U-31



**APPENDIX VI**

**SUMMARY OF WATER CHEMISTRY RESULTS**





James Price Point - Monitoring Bore Completion Report  
Water Chemistry Laboratory Results

	Analyte grouping/Analyte	pH Value	Electrical Conductivity @ 25°C	Total Dissolved Solids @180°C	Total Hardness as CaCO3	Bromide	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulfate as SO4 - Turbidimetric	Chloride	Calcium	Magnesium	Sodium	Potassium
Units		pH Unit	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Limit of Detection		0.01	1	5	1	0.010	1	1	1	1	1	1	1	1	1	1
	Sample date:															
<b>AD-10 - production bore</b>	03/11/2011	5.57 <sup>1</sup>	275	192	24	0.209	<1	<1	<1	<1	1	70	3	4	42	<1
<b>AD-16</b>	08/12/2011	7.59 <sup>1</sup>	439	420	45	0.251	<1	<1	71	71	4	79	13 <sup>1</sup>	3 <sup>1</sup>	65 <sup>1</sup>	1 <sup>1</sup>
<b>AD-20</b>	11/12/2011	7.49 <sup>1</sup>	464	321	54	0.262	<1	<1	81	81	14	81	15	4	65	2
<b>AD-28</b>	13/12/2011	7.47 <sup>1</sup>	327	197	42	0.190	<1	<1	61	61	4	54	12	3	49	1
<b>AE-10</b>	4/11/2011	9.21 <sup>1</sup>	906	722	5	0.240	<1	85	185	270	51	80	2	<1	209	1
<b>AP-10 - production bore</b>	03/11/2011	6.47 <sup>1</sup>	270	196	27	0.201	<1	<1	24	24	3	55	6	3	42	1
<b>AP-12</b>	04/12/2011	6.68 <sup>1</sup>	278	555	16	0.226	<1	<1	42	42	5	54	3	2	56	1
<b>AP-14</b>	07/12/2011	7.52 <sup>2</sup>	346	364	38	0.164	<1	<1	61	61	10	51	12	2	54	1
<b>Duplicate AP-14</b>	07/12/2011	7.47 <sup>1</sup>	337	351	38	0.165	<1	<1	57	57	11	52	12	2	54	1
<b>AP-20</b>	11/12/2011	7.68 <sup>1</sup>	446	311	71	0.244	<1	<1	85	85	8	69	22	4	58	1
<b>Duplicate AP-20</b>	11/12/2011	7.43 <sup>1</sup>	415	269	69	0.232	<1	<1	70	70	6	66	21	4	54	1
<b>AP-24</b>	12/12/2011	7.22 <sup>1</sup>	393	372	22	0.211	<1	<1	74	74	3	58	4 <sup>1</sup>	3 <sup>1</sup>	76 <sup>1</sup>	<1 <sup>1</sup>
<b>AP-28</b>	12/12/2011	7.21 <sup>1</sup>	596	467	55	0.418	<1	<1	73	73	5	118	12 <sup>1</sup>	6 <sup>1</sup>	94 <sup>1</sup>	2 <sup>1</sup>
<b>AP-32</b>	12/12/2011	6.97 <sup>1</sup>	1080	714	61	0.898	<1	<1	70	70	33	277	8 <sup>1</sup>	10 <sup>1</sup>	208 <sup>1</sup>	2 <sup>1</sup>
<b>AP-36</b>	13/12/2011	7.87 <sup>1</sup>	1020	687	50	0.693	<1	<1	150	150	33	216	12	5	207	2
<b>F-14</b>	04/12/2011	6.81 <sup>1</sup>	784	603	40	0.750	<1	<1	77	77	6	218	8	5	148	<1
<b>I-16</b>	07/12/2011	7.60 <sup>1</sup>	391	352	42	0.211	<1	<1	66	66	2	64	12	3	59	1
<b>N-4</b>	08/12/2011	7.75 <sup>1</sup>	495	513	32	0.270	<1	<1	84	84	12	77	8 <sup>1</sup>	3 <sup>1</sup>	92 <sup>1</sup>	1 <sup>1</sup>
<b>O-10</b>	08/12/2011	7.36 <sup>1</sup>	465	495	34	0.311	<1	<1	45	45	20	82	7 <sup>1</sup>	4 <sup>1</sup>	83 <sup>1</sup>	1 <sup>1</sup>
<b>P-17</b>	4/11/2011	9.76 <sup>1</sup>	915	526	23	0.350	<1	<1	261	261	33	91	6	2	201	3
<b>P-17 (sampled twice)</b>	10/12/2011	7.76 <sup>1</sup>	623	937 <sup>1</sup>	23	0.260	<1	<1	179	179	<1	68	6	2	135	2
<b>Duplicate P-17</b>	10/12/2011	7.79 <sup>1</sup>	636	775 <sup>1</sup>	23	0.261	<1	<1	185	185	<1	67	6	2	137	2
<b>P-21</b>	1/11/2011	7.65 <sup>1</sup>	613	439	16	0.308	<1	<1	121	121	73	101	3	2	140	1
<b>P-25</b>	10/12/2011	7.51 <sup>1</sup>	541	482 <sup>1</sup>	74	0.321	<1	<1	94	94	8	105	23	4	93	2
<b>P-29</b>	1/11/2011	7.24 <sup>1</sup>	912	599	50	0.712	<1	<1	82	82	36	219	7	8	192	2
<b>U-10</b>	4/11/2011	7.57 <sup>1</sup>	630	458	29	0.232	<1	<1	144	144	17	88	5	4	132	1
<b>U-16</b>	1/12/2011	7.14 <sup>1</sup>	317	231	9	0.134	<1	<1	80	80	9	43	2	1	62	<1
<b>U-20</b>	1/11/2011	7.58 <sup>1</sup>	736	552	22	0.435	<1	<1	119	119	32	137	4	3	170	2
<b>U-31</b>	10/12/2011	7.24 <sup>1</sup>	787	719 <sup>1</sup>	36	0.547	<1	<1	129	129	18	164	6	5	153	<1
<b>V-25</b>	09/12/2011	7.54 <sup>1</sup>	491	451 <sup>1</sup>	66	0.286	<1	<1	78	78	7	98	20	4	81	2
<b>BH6X</b>	28/07/2011	5.95 <sup>1</sup>	348	244	33		<1	<1	5	5	1	94	5	5	46	<1
<b>Bore X</b>	9/06/2011	5.92 <sup>1</sup>	361	251	30		<1	<1	6	6	4	86	4	5	41	<1
<b>Bore X1</b>	9/06/2011	6.80 <sup>1</sup>	1,230	991	190		<1	<1	46	46	30	454	20	34	215	2
<b>Field Blank -1</b>	12/12/2011	6.05 <sup>1</sup>	1	<5	<1	<0.010	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
<b>Field Blank -2</b>	13/12/2011	5.95 <sup>1</sup>	<1	<5	<1	0.019	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	NOTE															
	1 =	Sample outside of laboratory holding time														
	lab note:	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.														

James Price Point - Monitoring Bore Completion Report  
Water Chemistry Laboratory Results

	Aluminium	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Manganese	Selenium	Strontium	Zinc	Boron	Iron	Mercury	Ferrous Iron	Silica	Reactive Silica
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Limit of Detection	0.01	0.001	0.001	0.0001	0.001	0.001	0.001	0.001	0.01	0.001	0.005	0.05	0.05	0.0001	0.05	0.1	0.10
AD-10 - production bore	<0.01	<0.001	0.059	<0.0001	<0.001	0.007	<0.001	0.008	<0.01	0.117	0.008	0.09	<0.05	<0.0001	<0.05	46.7	57.4
AD-16	0.11	0.003	0.035	<0.0001	<0.001	0.013	<0.001	0.023	<0.01	0.158	0.052	0.11	<0.05	<0.0001	<0.05 <sup>1</sup>	39.0	50.1
AD-20	0.36	0.006	0.050	<0.0001	<0.001	0.007	<0.001	0.015	<0.01	0.128	0.028	0.16	0.08	<0.0001	<0.05	69.6	89.8
AD-28	0.09	0.004	0.035	<0.0001	<0.001	0.004	<0.001	0.015	<0.01	0.099	0.009	0.08	<0.05	<0.0001	<0.05	43.1	57.2
AE-10	0.13	0.012	0.011	<0.0001	<0.001	0.013	<0.001	0.025	<0.01	0.028	0.005	0.18	0.08	<0.0001	<0.05	56.8	69.2
AP-10 - production bore	0.02	<0.001	0.069	0.0005	<0.001	0.007	<0.001	0.212	<0.01	0.078	0.045	0.09	<0.05	<0.0001	<0.05	64.9	83.1
AP-12	0.52	0.001	0.044	<0.0001	<0.001	0.010	0.001	0.143	<0.01	0.060	0.059	0.10	0.37	<0.0001	0.25	66.0	76.8
AP-14	0.35	0.004	0.038	<0.0001	<0.001	0.033	<0.001	0.020	<0.01	0.094	0.116	0.10	0.12	<0.0001	<0.05	55.1	71.8
Duplicate AP-14	2.11	0.005	0.040	<0.0001	0.001	0.043	<0.001	0.022	<0.01	0.103	0.104	0.10	0.75	<0.0001	<0.05	55.1	72.2
AP-20	0.68	0.005	0.037	<0.0001	<0.001	0.008	<0.001	0.012	<0.01	0.159	0.016	0.11	0.18	<0.0001	<0.05	67.3	87.2
Duplicate AP-20	5.85	0.006	0.046	<0.0001	0.004	0.013	0.003	0.018	<0.01	0.160	0.028	0.10	1.85	<0.0001	<0.05	69.9	86.9
AP-24	0.36	0.007	0.054	<0.0001	<0.001	0.019	<0.001	0.025	<0.01	0.052	0.020	0.13	0.12	<0.0001	0.12	67.9	75.5
AP-28	0.07	0.006	0.046	<0.0001	<0.001	0.010	<0.001	0.024	<0.01	0.141	0.097	0.14	<0.05	<0.0001	<0.05	52.3	59.2
AP-32	0.78	<0.001	0.058	<0.0001	<0.001	0.003	<0.001	0.062	<0.01	0.209	0.042	0.25	0.18	<0.0001	<0.05	76.7	82.9
AP-36	1.35	0.011	0.021	<0.0001	0.001	0.003	<0.001	0.013	<0.01	0.089	0.005	0.42	0.38	<0.0001	0.05	74.8	92.4
F-14	0.62	<0.001	0.037	<0.0001	<0.001	0.002	<0.001	0.016	<0.01	0.139	0.009	0.19	0.18	<0.0001	<0.05	45.0	54.1
I-16	0.46	0.005	0.057	<0.0001	<0.001	0.008	<0.001	0.035	<0.01	0.092	0.024	0.07	0.10	<0.0001	<0.05	47.1	61.9
N-4	0.05	0.011	0.066	<0.0001	<0.001	0.007	<0.001	0.016	<0.01	0.063	0.020	0.18	<0.05	<0.0001	<0.05 <sup>1</sup>	75.4	93.1
O-10	0.68	0.006	0.030	<0.0001	<0.001	0.007	<0.001	0.014	<0.01	0.072	0.009	0.22	0.24	<0.0001	<0.05 <sup>1</sup>	80.1	95.6
P-17	45.8	0.043	0.050	0.0002	0.037	0.057	0.022	0.421	<0.01	0.050	0.066	0.38	15.4	<0.0001	0.28	73.7	74.8
P-17 (sampled twice)	2.92	0.023	0.027	<0.0001	0.003	0.003	0.006	0.104	<0.01	0.046	<0.005	0.46	1.19	<0.0001	<0.05	80.1	87.0
Duplicate P-17	2.44	0.022	0.027	<0.0001	0.002	0.002	0.005	0.104	<0.01	0.046	0.006	0.46	0.91	<0.0001	<0.05	84.9	87.4
P-21	0.16	0.002	0.014	<0.0001	<0.001	0.001	<0.001	0.012	<0.01	0.056	<0.005	0.37	0.06	<0.0001	<0.05	43.5	56
P-25	0.56	0.007	0.046	<0.0001	<0.001	0.009	0.001	0.038	<0.01	0.131	0.038	0.16	0.17	<0.0001	0.12	52.5	63.4
P-29	0.02	<0.001	0.036	<0.0001	<0.001	0.002	<0.001	0.012	<0.01	0.154	0.010	0.14	<0.05	<0.0001	<0.05	36.4	48.4
U-10	0.56	0.003	0.048	<0.0001	<0.001	0.008	0.002	0.106	<0.01	0.104	0.017	0.16	0.34	<0.0001	0.33	59.1	76.7
U-16	1.25	0.003	0.016	<0.0001	<0.001	0.004	0.001	0.018	<0.01	0.042	0.015	0.06	0.47	<0.0001	0.23	38.4	44.4
U-20	1	0.002	0.027	<0.0001	<0.001	0.003	<0.001	0.042	<0.01	0.064	0.008	0.24	0.36	<0.0001	<0.05	62.6	79.2
U-31	0.52	<0.001	0.021	<0.0001	<0.001	0.008	0.002	0.049	<0.01	0.124	0.040	0.64	0.41	<0.0001	0.13	71.8	89.8
V-25	0.85	0.003	0.046	<0.0001	<0.001	0.018	0.001	0.018	<0.01	0.214	0.037	0.11	0.29	<0.0001	0.08	48.9	59.0
BH6X	<0.01	<0.001		<0.0001	<0.001		<0.001	0.011	<0.01				<0.05	<0.0001			36.9
Bore X	<0.01	<0.001		<0.0001	<0.001		<0.001	0.004	<0.01				<0.05	<0.0001			55.5
Bore X1	<0.01	<0.001		<0.0001	<0.001		<0.001	0.004	<0.01				<0.05	<0.0001			23.6
Field Blank -1	<0.01	<0.001	<0.001	<0.0001	<0.001	0.001	<0.001	<0.001	<0.01	<0.001	0.018	0.34	<0.05	<0.0001	<0.05	4.5	5.11
Field Blank -2	<0.01	<0.001	<0.001	<0.0001	0.001	0.003	<0.001	<0.001	<0.01	<0.001	0.011	0.09	<0.05	<0.0001	<0.05	0.6	0.86

James Price Point - Monitoring Bore Completion Report  
Water Chemistry Laboratory Results

	Ferric Iron	Fluoride	Ammonia as N	Nitrite as N	Nitrate as N	Nitrite + Nitrate as N	Total Kjeldahl Nitrogen as N	Total Nitrogen as N	Total Phosphorus as P	Reactive Phosphorus as P	Sulfide as S2-	Total Anions	Total Cations	Ionic Balance	Dissolved Organic Carbon
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	%	mg/L
Limit of Detection	0.05	0.1	0.01	0.01	0.01	0.01	0.1	0.1	0.01	0.01	0.1	0.01	0.01	0.01	1
AD-10 - production bore	<0.05	<0.1	<0.01	<0.01	3.95	3.95	<0.5	4.0	<0.05	0.01	<0.1	2.00	2.31	7.20	<1
AD-16	<0.05	<0.1	0.06	0.15 <sup>1</sup>	2.57	2.72	0.9	3.6	<0.05	0.01 <sup>1</sup>	<0.1	3.73	3.75	0.22	13
AD-20	0.08	0.1	0.09	0.07	3.34	3.41	0.8	4.2	<0.05	0.04	<0.1	4.19	3.96	2.94	7
AD-28	<0.05	<0.1	0.06	0.05	3.39	3.44	0.9	4.3	<0.05	0.02	<0.1	2.83	3.00	3.02	7
AE-10	0.08	0.3	0.19	0.14	3.39	3.53	1.4	4.9	1.39	0.45	<0.1	8.71	9.22	2.75	60
AP-10 - production bore	<0.05	<0.1	0.01	<0.01	3.62	3.62	0.8	4.4	0.28	0.36	<0.1	2.09	2.40		10
AP-12	0.12	<0.1	0.04	<0.01	2.94	2.94	0.9	3.8	0.18	<0.01	<0.1	2.47	2.78		10
AP-14	0.12	<0.1	0.06	0.02	2.02	2.04	0.8	2.8	1.11	0.01	<0.1	2.87	3.14	4.51	16
Duplicate AP-14	0.75	<0.1	0.05	0.02	2.08	2.10	0.7	2.8	0.95	0.01	<0.1	2.83	3.14	5.06	17
AP-20	0.18	0.1	0.07	0.08	2.66	2.74	<0.5	2.7	<0.05	0.03	<0.1	3.81	3.98	2.10	15
Duplicate AP-20	1.85	<0.1	0.05	0.06	2.90	2.96	<0.5	3.0	0.17	0.03	<0.1	3.39	3.75	5.12	13
AP-24	<0.05	0.1	0.06	0.03	2.70	2.73	0.5	3.2	<0.05	0.03	<0.1	3.18	3.75	8.26	13
AP-28	<0.05	<0.1	0.08	0.05	4.47	4.52	1.3	5.8	<0.05	0.02	<0.1	4.89	5.23	3.35	11
AP-32	0.18	0.1	0.03	0.09	11.2	11.3	<0.5	11.3	0.43	<0.01	<0.1	9.90	10.3	2.06	1
AP-36	0.33	0.3	0.15	0.13	3.87	4.00	<0.5	4.0	0.06	0.08	<0.1	9.78	10.1	1.42	11
F-14	0.18	<0.1	0.05	0.01	3.49	3.50	1.4	4.9	0.20	<0.01	<0.1	7.81	7.25	3.77	2
I-16	0.10	0.1	0.03	0.03	2.38	2.41	0.8	3.2	<0.05	0.05	<0.1	3.17	3.44	4.10	6
N-4	<0.05	0.3	0.12	0.03 <sup>1</sup>	5.27	5.30	0.5	5.8	0.12	0.04 <sup>1</sup>	<0.1	4.10	4.67	6.50	5
O-10	0.24	0.2	0.14	0.09 <sup>1</sup>	5.28	5.37	0.8	6.2	<0.05	0.02 <sup>1</sup>	<0.1	3.63	4.31	8.61	7
P-17	15.1	0.9	3.14	0.7	1.43	2.13	9.7	11.8	22.8	20.1	<0.1	8.47	9.28	4.54	124
P-17 (sampled twice)	1.19	0.9	1.53			1.84	3.7	5.5	8.09	8.73 <sup>1</sup>	<0.1	5.49	6.39	7.47	42
Duplicate P-17	0.91	0.9	1.45			1.98	3.3	5.3	8.50	9.29 <sup>1</sup>	<0.1	5.59	6.47	7.32	42
P-21	0.06	0.3	0.04	0.17	4.54	4.71	<0.5	4.7	<0.05	0.02	<0.1	6.79	6.43	2.74	4
P-25	0.05	0.1	0.13			3.93	1.0	4.9	0.06	0.06 <sup>1</sup>	<0.1	5.01	5.57	5.34	9
P-29	<0.05	<0.1	0.08	0.1	2.73	2.83	<0.5	2.8	<0.05	<0.01	<0.1	8.57	9.41	4.67	2
U-10	<0.05	0.1	0.19	0.04	4.16	4.2	3.4	7.6	0.13	0.03	<0.1	5.71	6.35	5.2	55
U-16	0.24	<0.1	0.18	<0.01	1.71	1.71	<0.5	1.7	0.49	0.36	<0.1	3	2.88	2.08	<1
U-20	0.36	0.2	0.05	0.16	6.13	6.29	0.8	7.1	<0.05	0.03	<0.1	6.97	7.89	6.61	3
U-31	0.28	0.8	0.03			5.09	0.8	5.9	<0.05	0.02 <sup>1</sup>	<0.1	7.58	7.37	1.46	<1
V-25	0.21	<0.1	0.05			3.06	0.6	3.7	<0.05	0.01 <sup>1</sup>	<0.1	4.47	4.90	4.61	8
BH6X			<0.01	<0.01	2.99	2.99	1.2	4.2	0.22	<0.01					
Bore X			0.36	0.01 <sup>1</sup>	3.50	3.51	0.6	4.1	0.07	0.07 <sup>1</sup>					
Bore X1			0.09	<0.01 <sup>1</sup>	2.67	2.67	1.0	3.7	0.03	0.04 <sup>1</sup>					
Field Blank -1	<0.05	<0.1	0.02	<0.01	<0.01	<0.01	<0.1	<0.1	0.03	<0.01	<0.1	<0.01	<0.01		<1
Field Blank -2	<0.05	<0.1	<0.01	<0.01	0.02	0.02	<0.1	<0.1	<0.01	<0.01	<0.1	0.08	<0.01		<1

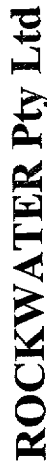
James Price Point - Monitoring Bore Completion Report  
Water Chemistry Laboratory Results

	Total Organic Carbon	Total Inorganic Carbon	Silicon	Silica
Units	mg/L	mg/L	mg/L	mg/L
Limit of Detection	1	1	0.05	0.1
AD-10 - production bore	<1	13		
AD-16	11	23	18.2	
AD-20	7	21	32.5	
AD-28	7	18		
AE-10	21	51	26.5	
AP-10 - production bore	1	14		
AP-12	1	9		
AP-14	16	22		
Duplicate AP-14	18	22		
AP-20	13	26	31.4	
Duplicate AP-20	14	23	32.6	
AP-24	14	27		
AP-28	9	25		
AP-32	1	31		
AP-36	9	46		
F-14	1	12		
I-16	6	21		
N-4	3	28	35.2	
O-10	7	18	37.4	
P-17	77	54	34.4	
P-17 (sampled twice)	44			
Duplicate P-17	43			
P-21	4	35		
P-25	7	28		
P-29	2	29		
U-10	8	42	27.6	
U-16	2	19		38.4
U-20	3	33		
U-31	<1	44		
V-25	6	25		
BH6X				
Bore X				
Bore X1				
Field Blank -1	<1	<1		
Field Blank -2	<1	<1		

**APPENDIX VII**

**WATER CHEMISTRY**  
**CERTIFICATES OF ANALYSIS**





## HYDROGEOLOGISTS

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## CHAIN OF CUSTODY AND ANALYSIS REQUEST



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# CHAIN OF CUSTODY AND ANALYSIS REQUEST

Environmental Division  
Perth  
Work Order

**EP1108733**



Telephone : +61-8-9209 7655

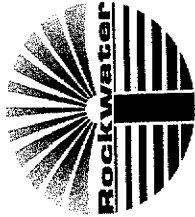




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# CHAIN OF CUSTODY AND ANALYSIS REQUEST



**ROCKWATER Pty Ltd**

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## CHAIN OF CUSTODY AND ANALYSIS REQUEST

<b>CLIENT:</b> WELL		<b>CLIENT No.:</b> 368-0-2A		<b>ALS (Australian Lab. Services)</b>									
<b>PROJECT NAME:</b> JPP/78		<b>COLLECTOR'S NAME:</b> CA-35		<b>10 Hod Way, Malaga WA 6090</b>									
<b>LABORATORY JOB No.:</b>		<b>ORDER/QUOTE No. (circle):</b> EP-585-11		<b>Ph: 9209 7655</b>									
		<small>(use EP-513-10 if 1 of 2 normal suites* is analysed)</small>		<b>Fax: 9209 7600</b>									
General Sample Information						Preservation Method			Analyses Required			Additional Notes/Comments	
Sample I.D.	Lab. No.	Sample Date	Sample Time	Field EC (µS/cm)	Field pH	No. of Containers	Ice	Acidified	Other (name)	Major Components Analysis*	Comprehensive Analysis*		
AP-20		11/12/11	10:30	451	7.21	10	2					EP-585-11	Environmental Division Perth Work Order <b>EP1108733</b>
DAP-20		11/12/11	10:30	451	7.21	10	2						
AN-20		11/12/11	8:00	467	6.94	10	2						
Relinquished by: JULIE FERREY						Received by: M. WATSON						Comments:	
Date/Time: 11/12/11 16:00						Date/Time: 12/12/11 14:30							
Relinquished by:						Received by:						Comments:	
Date/Time:						Date/Time:							



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# CHAIN OF CUSTODY AND ANALYSIS REQUEST

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Environmental Division  
Perth

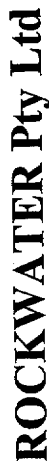
## Work Order

**EP1108795**



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Page: 1 of



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## CHAIN OF CUSTODY AND ANALYSIS REQUEST

General Sample Information							Preservation Method			Analyses Required		
Sample I.D.	Lab. No.	Sample Date	Sample Time	Field EC (µS/cm)	Field pH	No. of Containers	Ice	Acidified	Other (name)	Major Components Analysis*	Comprehensive Analysis*	Additional Notes/Comments
P-25	1	10-12-11	12WS	570	7.25	10	✓					Please note that for some samples 10/11/12 = 10/12/11
P-17	2	10-12-11	10W15	657	7.44	9	✓					Please DO NOT analyse for nitrites if sent out of their holding time
DP-17	3	10-12-11	10W15	657	7.44	9	✓					
V-31	4	9-12-11	8:30	852	6.88	10	✓					
V-25	5	9-12-11	12:30	326	7.14	10	✓					
Environmental Division Perth												
Work Order EP1108768												
Telephone : + 61-8-9209 7655												
Page: 1 of 1												

CLIENT: WEL		CLIENT No.: 368-0-2A		ALS (Australian Lab. Services) 10 Hod Way, Malaga WA 6090 Ph: 9209 7655 Fax: 9209 7600	
PROJECT NAME: JPP #68		COLLECTOR'S NAME: CKSF			
LABORATORY JOB No.:		ORDER/QUOTE No. (circle): EP-S&S-11		(use EP-513-10 if 1 of 2 normal suites* is analysed)	
Relinquished by: J. FERET	Date/Time: 11/12/11	Received by: M Darnach	Date/Time: 13/12/11		
Relinquished by:	Date/Time:	Received by:	Date/Time:		

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Page: 1 of 1

**ROCKWATER Pty Ltd**

**CONSULTANT**

# HYDROGEOLOGISTS

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## CHAIN OF CUSTODY AND ANALYSIS REQUEST

[illegible]Environmental Division  
Perth

## Work Order

**EP1108806**



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Page:



# CONSULTANT

[consult@rockwater.com.au](mailto:consult@rockwater.com.au)

# CHAIN OF CUSTODY AND ANALYSIS REQUEST

CLIENT: Woodside		CLIENT No.: 368-0-1		ALS (Australian Lab. Services) 10 Hod Way, Malaga WA 6090 Ph: 9209 7655 Fax: 9209 7600								
PROJECT NAME: JPP Water Sampling		COLLECTOR'S NAME: DS										
LABORATORY JOB No.:		ORDER/QUOTE No. (circle): EP/513/10 <small>(use EP-001-09 if 1 of 2 normal suites* is analysed)</small>										
General Sample Information				Preservation Method		Analyses Required		Additional Notes/Comments				
Sample I.D.	Lab. No.	Sample Date	Sample Time	Field EC (µS/cm)	Field pH	No. of Containers	Ice		Acidified	Other (name)	Major Components Analysis*	Comprehensive Analysis*
BH6x	1	28/7/11	13:01	469	5.81	3	Y				Y	
Relinquished by: Daisy				Received by:				Comments:				
Date/Time: 29/07/2011 14:30				Date/Time:								
Relinquished by:				Received by:				Comments:				
Date/Time:				Date/Time:								



## CONSULTANT

[consult@rockwater.com.au](mailto:consult@rockwater.com.au)

# CHAIN OF CUSTODY AND ANALYSIS REQUEST

<b>CLIENT:</b>	Woodside						<b>CLIENT No.:</b>	368-0-1					<b>ALS (Australian Lab. Services)</b>													
<b>PROJECT NAME:</b>	JPP Water Sampling						<b>COLLECTOR'S NAME:</b>					DS					<b>10 Hod Way, Malaga WA 6090</b>									
<b>LABORATORY JOB No.:</b>							<b>ORDER/QUOTE No. (circle):</b>					EP/513/10 <small>(use EP-001-09 if 1 of 2 normal suites* is analysed)</small>					<b>Ph: 9209 7655</b>									
												<b>Fax: 9209 7600</b>														
General Sample Information												Preservation Method			Analyses Required					Additional Notes/Comments						
Sample I.D.	Lab. No.	Sample Date	Sample Time	Field EC ( $\mu\text{S}/\text{cm}$ )	Field pH	No. of Containers	Ice	Acidified	Other (name)	Major Components*	Comprehensive Analysis*															
BOREX1	1	9/6/11	9:50	3,281	5.81	3	Y				Y															
BOREX	2	9/6/11	14:30	7,185	4.97	3	Y				Y															
Relinquished by: Daisy							Received by:							Comments:												
Date/Time: 13/06/2011 8:30							Date/Time:																			
Relinquished by:							Received by:							Comments:												
Date/Time:							Date/Time:																			



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108705</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: 368-0-2A</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 12-DEC-2011</b>
<b>Sampler</b>	<b>: C.K &amp; J.F</b>	<b>Issue Date</b>	<b>: 20-DEC-2011</b>
<b>Site</b>	<b>: JPP #68</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 3</b>
		<b>No. of samples analysed</b>	<b>: 3</b>

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

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Scott James	Laboratory Manager	Perth Inorganics

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## General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK061/EK067: LOR for samples raised due to the high amount of NOx present.**
- **EP002: It has been noted that DOC is greater than TOC for sample ID's 'AD-16' and 'N-4', however, these differences are 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.**



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AD-16	O-10	N-4	----	----
				08-DEC-2011 09:00	08-DEC-2011 11:15	08-DEC-2011 12:45	----	----
Compound	CAS Number	LOR	Unit	EP1108705-001	EP1108705-002	EP1108705-003	----	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	7.59	7.36	7.75	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	439	465	495	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	420	495	513	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	45	34	32	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.251	0.311	0.270	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	71	45	84	----	----
Total Alkalinity as CaCO3	----	1	mg/L	71	45	84	----	----
<b>ED040F: Dissolved Major Anions</b>								
Silicon	7440-21-3	0.05	mg/L	18.2	37.4	35.2	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4	20	12	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	79	82	77	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	13	7	8	----	----
Magnesium	7439-95-4	1	mg/L	3	4	3	----	----
Sodium	7440-23-5	1	mg/L	65	83	92	----	----
Potassium	7440-09-7	1	mg/L	1	1	1	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.11	0.68	0.05	----	----
Arsenic	7440-38-2	0.001	mg/L	0.003	0.006	0.011	----	----
Barium	7440-39-3	0.001	mg/L	0.035	0.030	0.066	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L	0.013	0.007	0.007	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	0.023	0.014	0.016	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Strontium	7440-24-6	0.001	mg/L	0.158	0.072	0.063	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AD-16	O-10	N-4	----	----
				08-DEC-2011 09:00	08-DEC-2011 11:15	08-DEC-2011 12:45	----	----
Compound	CAS Number	LOR	Unit	EP1108705-001	EP1108705-002	EP1108705-003	----	----
<b>EG020F: Dissolved Metals by ICP-MS - Continued</b>								
Zinc	7440-66-6	0.005	mg/L	0.052	0.009	0.020	----	----
Boron	7440-42-8	0.05	mg/L	0.11	0.22	0.18	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	0.24	<0.05	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	<0.05	<0.05	<0.05	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	39.0	80.1	75.4	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	50.1	95.6	93.1	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	<0.05	0.24	<0.05	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	<0.1	0.2	0.3	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.14	0.12	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	0.15	0.09	0.03	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	2.57	5.28	5.27	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	2.72	5.37	5.30	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.9	0.8	0.5	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
Total Nitrogen as N	----	0.1	mg/L	3.6	6.2	5.8	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.05	0.12	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	0.01	0.02	0.04	----	----
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	----	----
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	3.73	3.63	4.10	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AD-16	O-10	N-4	----	----
				08-DEC-2011 09:00	08-DEC-2011 11:15	08-DEC-2011 12:45	----	----
Compound	CAS Number	LOR	Unit	EP1108705-001	EP1108705-002	EP1108705-003	----	----
<b>EN055: Ionic Balance - Continued</b>								
Total Cations	----	0.01	meq/L	3.75	4.31	4.67	----	----
Ionic Balance	----	0.01	%	0.22	8.61	6.50	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	13	7	5	----	----
<b>EP005: Total Organic Carbon (TOC)</b>								
Total Organic Carbon	----	1	mg/L	11	7	3	----	----
<b>EP006 Total Inorganic Carbon</b>								
Total Inorganic Carbon	----	1	mg/L	23	18	28	----	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108806</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
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<b>Project</b>	<b>: JJP #68</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 14-DEC-2011</b>
<b>Sampler</b>	<b>: CK/JF</b>	<b>Issue Date</b>	<b>: 22-DEC-2011</b>
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 3</b>
		<b>No. of samples analysed</b>	<b>: 3</b>

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



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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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Scott James	Laboratory Manager	Perth Inorganics

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## General Comments

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK061G/EK067G: LOR for various samples raised due to the high amount of NOx present.**
- **EP002: It has been noted that DOC is greater than TOC for sample ID 'AP-36', however, this difference is within the limits of experimental variation.**
- **It is recognised that total phosphorus is less than reactive phosphorus for sample AP-36. However, the difference is within experimental variation of the methods.**



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AD-28	FB-2	AP-36		
				13-DEC-2011 08:30	13-DEC-2011 10:00	13-DEC-2011 10:30	----	----
Compound	CAS Number	LOR	Unit	EP1108806-001	EP1108806-002	EP1108806-003	----	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	7.47	5.95	7.87	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	327	<1	1020	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	197	<5	687	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	42	<1	50	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.190	0.019	0.693	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	61	<1	150	----	----
Total Alkalinity as CaCO3	----	1	mg/L	61	<1	150	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4	<1	33	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	54	<1	216	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	12	<1	12	----	----
Magnesium	7439-95-4	1	mg/L	3	<1	5	----	----
Sodium	7440-23-5	1	mg/L	49	<1	207	----	----
Potassium	7440-09-7	1	mg/L	1	<1	2	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.09	<0.01	1.35	----	----
Arsenic	7440-38-2	0.001	mg/L	0.004	<0.001	0.011	----	----
Barium	7440-39-3	0.001	mg/L	0.035	<0.001	0.021	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	0.001	0.001	----	----
Copper	7440-50-8	0.001	mg/L	0.004	0.003	0.003	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	0.015	<0.001	0.013	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Strontium	7440-24-6	0.001	mg/L	0.099	<0.001	0.089	----	----
Zinc	7440-66-6	0.005	mg/L	0.009	0.011	0.005	----	----
Boron	7440-42-8	0.05	mg/L	0.08	0.09	0.42	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.38	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AD-28	FB-2	AP-36		
				13-DEC-2011 08:30	13-DEC-2011 10:00	13-DEC-2011 10:30	----	----
Compound	CAS Number	LOR	Unit	EP1108806-001	EP1108806-002	EP1108806-003	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	<0.05	<0.05	<b>0.05</b>	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	<b>43.1</b>	<b>0.6</b>	<b>74.8</b>	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	<b>57.2</b>	<b>0.86</b>	<b>92.4</b>	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	<0.05	<0.05	<b>0.33</b>	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	<b>0.3</b>	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	<b>0.06</b>	<0.01	<b>0.15</b>	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	<b>0.05</b>	<0.01	<b>0.13</b>	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	<b>3.39</b>	<b>0.02</b>	<b>3.87</b>	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	<b>3.44</b>	<b>0.02</b>	<b>4.00</b>	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<b>0.9</b>	<0.1	<0.5	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	<b>4.3</b>	<0.1	<b>4.0</b>	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.01	<b>0.06</b>	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	<b>0.02</b>	<0.01	<b>0.08</b>	----	----
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	----	----
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	<b>2.83</b>	<b>0.08</b>	<b>9.78</b>	----	----
Total Cations	----	0.01	meq/L	<b>3.00</b>	<0.01	<b>10.1</b>	----	----
Ionic Balance	----	0.01	%	<b>3.02</b>	----	<b>1.42</b>	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	<b>7</b>	<1	<b>11</b>	----	----





Analytical Results

Sub-Matrix: WATER

				Client sample ID	AD-28	FB-2	AP-36		
				Client sampling date / time	13-DEC-2011 08:30	13-DEC-2011 10:00	13-DEC-2011 10:30	----	----
Compound	CAS Number	LOR	Unit		EP1108806-001	EP1108806-002	EP1108806-003	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		7	<1	9	----	----
EP006 Total Inorganic Carbon									
Total Inorganic Carbon	----	1	mg/L		18	<1	46	----	----

## CERTIFICATE OF ANALYSIS

Work Order	: EP1107653	Page	: 1 of 5
Amendment	: 1		
Client	: ROCKWATER PTY LTD	Laboratory	: Environmental Division Perth
Contact	: CONSULT	Contact	: Scott James
Address	: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014	Address	: 10 Hod Way Malaga WA Australia 6090
E-mail	: consult@rockwater.com.au	E-mail	: perth.enviro.services@alsglobal.com
Telephone	: +61 08 9284 0222	Telephone	: +61-8-9209 7655
Facsimile	: +61 9284 1785	Facsimile	: +61-8-9209 7600
Project	: JPP 68	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 04-NOV-2011
Sampler	: AM & DS	Issue Date	: 23-NOV-2011
Site	: ----		
Quote number	: EP/580/11	No. of samples received	: 3
		No. of samples analysed	: 3

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

This document is issued in accordance with NATA accreditation requirements.

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
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Nikki Stepniewski	Senior Inorganic Instrument Chemist	Melbourne Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Stephen Hislop	Senior Inorganic Chemist	WB Water Lab Brisbane



## General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EP005 : Total organic carbon results for EP1107653 have been confirmed by re-preparation and re-analysis.**
- **TOC conducted by ALS Melbourne, NATA accreditation no. 825, site no 13778**



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AE-10	P-17	U-10		
				04-NOV-2011 14:30	04-NOV-2011 10:25	04-NOV-2011 13:00	----	----
Compound	CAS Number	LOR	Unit	EP1107653-001	EP1107653-002	EP1107653-003	----	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	9.21	7.76	7.57	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	906	915	630	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	722	526	458	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	5	23	29	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.240	0.350	0.232	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	85	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	185	261	144	----	----
Total Alkalinity as CaCO3	----	1	mg/L	270	261	144	----	----
<b>ED040F: Dissolved Major Anions</b>								
Silicon	7440-21-3	0.05	mg/L	26.5	34.4	27.6	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	51	33	17	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	80	91	88	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	2	6	5	----	----
Magnesium	7439-95-4	1	mg/L	<1	2	4	----	----
Sodium	7440-23-5	1	mg/L	209	201	132	----	----
Potassium	7440-09-7	1	mg/L	1	3	1	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.13	45.8	0.56	----	----
Arsenic	7440-38-2	0.001	mg/L	0.012	0.043	0.003	----	----
Barium	7440-39-3	0.001	mg/L	0.011	0.050	0.048	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.0002	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	0.037	<0.001	----	----
Copper	7440-50-8	0.001	mg/L	0.013	0.057	0.008	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	0.022	0.002	----	----
Manganese	7439-96-5	0.001	mg/L	0.025	0.421	0.106	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----

Sub-Matrix: **WATER**

*Client sample ID*

Client sampling date / time

Sub-Matrix: WATER	Client sample ID			AE-10	P-17	U-10	----	----
	Client sampling date / time			04-NOV-2011 14:30	04-NOV-2011 10:25	04-NOV-2011 13:00	----	----
Compound	CAS Number	LOR	Unit	EP1107653-001	EP1107653-002	EP1107653-003	----	----
EG020F: Dissolved Metals by ICP-MS - Continued								
Strontium	7440-24-6	0.001	mg/L	0.028	0.050	0.104	----	----
Zinc	7440-66-6	0.005	mg/L	0.005	0.066	0.017	----	----
Boron	7440-42-8	0.05	mg/L	0.18	0.38	0.16	----	----
Iron	7439-89-6	0.05	mg/L	0.08	15.4	0.34	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
EG051G: Ferrous Iron by Discrete Analyser								
Ferrous Iron	----	0.05	mg/L	<0.05	0.28	0.33	----	----
EG052F: Dissolved Silica by ICPAES								
Silica	7631-86-9	0.1	mg/L	56.8	73.7	59.1	----	----
EG052G: Silica by Discrete Analyser								
Reactive Silica	----	0.10	mg/L	69.2	74.8	76.7	----	----
EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA								
Ferric Iron	----	0.05	mg/L	0.08	15.1	<0.05	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.3	0.9	0.1	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.19	3.14	0.19	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	0.14	0.70	0.04	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	3.39	1.43	4.16	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	3.53	2.13	4.20	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.4	9.7	3.4	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
Total Nitrogen as N	----	0.1	mg/L	4.9	11.8	7.6	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	1.39	22.8	0.13	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	0.45	20.1	0.03	----	----
EK085M: Sulfide as S2-								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	----	----
EN055: Ionic Balance								



Analytical Results

Sub-Matrix: WATER

				Client sample ID				
				Client sampling date / time	AE-10	P-17	U-10	
					04-NOV-2011 14:30	04-NOV-2011 10:25	04-NOV-2011 13:00	
Compound	CAS Number	LOR	Unit		EP1107653-001	EP1107653-002	EP1107653-003	
EN055: Ionic Balance - Continued								
Total Anions	----	0.01	meq/L		8.71	8.47	5.71	----
Total Cations	----	0.01	meq/L		9.22	9.28	6.35	----
Ionic Balance	----	0.01	%		2.75	4.54	5.20	----
EP002: Dissolved Organic Carbon (DOC)								
Dissolved Organic Carbon	----	1	mg/L		60	124	55	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L		21	77	8	----
EP006 Total Inorganic Carbon								
Total Inorganic Carbon	----	1	mg/L		51	54	42	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1107664</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: JPP # 68</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 04-NOV-2011</b>
<b>Sampler</b>	<b>: AM/DS</b>	<b>Issue Date</b>	<b>: 14-NOV-2011</b>
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 2</b>
		<b>No. of samples analysed</b>	<b>: 2</b>

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

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Scott James	Laboratory Manager	Perth Inorganics

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## General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK061/67G: LOR for samples raised due to the high amount of NOx present.**
- **It has been noted that Reactive Phosphorus is greater than Total Phosphorus for sample AP-10, however this difference is within the limits of experimental variation.**





## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AP-10	AD-10			
				03-NOV-2011 10:00	03-NOV-2011 15:00			
Compound	CAS Number	LOR	Unit	EP1107664-001	EP1107664-002			
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	6.47	5.57	----	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	270	275	----	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	196	192	----	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	27	24	----	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.201	0.209	----	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	24	<1	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	24	<1	----	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	3	1	----	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	55	70	----	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	6	3	----	----	----
Magnesium	7439-95-4	1	mg/L	3	4	----	----	----
Sodium	7440-23-5	1	mg/L	42	42	----	----	----
Potassium	7440-09-7	1	mg/L	1	<1	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.02	<0.01	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	----	----	----
Barium	7440-39-3	0.001	mg/L	0.069	0.059	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	0.0005	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	0.007	0.007	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.212	0.008	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	----	----
Strontium	7440-24-6	0.001	mg/L	0.078	0.117	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.045	0.008	----	----	----
Boron	7440-42-8	0.05	mg/L	0.09	0.09	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	----	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	AP-10	AD-10			
				03-NOV-2011 10:00	03-NOV-2011 15:00			
				EP1107664-001	EP1107664-002			
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	<0.05	<0.05	----	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	<b>64.9</b>	<b>46.7</b>	----	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	<b>83.1</b>	<b>57.4</b>	----	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	<0.05	<0.05	----	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	----	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	<b>0.01</b>	<0.01	----	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	<0.01	<0.01	----	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	<b>3.62</b>	<b>3.95</b>	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	<b>3.62</b>	<b>3.95</b>	----	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<b>0.8</b>	<0.5	----	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	<b>4.4</b>	<b>4.0</b>	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<b>0.28</b>	<0.05	----	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	<b>0.36</b>	<b>0.01</b>	----	----	----
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	----	----	----
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	<b>2.09</b>	<b>2.00</b>	----	----	----
Total Cations	----	0.01	meq/L	<b>2.40</b>	<b>2.31</b>	----	----	----
Ionic Balance	----	0.01	%	----	<b>7.20</b>	----	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	<b>10</b>	<1	----	----	----



Analytical Results

Sub-Matrix: WATER

				Client sample ID				
				Client sampling date / time				
Compound	CAS Number	LOR	Unit		AP-10	AD-10		
					03-NOV-2011 10:00	03-NOV-2011 15:00	----	----
					EP1107664-001	EP1107664-002	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L		1	<1	----	----
EP006 Total Inorganic Carbon								
Total Inorganic Carbon	----	1	mg/L		14	13	----	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108633</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: JPP #68</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 08-DEC-2011</b>
<b>Sampler</b>	<b>: CKJF</b>	<b>Issue Date</b>	<b>: 20-DEC-2011</b>
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 3</b>
		<b>No. of samples analysed</b>	<b>: 3</b>

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

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Scott James	Laboratory Manager	Perth Inorganics

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Part of the **ALS Laboratory Group**

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## General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **ED041G: Poor matrix spike recovery due to matrix affects. Spike has been confirmed by re-analysis**
- **EK067G: LOR for sample I-16 raised due to the high amount of NOx present.**
- **It is recognised that total phosphorus is less than reactive phosphorus for sample I-16. However, the difference is within experimental variation of the methods.**
- **TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AP-14	DP-14	I-16		
				07-DEC-2011 09:00	07-DEC-2011 10:30	07-DEC-2011 12:30	----	----
Compound	CAS Number	LOR	Unit	EP1108633-001	EP1108633-002	EP1108633-003	----	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	7.52	7.47	7.60	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	346	337	391	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	364	351	352	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	38	38	42	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.164	0.165	0.211	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	61	57	66	----	----
Total Alkalinity as CaCO3	----	1	mg/L	61	57	66	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	10	11	2	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	51	52	64	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	12	12	12	----	----
Magnesium	7439-95-4	1	mg/L	2	2	3	----	----
Sodium	7440-23-5	1	mg/L	54	54	59	----	----
Potassium	7440-09-7	1	mg/L	1	1	1	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.35	2.11	0.46	----	----
Arsenic	7440-38-2	0.001	mg/L	0.004	0.005	0.005	----	----
Barium	7440-39-3	0.001	mg/L	0.038	0.040	0.057	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L	0.033	0.043	0.008	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	0.020	0.022	0.035	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Strontium	7440-24-6	0.001	mg/L	0.094	0.103	0.092	----	----
Zinc	7440-66-6	0.005	mg/L	0.116	0.104	0.024	----	----
Boron	7440-42-8	0.05	mg/L	0.10	0.10	0.07	----	----
Iron	7439-89-6	0.05	mg/L	0.12	0.75	0.10	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AP-14	DP-14	I-16		
				07-DEC-2011 09:00	07-DEC-2011 10:30	07-DEC-2011 12:30	----	----
Compound	CAS Number	LOR	Unit	EP1108633-001	EP1108633-002	EP1108633-003	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	<0.05	<0.05	<0.05	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	55.1	55.1	47.1	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	71.8	72.2	61.9	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	0.12	0.75	0.10	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.1	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.05	0.03	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	0.02	0.02	0.03	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	2.02	2.08	2.38	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	2.04	2.10	2.41	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.8	0.7	0.8	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	2.8	2.8	3.2	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	1.11	0.95	<0.05	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	0.01	0.01	0.05	----	----
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	----	----
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	2.87	2.83	3.17	----	----
Total Cations	----	0.01	meq/L	3.14	3.14	3.44	----	----
Ionic Balance	----	0.01	%	4.51	5.06	4.10	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	16	17	6	----	----



Analytical Results

Sub-Matrix: WATER

				Client sample ID				
				Client sampling date / time	AP-14	DP-14	I-16	
					07-DEC-2011 09:00	07-DEC-2011 10:30	07-DEC-2011 12:30	
Compound	CAS Number	LOR	Unit		EP1108633-001	EP1108633-002	EP1108633-003	
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L		16	18	6	----
EP006 Total Inorganic Carbon								
Total Inorganic Carbon	----	1	mg/L		22	22	21	----





## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108733</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: JPP 78</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 12-DEC-2011</b>
<b>Sampler</b>	<b>: CK/JF</b>	<b>Issue Date</b>	<b>: 20-DEC-2011</b>
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 3</b>
		<b>No. of samples analysed</b>	<b>: 3</b>

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- General Comments
- Analytical Results



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Scott James	Laboratory Manager	Perth Inorganics

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK061G/EK067G: LOR for samples raised due to the high amount of NOx present.**
- **EP002: It has been noted that DOC is greater than TOC for sample ID 'AP-20', however, this difference is within the limits of experimental variation.**



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AP-20	DAP-20	AD-20		
				11-DEC-2011 10:30	11-DEC-2011 10:30	11-DEC-2011 08:00	----	----
Compound	CAS Number	LOR	Unit	EP1108733-001	EP1108733-002	EP1108733-003	----	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	7.68	7.43	7.49	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	446	415	464	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	311	269	321	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	71	69	54	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.244	0.232	0.262	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	85	70	81	----	----
Total Alkalinity as CaCO3	----	1	mg/L	85	70	81	----	----
<b>ED040F: Dissolved Major Anions</b>								
Silicon	7440-21-3	0.05	mg/L	31.4	32.6	32.5	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	8	6	14	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	69	66	81	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	22	21	15	----	----
Magnesium	7439-95-4	1	mg/L	4	4	4	----	----
Sodium	7440-23-5	1	mg/L	58	54	65	----	----
Potassium	7440-09-7	1	mg/L	1	1	2	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.68	5.85	0.36	----	----
Arsenic	7440-38-2	0.001	mg/L	0.005	0.006	0.006	----	----
Barium	7440-39-3	0.001	mg/L	0.037	0.046	0.050	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	0.004	<0.001	----	----
Copper	7440-50-8	0.001	mg/L	0.008	0.013	0.007	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	0.003	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	0.012	0.018	0.015	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Strontium	7440-24-6	0.001	mg/L	0.159	0.160	0.128	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AP-20	DAP-20	AD-20		
				11-DEC-2011 10:30	11-DEC-2011 10:30	11-DEC-2011 08:00	----	----
Compound	CAS Number	LOR	Unit	EP1108733-001	EP1108733-002	EP1108733-003	----	----
<b>EG020F: Dissolved Metals by ICP-MS - Continued</b>								
Zinc	7440-66-6	0.005	mg/L	0.016	0.028	0.028	----	----
Boron	7440-42-8	0.05	mg/L	0.11	0.10	0.16	----	----
Iron	7439-89-6	0.05	mg/L	0.18	1.85	0.08	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	<0.05	<0.05	<0.05	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	67.3	69.9	69.6	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	87.2	86.9	89.8	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	0.18	1.85	0.08	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	0.1	<0.1	0.1	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	0.07	0.05	0.09	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	0.08	0.06	0.07	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	2.66	2.90	3.34	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	2.74	2.96	3.41	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	0.8	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
Total Nitrogen as N	----	0.1	mg/L	2.7	3.0	4.2	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<0.05	0.17	<0.05	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	0.03	0.03	0.04	----	----
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	----	----
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	3.81	3.39	4.19	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AP-20	DAP-20	AD-20		
				11-DEC-2011 10:30	11-DEC-2011 10:30	11-DEC-2011 08:00	----	----
Compound	CAS Number	LOR	Unit	EP1108733-001	EP1108733-002	EP1108733-003	----	----
<b>EN055: Ionic Balance - Continued</b>								
Total Cations	----	0.01	meq/L	3.98	3.75	3.96	----	----
Ionic Balance	----	0.01	%	2.10	5.12	2.94	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	15	13	7	----	----
<b>EP005: Total Organic Carbon (TOC)</b>								
Total Organic Carbon	----	1	mg/L	13	14	7	----	----
<b>EP006 Total Inorganic Carbon</b>								
Total Inorganic Carbon	----	1	mg/L	26	23	21	----	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108795</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: 368-0-2A</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 13-DEC-2011</b>
<b>Sampler</b>	<b>: CKJM</b>	<b>Issue Date</b>	<b>: 22-DEC-2011</b>
<b>Site</b>	<b>: JPP #68</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 4</b>
		<b>No. of samples analysed</b>	<b>: 4</b>

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

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics

**Environmental Division Perth**  
Part of the **ALS Laboratory Group**

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## General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK061G/EK067G: LOR for various samples raised due to the high amount of NOx present.**
- **EP002: It has been noted that DOC is greater than TOC for sample ID 'AP-28', however, this difference is within the limits of experimental variation.**
- **It is recognised that total Phosphorus (EK067G) is less than Reactive Phosphorus (EK071G) for samples 'AP-36'. However, the difference is within experimental variation of the methods.**



## Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				AP-28	AP-24	AP-32	FB-1	----
				12-DEC-2011 09:00	12-DEC-2011 10:30	12-DEC-2011 12:00	12-DEC-2011 13:00	----
Compound	CAS Number	LOR	Unit	EP1108795-001	EP1108795-002	EP1108795-003	EP1108795-004	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	7.21	7.22	6.97	6.05	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	596	393	1080	1	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	467	372	714	<5	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	55	22	61	<1	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.418	0.211	0.898	<0.010	----
<b>ED037P: Alkalinity by PC Titrator</b>								
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	73	74	70	<1	----
Total Alkalinity as CaCO3	----	1	mg/L	73	74	70	<1	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	5	3	33	<1	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	118	58	277	<1	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	12	4	8	<1	----
Magnesium	7439-95-4	1	mg/L	6	3	10	<1	----
Sodium	7440-23-5	1	mg/L	94	76	208	<1	----
Potassium	7440-09-7	1	mg/L	2	<1	2	<1	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.07	0.36	0.78	<0.01	----
Arsenic	7440-38-2	0.001	mg/L	0.006	0.007	<0.001	<0.001	----
Barium	7440-39-3	0.001	mg/L	0.046	0.054	0.058	<0.001	----
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	----
Copper	7440-50-8	0.001	mg/L	0.010	0.019	0.003	0.001	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Manganese	7439-96-5	0.001	mg/L	0.024	0.025	0.062	<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	0.141	0.052	0.209	<0.001	----
Zinc	7440-66-6	0.005	mg/L	0.097	0.020	0.042	0.018	----
Boron	7440-42-8	0.05	mg/L	0.14	0.13	0.25	0.34	----
Iron	7439-89-6	0.05	mg/L	<0.05	0.12	0.18	<0.05	----





## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				AP-28	AP-24	AP-32	FB-1	----
				12-DEC-2011 09:00	12-DEC-2011 10:30	12-DEC-2011 12:00	12-DEC-2011 13:00	----
Compound	CAS Number	LOR	Unit	EP1108795-001	EP1108795-002	EP1108795-003	EP1108795-004	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	<0.05	0.12	<0.05	<0.05	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	52.3	67.9	76.7	4.5	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	59.2	75.5	82.9	5.11	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	<0.05	<0.05	0.18	<0.05	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	<0.1	0.1	0.1	<0.1	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	0.08	0.06	0.03	0.02	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	0.05	0.03	0.09	<0.01	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	4.47	2.70	11.2	<0.01	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	4.52	2.73	11.3	<0.01	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.3	0.5	<0.5	<0.1	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	5.8	3.2	11.3	<0.1	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.05	0.43	0.03	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	0.02	0.03	<0.01	<0.01	----
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	4.89	3.18	9.90	<0.01	----
Total Cations	----	0.01	meq/L	5.23	3.75	10.3	<0.01	----
Ionic Balance	----	0.01	%	3.35	8.26	2.06	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	11	13	1	<1	----



Analytical Results

Sub-Matrix: WATER

				Client sample ID	AP-28	AP-24	AP-32	FB-1	
				Client sampling date / time	12-DEC-2011 09:00	12-DEC-2011 10:30	12-DEC-2011 12:00	12-DEC-2011 13:00	----
Compound	CAS Number	LOR	Unit		EP1108795-001	EP1108795-002	EP1108795-003	EP1108795-004	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		9	14	1	<1	----
EP006 Total Inorganic Carbon									
Total Inorganic Carbon	----	1	mg/L		25	27	31	<1	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108513</b>	<b>Page</b>	: 1 of 5
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	: Environmental Division Perth
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	: Scott James
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	: 10 Hod Way Malaga WA Australia 6090
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	: perth.enviro.services@alsglobal.com
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	: +61-8-9209 7655
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	: +61-8-9209 7600
<b>Project</b>	<b>: JPP</b>	<b>QC Level</b>	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	: 06-DEC-2011
<b>Sampler</b>	<b>: CK</b>	<b>Issue Date</b>	: 14-DEC-2011
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	: 2
		<b>No. of samples analysed</b>	: 2

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



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<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics
Nikki Stepniewski	Senior Inorganic Instrument Chemist	Melbourne Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics

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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.

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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.

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- 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.



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				F-14	AP-12			
				04-DEC-2011 09:00	04-DEC-2011 12:30			
Compound	CAS Number	LOR	Unit	EP1108513-001	EP1108513-002			
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	6.81	6.68	----	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	784	278	----	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	603	555	----	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	40	16	----	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.750	0.226	----	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	77	42	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	77	42	----	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	6	5	----	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	218	54	----	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	8	3	----	----	----
Magnesium	7439-95-4	1	mg/L	5	2	----	----	----
Sodium	7440-23-5	1	mg/L	148	56	----	----	----
Potassium	7440-09-7	1	mg/L	<1	1	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.62	0.52	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.001	----	----	----
Barium	7440-39-3	0.001	mg/L	0.037	0.044	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	0.002	0.010	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.016	0.143	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	----	----
Strontium	7440-24-6	0.001	mg/L	0.139	0.060	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.009	0.059	----	----	----
Boron	7440-42-8	0.05	mg/L	0.19	0.10	----	----	----
Iron	7439-89-6	0.05	mg/L	0.18	0.37	----	----	----



## Analytical Results

Sub-Matrix: **WATER**

				Client sample ID	F-14	AP-12			
				Client sampling date / time	04-DEC-2011 09:00	04-DEC-2011 12:30			
Compound	CAS Number	LOR	Unit		EP1108513-001	EP1108513-002			
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	----	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>									
Ferrous Iron	----	0.05	mg/L		<0.05	0.25	----	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>									
Silica	7631-86-9	0.1	mg/L		45.0	66.0	----	----	----
<b>EG052G: Silica by Discrete Analyser</b>									
Reactive Silica	----	0.10	mg/L		54.1	76.8	----	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>									
Ferric Iron	----	0.05	mg/L		0.18	0.12	----	----	----
<b>EK040P: Fluoride by PC Titrator</b>									
Fluoride	16984-48-8	0.1	mg/L		<0.1	<0.1	----	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>									
Ammonia as N	7664-41-7	0.01	mg/L		0.05	0.04	----	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>									
Nitrite as N	----	0.01	mg/L		0.01	<0.01	----	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>									
Nitrate as N	14797-55-8	0.01	mg/L		3.49	2.94	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L		3.50	2.94	----	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		1.4	0.9	----	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L		4.9	3.8	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L		0.20	0.18	----	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>									
Reactive Phosphorus as P	----	0.01	mg/L		<0.01	<0.01	----	----	----
<b>EK085M: Sulfide as S2-</b>									
Sulfide as S2-	18496-25-8	0.1	mg/L		<0.1	<0.1	----	----	----
<b>EN055: Ionic Balance</b>									
Total Anions	----	0.01	meq/L		7.81	2.47	----	----	----
Total Cations	----	0.01	meq/L		7.25	2.78	----	----	----
Ionic Balance	----	0.01	%		3.77	----	----	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>									
Dissolved Organic Carbon	----	1	mg/L		2	10	----	----	----



Analytical Results

Sub-Matrix: WATER

				Client sample ID	F-14	AP-12			
				Client sampling date / time	04-DEC-2011 09:00	04-DEC-2011 12:30			
Compound	CAS Number	LOR	Unit		EP1108513-001	EP1108513-002			
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		1	1	----	----	----
EP006 Total Inorganic Carbon									
Total Inorganic Carbon	----	1	mg/L		12	9	----	----	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1107604</b>	<b>Page</b>	<b>: 1 of 5</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: JPP # 68</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 03-NOV-2011</b>
<b>Sampler</b>	<b>: AM/DS</b>	<b>Issue Date</b>	<b>: 10-NOV-2011</b>
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 3</b>
		<b>No. of samples analysed</b>	<b>: 3</b>

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.

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- General Comments
- Analytical Results



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Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics

**Environmental Division Perth**  
Part of the **ALS Laboratory Group**

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## General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK061/67G: LOR for samples raised due to the high amount of NOx present.**



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				P-21	P-29	U-20		
				01-NOV-2011 13:25	01-NOV-2011 11:35	01-NOV-2011 09:25	----	----
Compound	CAS Number	LOR	Unit	EP1107604-001	EP1107604-002	EP1107604-003	----	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	7.65	7.24	7.58	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	613	912	736	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	439	599	552	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	16	50	22	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.308	0.712	0.435	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	121	82	119	----	----
Total Alkalinity as CaCO3	----	1	mg/L	121	82	119	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	73	36	32	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	101	219	137	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	3	7	4	----	----
Magnesium	7439-95-4	1	mg/L	2	8	3	----	----
Sodium	7440-23-5	1	mg/L	140	192	170	----	----
Potassium	7440-09-7	1	mg/L	1	2	2	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.16	0.02	1.00	----	----
Arsenic	7440-38-2	0.001	mg/L	0.002	<0.001	0.002	----	----
Barium	7440-39-3	0.001	mg/L	0.014	0.036	0.027	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L	0.001	0.002	0.003	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	0.012	0.012	0.042	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Strontium	7440-24-6	0.001	mg/L	0.056	0.154	0.064	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	0.010	0.008	----	----
Boron	7440-42-8	0.05	mg/L	0.37	0.14	0.24	----	----
Iron	7439-89-6	0.05	mg/L	0.06	<0.05	0.36	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				P-21	P-29	U-20		
				01-NOV-2011 13:25	01-NOV-2011 11:35	01-NOV-2011 09:25	----	----
Compound	CAS Number	LOR	Unit	EP1107604-001	EP1107604-002	EP1107604-003	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	<0.05	<0.05	<0.05	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	<b>43.5</b>	<b>36.4</b>	<b>62.6</b>	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	<b>56.0</b>	<b>48.4</b>	<b>79.2</b>	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	<b>0.06</b>	<0.05	<b>0.36</b>	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	<b>0.3</b>	<0.1	<b>0.2</b>	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	<b>0.04</b>	<b>0.08</b>	<b>0.05</b>	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	<b>0.17</b>	<b>0.10</b>	<b>0.16</b>	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
Nitrate as N	14797-55-8	0.01	mg/L	<b>4.54</b>	<b>2.73</b>	<b>6.13</b>	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	<b>4.71</b>	<b>2.83</b>	<b>6.29</b>	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	<b>0.8</b>	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	<b>4.7</b>	<b>2.8</b>	<b>7.1</b>	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.05	<0.05	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	<b>0.02</b>	<0.01	<b>0.03</b>	----	----
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	----	----
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	<b>6.79</b>	<b>8.57</b>	<b>6.91</b>	----	----
Total Cations	----	0.01	meq/L	<b>6.43</b>	<b>9.41</b>	<b>7.89</b>	----	----
Ionic Balance	----	0.01	%	<b>2.74</b>	<b>4.67</b>	<b>6.61</b>	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	<b>4</b>	<b>2</b>	<b>3</b>	----	----



Analytical Results

Sub-Matrix: WATER

				Client sample ID	P-21	P-29	U-20		
				Client sampling date / time	01-NOV-2011 13:25	01-NOV-2011 11:35	01-NOV-2011 09:25	----	----
Compound	CAS Number	LOR	Unit		EP1107604-001	EP1107604-002	EP1107604-003	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		4	2	3	----	----
EP006 Total Inorganic Carbon									
Total Inorganic Carbon	----	1	mg/L		35	29	33	----	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108768</b>	<b>Page</b>	<b>: 1 of 4</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: 368-0-2A</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 13-DEC-2011</b>
<b>Sampler</b>	<b>: CKJF</b>	<b>Issue Date</b>	<b>: 22-DEC-2011</b>
<b>Site</b>	<b>: JPP #68</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	<b>: 5</b>
		<b>No. of samples analysed</b>	<b>: 5</b>

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

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics

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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.

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LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EK067G: LOR for various samples raised due to the high amount of NOx present.**
- **EP002: It has been noted that DOC is greater than TOC for sample ID's 'P-25' and 'V-25', however, these differences are within the limits of experimental variation.**
- **It is recognised that Total Phosphorus (EK067G) is less than Reactive Phosphorus for samples 'P-17' and 'DP-17'. However, the difference is within experimental variation of the methods.**
- **TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**



## Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				P-25	P-17	DP-17	U-31	V-25
				10-DEC-2011 12:15	10-DEC-2011 10:15	10-DEC-2011 10:15	10-DEC-2011 08:30	09-DEC-2011 12:30
Compound	CAS Number	LOR	Unit	EP1108768-001	EP1108768-002	EP1108768-003	EP1108768-004	EP1108768-005
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	7.51	7.76	7.79	7.24	7.54
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	541	623	636	787	491
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	482	937	775	719	451
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	74	23	23	36	66
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	0.321	0.260	0.261	0.547	0.286
<b>ED037P: Alkalinity by PC Titrator</b>								
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	94	179	185	129	78
Total Alkalinity as CaCO3	----	1	mg/L	94	179	185	129	78
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	8	<1	<1	18	7
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	105	68	67	164	98
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	23	6	6	6	20
Magnesium	7439-95-4	1	mg/L	4	2	2	5	4
Sodium	7440-23-5	1	mg/L	93	135	137	153	81
Potassium	7440-09-7	1	mg/L	2	2	2	<1	2
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	0.56	2.92	2.44	0.52	0.85
Arsenic	7440-38-2	0.001	mg/L	0.007	0.023	0.022	<0.001	0.003
Barium	7440-39-3	0.001	mg/L	0.046	0.027	0.027	0.021	0.046
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	0.003	0.002	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	0.009	0.003	0.002	0.008	0.018
Lead	7439-92-1	0.001	mg/L	0.001	0.006	0.005	0.002	0.001
Manganese	7439-96-5	0.001	mg/L	0.038	0.104	0.104	0.049	0.018
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	0.131	0.046	0.046	0.124	0.214
Zinc	7440-66-6	0.005	mg/L	0.038	<0.005	0.006	0.040	0.037
Boron	7440-42-8	0.05	mg/L	0.16	0.46	0.46	0.64	0.11
Iron	7439-89-6	0.05	mg/L	0.17	1.19	0.91	0.41	0.29



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				P-25	P-17	DP-17	U-31	V-25
				10-DEC-2011 12:15	10-DEC-2011 10:15	10-DEC-2011 10:15	10-DEC-2011 08:30	09-DEC-2011 12:30
Compound	CAS Number	LOR	Unit	EP1108768-001	EP1108768-002	EP1108768-003	EP1108768-004	EP1108768-005
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
Ferrous Iron	----	0.05	mg/L	0.12	<0.05	<0.05	0.13	0.08
<b>EG052F: Dissolved Silica by ICPAES</b>								
Silica	7631-86-9	0.1	mg/L	52.5	80.1	84.9	71.8	48.9
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	63.4	87.0	87.4	89.8	59.0
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
Ferric Iron	----	0.05	mg/L	0.05	1.19	0.91	0.28	0.21
<b>EK040P: Fluoride by PC Titrator</b>								
Fluoride	16984-48-8	0.1	mg/L	0.1	0.9	0.9	0.8	<0.1
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
Ammonia as N	7664-41-7	0.01	mg/L	0.13	1.53	1.45	0.03	0.05
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	3.93	1.84	1.98	5.09	3.06
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.0	3.7	3.3	0.8	0.6
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	4.9	5.5	5.3	5.9	3.7
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	0.06	8.09	8.50	<0.05	<0.05
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	0.06	8.73	9.29	0.02	0.01
<b>EK085M: Sulfide as S2-</b>								
Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
<b>EN055: Ionic Balance</b>								
Total Anions	----	0.01	meq/L	5.01	5.49	5.59	7.58	4.47
Total Cations	----	0.01	meq/L	5.57	6.39	6.47	7.37	4.90
Ionic Balance	----	0.01	%	5.34	7.47	7.32	1.46	4.61
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	9	42	42	<1	8
<b>EP005: Total Organic Carbon (TOC)</b>								
Total Organic Carbon	----	1	mg/L	7	44	43	<1	6
<b>EP006 Total Inorganic Carbon</b>								
Total Inorganic Carbon	----	1	mg/L	28	52	52	44	25





## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108475</b>	<b>Page</b>	: 1 of 5
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	: Environmental Division Perth
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	: Scott James
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	: 10 Hod Way Malaga WA Australia 6090
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	: perth.enviro.services@alsglobal.com
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	: +61-8-9209 7655
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	: +61-8-9209 7600
<b>Project</b>	<b>: JPP #68</b>	<b>QC Level</b>	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	: 05-DEC-2011
<b>Sampler</b>	<b>: AM/CK</b>	<b>Issue Date</b>	: 14-DEC-2011
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: EP/580/11</b>	<b>No. of samples received</b>	: 1
		<b>No. of samples analysed</b>	: 1

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics

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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

- **EK061G/EK067G: LOR for samples raised due to possible matrix interference**



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				<b>U-16</b>	----	----	----	----
				01-DEC-2011 10:20	----	----	----	----
<i>Compound</i>	<i>CAS Number</i>	<i>LOR</i>	<i>Unit</i>	<b>EP1108475-001</b>	----	----	----	----
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	<b>7.14</b>	----	----	----	----
<b>EA010P: Conductivity by PC Titrator</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	<b>317</b>	----	----	----	----
<b>EA015: Total Dissolved Solids</b>								
Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	<b>231</b>	----	----	----	----
<b>EA065: Total Hardness as CaCO3</b>								
Total Hardness as CaCO3	----	1	mg/L	<b>9</b>	----	----	----	----
<b>ED009: Anions</b>								
Bromide	24959-67-9	0.010	mg/L	<b>0.134</b>	----	----	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<b>&lt;1</b>	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<b>&lt;1</b>	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<b>80</b>	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<b>80</b>	----	----	----	----
<b>ED040F: Dissolved Major Anions</b>								
Silica	7631-86-9	0.1	mg/L	<b>38.4</b>	----	----	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<b>9</b>	----	----	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	<b>43</b>	----	----	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	<b>2</b>	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<b>1</b>	----	----	----	----
Sodium	7440-23-5	1	mg/L	<b>62</b>	----	----	----	----
Potassium	7440-09-7	1	mg/L	<b>&lt;1</b>	----	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	<b>1.25</b>	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<b>0.003</b>	----	----	----	----
Barium	7440-39-3	0.001	mg/L	<b>0.016</b>	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<b>&lt;0.0001</b>	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<b>&lt;0.001</b>	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<b>0.004</b>	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<b>0.001</b>	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	<b>0.018</b>	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<b>&lt;0.01</b>	----	----	----	----
Strontium	7440-24-6	0.001	mg/L	<b>0.042</b>	----	----	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				<b>U-16</b>	----	----	----	----
				01-DEC-2011 10:20	----	----	----	----
<i>Compound</i>	<i>CAS Number</i>	<i>LOR</i>	<i>Unit</i>	<b>EP1108475-001</b>	----	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS - Continued</b>								
<b>Zinc</b>	7440-66-6	0.005	mg/L	<b>0.015</b>	----	----	----	----
<b>Boron</b>	7440-42-8	0.05	mg/L	<b>0.06</b>	----	----	----	----
<b>Iron</b>	7439-89-6	0.05	mg/L	<b>0.47</b>	----	----	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
<b>Mercury</b>	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
<b>EG051G: Ferrous Iron by Discrete Analyser</b>								
<b>Ferrous Iron</b>	----	0.05	mg/L	<b>0.23</b>	----	----	----	----
<b>EG052F: Dissolved Silica by ICPAES</b>								
<b>Silica</b>	7631-86-9	0.1	mg/L	<b>38.4</b>	----	----	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
<b>Reactive Silica</b>	----	0.10	mg/L	<b>44.4</b>	----	----	----	----
<b>EG053FG-MS: Dissolved Ferric Iron by ICPMS and DA</b>								
<b>Ferric Iron</b>	----	0.05	mg/L	<b>0.24</b>	----	----	----	----
<b>EK040P: Fluoride by PC Titrator</b>								
<b>Fluoride</b>	16984-48-8	0.1	mg/L	<0.1	----	----	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								
<b>Ammonia as N</b>	7664-41-7	0.01	mg/L	<b>0.18</b>	----	----	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
<b>Nitrite as N</b>	----	0.01	mg/L	<0.01	----	----	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
<b>Nitrate as N</b>	14797-55-8	0.01	mg/L	<b>1.71</b>	----	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
<b>Nitrite + Nitrate as N</b>	----	0.01	mg/L	<b>1.71</b>	----	----	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
<b>Total Kjeldahl Nitrogen as N</b>	----	0.1	mg/L	<0.5	----	----	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
<b>Total Nitrogen as N</b>	----	0.1	mg/L	<b>1.7</b>	----	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
<b>Total Phosphorus as P</b>	----	0.01	mg/L	<b>0.49</b>	----	----	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
<b>Reactive Phosphorus as P</b>	----	0.01	mg/L	<b>0.36</b>	----	----	----	----
<b>EK085M: Sulfide as S2-</b>								
<b>Sulfide as S2-</b>	18496-25-8	0.1	mg/L	<0.1	----	----	----	----
<b>EN055: Ionic Balance</b>								
<b>Total Anions</b>	----	0.01	meq/L	<b>3.00</b>	----	----	----	----



## Analytical Results

Sub-Matrix: **WATER**

Client sample ID

**U-16**

Client sampling date / time

01-DEC-2011 10:20

Compound	CAS Number	LOR	Unit	EP1108475-001	----	----	----	----
<b>EN055: Ionic Balance - Continued</b>								
Total Cations	----	0.01	meq/L	<b>2.88</b>	----	----	----	----
Ionic Balance	----	0.01	%	<b>2.08</b>	----	----	----	----
<b>EP002: Dissolved Organic Carbon (DOC)</b>								
Dissolved Organic Carbon	----	1	mg/L	<1	----	----	----	----
<b>EP005: Total Organic Carbon (TOC)</b>								
Total Organic Carbon	----	1	mg/L	<b>2</b>	----	----	----	----
<b>EP006 Total Inorganic Carbon</b>								
Total Inorganic Carbon	----	1	mg/L	<b>19</b>	----	----	----	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1103652</b>	<b>Page</b>	<b>: 1 of 4</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: 368-0-1 JPP Water Sampling</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 13-JUN-2011</b>
<b>C-O-C number</b>	<b>: ----</b>	<b>Issue Date</b>	<b>: 20-JUN-2011</b>
<b>Sampler</b>	<b>: DS</b>	<b>No. of samples received</b>	<b>: 2</b>
<b>Site</b>	<b>: ----</b>	<b>No. of samples analysed</b>	<b>: 2</b>
<b>Quote number</b>	<b>: EP/513/10</b>		

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

This document is issued in accordance with NATA accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics

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- It is recognised that TP is less than RP for sample 'BOREX1'. However, the difference is within experimental variation of the methods.



## Analytical Results

Sub-Matrix: GROUNDWATER

Client sample ID

Client sampling date / time

				BOREX1	BOREX			
				09-JUN-2011 09:50	09-JUN-2011 14:30			
Compound	CAS Number	LOR	Unit	EP1103652-001	EP1103652-002			
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	6.80	5.92	----	----	----
<b>EA010: Conductivity</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	1230	361	----	----	----
<b>EA015: Total Dissolved Solids</b>								
^ Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	991	259	----	----	----
<b>EA065: Total Hardness as CaCO3</b>								
^ Total Hardness as CaCO3	----	1	mg/L	190	30	----	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	46	6	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	46	6	----	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	30	4	----	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	454	86	----	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	20	4	----	----	----
Magnesium	7439-95-4	1	mg/L	34	5	----	----	----
Sodium	7440-23-5	1	mg/L	215	41	----	----	----
Potassium	7440-09-7	1	mg/L	2	<1	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.004	0.004	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	0.011	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	----	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	23.6	55.5	----	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								





## Analytical Results

Sub-Matrix: **GROUNDWATER**

Client sample ID

Client sampling date / time

				<b>BOREX1</b>	<b>BOREX</b>			
				09-JUN-2011 09:50	09-JUN-2011 14:30			
<i>Compound</i>	<i>CAS Number</i>	<i>LOR</i>	<i>Unit</i>	<b>EP1103652-001</b>	<b>EP1103652-002</b>			
<b>EK055G: Ammonia as N by Discrete Analyser - Continued</b>								
Ammonia as N	7664-41-7	0.01	mg/L	<b>0.09</b>	<b>0.36</b>	----	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	<0.01	<b>0.01</b>	----	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
^ Nitrate as N	14797-55-8	0.01	mg/L	<b>2.67</b>	<b>3.50</b>	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	<b>2.67</b>	<b>3.51</b>	----	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<b>1.0</b>	<b>0.6</b>	----	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	<b>3.7</b>	<b>4.1</b>	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	<b>0.03</b>	<b>0.07</b>	----	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	<b>0.04</b>	<b>0.07</b>	----	----	----



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1104886</b>	<b>Page</b>	<b>: 1 of 4</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: DANA E RONEY</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: droney@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: ----</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: 368-0-1</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 29-JUL-2011</b>
<b>Sampler</b>	<b>: D.S</b>	<b>Issue Date</b>	<b>: 05-AUG-2011</b>
<b>Site</b>	<b>: JPP Water Sampling</b>		
<b>Quote number</b>	<b>: EP/513/10</b>	<b>No. of samples received</b>	<b>: 1</b>
		<b>No. of samples analysed</b>	<b>: 1</b>

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.

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<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Canhuang Ke	Metals Instrument Chemist	Perth Inorganics
Chas Tucker	Inorganic Chemist	Perth Inorganics
Cicelia Bartels	Metals Instrument Chemist	Perth Inorganics

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LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting



## Analytical Results

Sub-Matrix: GROUNDWATER

Client sample ID

Client sampling date / time

				BH6x				
				28-JUL-2011 13:01				
				EP1104886-001				
Compound	CAS Number	LOR	Unit					
<b>EA005P: pH by PC Titrator</b>								
pH Value	----	0.01	pH Unit	5.96	----	----	----	----
<b>EA010: Conductivity</b>								
Electrical Conductivity @ 25°C	----	1	µS/cm	348	----	----	----	----
<b>EA015: Total Dissolved Solids</b>								
^ Total Dissolved Solids @180°C	GIS-210-010	5	mg/L	244	----	----	----	----
<b>EA065: Total Hardness as CaCO3</b>								
^ Total Hardness as CaCO3	----	1	mg/L	33	----	----	----	----
<b>ED037P: Alkalinity by PC Titrator</b>								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	5	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	5	----	----	----	----
<b>ED041G: Sulfate (Turbidimetric) as SO4 2- by DA</b>								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	1	----	----	----	----
<b>ED045G: Chloride Discrete analyser</b>								
Chloride	16887-00-6	1	mg/L	94	----	----	----	----
<b>ED093F: Dissolved Major Cations</b>								
Calcium	7440-70-2	1	mg/L	5	----	----	----	----
Magnesium	7439-95-4	1	mg/L	5	----	----	----	----
Sodium	7440-23-5	1	mg/L	46	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Aluminium	7429-90-5	0.01	mg/L	<0.01	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.011	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	----	----	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
<b>EG052G: Silica by Discrete Analyser</b>								
Reactive Silica	----	0.10	mg/L	36.9	----	----	----	----
<b>EK055G: Ammonia as N by Discrete Analyser</b>								



## Analytical Results

Sub-Matrix: GROUNDWATER

Client sample ID

Client sampling date / time

				BH6x				
				28-JUL-2011 13:01				
Compound	CAS Number	LOR	Unit	EP1104886-001				
<b>EK055G: Ammonia as N by Discrete Analyser - Continued</b>								
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	----	----	----	----
<b>EK057G: Nitrite as N by Discrete Analyser</b>								
Nitrite as N	----	0.01	mg/L	<0.01	----	----	----	----
<b>EK058G: Nitrate as N by Discrete Analyser</b>								
^ Nitrate as N	14797-55-8	0.01	mg/L	2.99	----	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	2.99	----	----	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.2	----	----	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	4.2	----	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	0.22	----	----	----	----
<b>EK071G: Reactive Phosphorus as P by discrete analyser</b>								
Reactive Phosphorus as P	----	0.01	mg/L	<0.01	----	----	----	----
<b>EN055: Ionic Balance</b>								
^ Total Anions	----	0.01	meq/L	2.77	----	----	----	----
^ Total Cations	----	0.01	meq/L	2.66	----	----	----	----



**ROCKWATER Pty Ltd**  
**HYDROGEOLOGICAL & ENVIRONMENTAL**  
**CONSULTANTS**

**CHAIN OF CUSTODY AND ANALYSIS REQUEST**

1st Floor, 76 Jersey Street, Jolimont, WA 6014  
Tel (08) 9284 0222 Fax (08) 9284 1785  
PO Box 201, Jolimont  
WESTERN AUSTRALIA 6913  
A.C.N. 008 804 653

Client: Woodside Energy Ltd

Client Number: 368-0-2

Project Name: JPP Isotope Sampling (SKM)

Collector's Name: NE & DS

Laboratory Job No.:

Jason Tranter  
B19 Room 242  
**Edith Cowan University**  
270 Joondalup Drive  
Joondalup Drive WA 6027  
Perth, Western Australia

270 Joondalup Drive Joondalup Drive WA 6027 Perth, Western Australia		ANALYSES REQUIRED	SAMPLE DETAILS							REMARKS			
			Laboratory number	Ice	Acidified	100% Ethanol	None	Sampling Date	Sample Time		Field EC (µS/cm)	Field pH	No. of Containers
SAMPLE ID	Bore X	1	✓				28-07-11	0930	532.4	4.79	2	✓	
	BH6x	2	✓				28-07-11	1301	468.8	5.07	2	✓	

TOTAL (Sites) 2

TOTAL (Vials) 2

Relinquished by: Daisy Scott

Received by: *Jason Tranter*

Date/time: 14:30 am 29/07/11

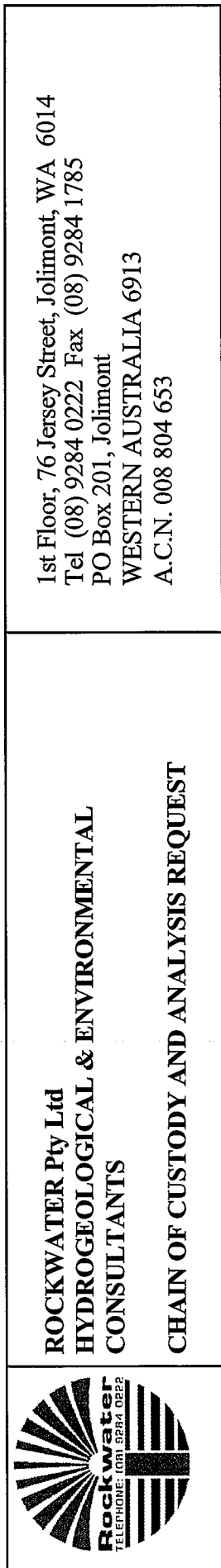
Date/time:

Comments:

*29/July/11 17:00*



**Rockwater**



1st Floor, 76 Jersey Street, Jolimont, WA 6014  
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PO Box 201, Jolimont  
WESTERN AUSTRALIA 6913  
A.C.N. 008 804 653

# CHAIN OF CUSTODY AND ANALYSIS REQUEST

[illegible]

TOTAL (Sites)	7
---------------	---

TOTAL (Vials)	14
---------------	----

14

Relinquished by: Adam Mahon  
Date/time: 10:00 am 16/12/11

W. Mahren

Received by: Jason Towner  
Date/time: 13:55 16/12/11

Comments:



## Rockwater

# STABLE ISOTOPE RESULTS

## BATCH REPORT

15th Dec 2011

**Organisation:** RockWater Pty Ltd  
**Contact:** Daisy Scott  
**Project Id (ECU):** RW-11-11-04-1  
**Project Id (RW):** JPP Isotope Sampling (SKM)  
**Sample Description:** Water  
**No. of Samples:** 2  
**Analysis Performed:** d2H and d18O

**Notes:** Nil

Sample Name	d2H Reportable Value (permil)	d2H Standard Deviation (permil)	d18O Reportable Value (permil)	d18O Standard Deviation (permil)
AE-10	-48.4	0.2	-7.30	0.02
U-20	-48.0	0.2	-7.19	0.06



# STABLE ISOTOPE RESULTS

## BATCH REPORT

# STABLE ISOTOPE RESULTS

## BATCH REPORT

20-December-2011

**Organisation:** RockWater  
**Contact:** Daisy Scott  
**Project Id (ECU):** RW-11-12-16-1  
**Project Id (RW):** JPP Isotope Sampling (SKM)  
**Sample Description:** Water  
**No. of Samples:** 7  
**Analysis Performed:** d2H and d18O

**Notes:** Samples were filtered through a 0.45um filter prior to analysis.

Sample Name	d2H Reportable Value (permil)	d2H Standard Deviation (permil)	d18O Reportable Value (permil)	d18O Standard Deviation (permil)
AP-12	-48.5	0.1	-7.24	0.06
AP-14	-48.3	0.3	-7.20	0.02
F-14	-49.2	0.3	-7.33	0.05
P-17A	-48.9	0.1	-7.33	0.02
P-17	-49.0	0.2	-7.31	0.06
U-16	-49.5	0.3	-7.36	0.03
U-31	-48.2	0.3	-7.19	0.02

# STABLE ISOTOPE RESULTS

## BATCH REPORT

**APPENDIX VIII**

**PASS SAMPLING**

**CERTIFICATES OF ANALYSIS**



**Texture-based acid sulfate soils ‘action criteria’ (Department of Environment and Conservation 2009).**

		Net Acidity Action Criteria			
Type of material		<1000 tonnes of materials is disturbed		>1000 tonnes of materials is disturbed	
Texture range McDonald <i>et al.</i> (1990)	Approx. clay content (%)	Equivalent sulfur (%S) (oven-dry basis)	Equivalent Acidity (mol H <sup>+</sup> /tonne) (oven-dry basis)	Equivalent sulfur (%S) (oven-dry basis)	Equivalent Acidity (mol H <sup>+</sup> /tonne) (oven-dry basis)
Coarse Texture Sands to Loamy sands	< 5	0.03	18.7	0.03	18.7
Medium Texture Sandy Loams to Light Clays	5 – 40	0.06	37.4	0.03	18.7
Fine Texture Medium to Heavy Clays and Silty Clays	> 40	0.1	64.8	0.03	18.7

## References

DEPARTMENT OF ENVIRONMENT AND CONSERVATION, 2009. Identification and Investigation of acid sulphate soils and acidic landscapes, Government of Western Australia, Acid Sulfate Soils Guideline Series, May 2009.

MCDONALD, R. C., ISBELL, R. F., SPEIGHT, J. G., WALKER, J., and HOPKINS M. S., 1990. Australian Soil and Land Survey Field Handbook, Australian Soil and Land Survey Field Handbooks Series Volume 1 (2<sup>nd</sup> edition): CSIRO Publishing, 190p.



# CONSULTANT

## HYDROGEOLOGISTS

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## **CHAIN OF CUSTODY AND ANALYSIS REQUEST**

[illegible]Environmental Division  
Perth

## Work Order

**EP1108980**



Telephone : +61-8-9209 7655



## Environmental Division

### CERTIFICATE OF ANALYSIS

<b>Work Order</b>	<b>: EP1108980</b>	<b>Page</b>	<b>: 1 of 4</b>
<b>Client</b>	<b>: ROCKWATER PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Perth</b>
<b>Contact</b>	<b>: CONSULT</b>	<b>Contact</b>	<b>: Scott James</b>
<b>Address</b>	<b>: 1ST FLOOR, 76 JERSEY ST WEMBLEY WA, AUSTRALIA 6014</b>	<b>Address</b>	<b>: 10 Hod Way Malaga WA Australia 6090</b>
<b>E-mail</b>	<b>: consult@rockwater.com.au</b>	<b>E-mail</b>	<b>: perth.enviro.services@alsglobal.com</b>
<b>Telephone</b>	<b>: +61 08 9284 0222</b>	<b>Telephone</b>	<b>: +61-8-9209 7655</b>
<b>Facsimile</b>	<b>: +61 9284 1785</b>	<b>Facsimile</b>	<b>: +61-8-9209 7600</b>
<b>Project</b>	<b>: 368-0-2B</b>	<b>QC Level</b>	<b>: NEPM 1999 Schedule B(3) and ALS QCS3 requirement</b>
<b>Order number</b>	<b>: ----</b>		
<b>C-O-C number</b>	<b>: ----</b>	<b>Date Samples Received</b>	<b>: 16-DEC-2011</b>
<b>Sampler</b>	<b>: C.K &amp; A.M</b>	<b>Issue Date</b>	<b>: 28-DEC-2011</b>
<b>Site</b>	<b>: #68 JPP - PASS Sampling</b>		
<b>Quote number</b>	<b>: ----</b>	<b>No. of samples received</b>	<b>: 5</b>
		<b>No. of samples analysed</b>	<b>: 5</b>

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



WORLD RECOGNISED  
**ACCREDITATION**

NATA Accredited Laboratory 825

This document is issued in  
accordance with NATA  
accreditation requirements.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Leanne Cooper	Acid Sulfate Soils Supervisor	Perth ASS

**Environmental Division Perth**  
Part of the **ALS Laboratory Group**

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A Campbell Brothers Limited Company



## General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **ASS: EA029 (SPOCAS):** Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime ( $\text{CaCO}_3$ ) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from kg/t dry weight to kg/m<sup>3</sup> in-situ soil, multiply reported results x wet bulk density of soil in t/m<sup>3</sup>.
- **ASS: EA029 (SPOCAS):** Retained Acidity not required because pH KCl greater than or equal to 4.5
- **ASS: EA033 (CRS Suite):** Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime ( $\text{CaCO}_3$ ) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m<sup>3</sup> in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m<sup>3</sup>'.
- **ASS: EA033 (CRS Suite):** Retained Acidity not required because pH KCl greater than or equal to 4.5





## Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				AD-20	U-31	AE-10	AD-16	U-16
				12-NOV-2011 14:30	04-OCT-2011 14:50	31-AUG-2011 22:30	06-NOV-2011 07:51	07-NOV-2011 21:00
Compound	CAS Number	LOR	Unit	EP1108980-001	EP1108980-002	EP1108980-003	EP1108980-004	EP1108980-005
<b>EA029-A: pH Measurements</b>								
pH KCl (23A)	----	0.1	pH Unit	6.3	5.9	5.9	7.0	6.4
pH OX (23B)	----	0.1	pH Unit	6.1	6.2	6.1	6.7	6.1
<b>EA029-B: Acidity Trail</b>								
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	5	4	<2	<2
Titrateable Peroxide Acidity (23G)	----	2	mole H+ / t	<2	<2	<2	<2	<2
Titrateable Sulfidic Acidity (23H)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.005	% pyrite S	<0.005	0.008	0.006	<0.005	<0.005
sulfidic - Titrateable Peroxide Acidity (s-23G)	----	0.005	% pyrite S	<0.005	<0.005	<0.005	<0.005	<0.005
sulfidic - Titrateable Sulfidic Acidity (s-23H)	----	0.005	% pyrite S	<0.005	<0.005	<0.005	<0.005	<0.005
<b>EA029-C: Sulfur Trail</b>								
KCl Extractable Sulfur (23Ce)	----	0.005	% S	<0.005	<0.005	<0.005	<0.005	<0.005
Peroxide Sulfur (23De)	----	0.005	% S	<0.005	<0.005	<0.005	<0.005	<0.005
Peroxide Oxidisable Sulfur (23E)	----	0.005	% S	<0.005	<0.005	<0.005	<0.005	<0.005
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	5	mole H+ / t	<5	<5	<5	<5	<5
<b>EA029-D: Calcium Values</b>								
KCl Extractable Calcium (23Vh)	----	0.005	% Ca	0.01	<0.005	<0.005	0.01	<0.005
Peroxide Calcium (23Wh)	----	0.005	% Ca	0.01	<0.005	<0.005	0.02	<0.005
Acid Reacted Calcium (23X)	----	0.005	% Ca	<0.005	<0.005	<0.005	<0.005	<0.005
acidity - Acid Reacted Calcium (a-23X)	----	5	mole H+ / t	<5	<5	<5	<5	<5
sulfidic - Acid Reacted Calcium (s-23X)	----	0.005	% S	<0.005	<0.005	<0.005	<0.005	<0.005
<b>EA029-E: Magnesium Values</b>								
KCl Extractable Magnesium (23Sm)	----	0.005	% Mg	<0.005	0.005	<0.005	<0.005	<0.005
Peroxide Magnesium (23Tm)	----	0.005	% Mg	0.01	<0.005	<0.005	0.02	<0.005
Acid Reacted Magnesium (23U)	----	0.005	% Mg	0.01	<0.005	<0.005	0.01	<0.005
Acidity - Acid Reacted Magnesium (a-23U)	----	5	mole H+ / t	8	<5	<5	12	<5
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.005	% S	0.01	<0.005	<0.005	0.02	<0.005
<b>EA029-F: Excess Acid Neutralising Capacity</b>								
Excess Acid Neutralising Capacity (23Q)	----	0.02	% CaCO3	----	----	----	0.10	----
acidity - Excess Acid Neutralising Capacity (a-23Q)	----	10	mole H+ / t	----	----	----	20	----
sulfidic - Excess Acid Neutralising Capacity (s-23Q)	----	0.02	% S	----	----	----	0.03	----
<b>EA029-H: Acid Base Accounting</b>								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5



## Analytical Results

Sub-Matrix: SOIL

Client sample ID

Client sampling date / time

				AD-20	U-31	AE-10	AD-16	U-16
				12-NOV-2011 14:30	04-OCT-2011 14:50	31-AUG-2011 22:30	06-NOV-2011 07:51	07-NOV-2011 21:00
Compound	CAS Number	LOR	Unit	EP1108980-001	EP1108980-002	EP1108980-003	EP1108980-004	EP1108980-005
<b>EA029-H: Acid Base Accounting - Continued</b>								
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	<1	<1	<1
<b>EA033-A: Actual Acidity</b>								
pH KCl (23A)	----	0.1	pH Unit	<b>6.3</b>	<b>5.9</b>	<b>5.9</b>	<b>7.0</b>	<b>6.4</b>
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<b>5</b>	<b>4</b>	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
<b>EA033-B: Potential Acidity</b>								
Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	<0.005	<0.005	<0.005	<0.005
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	<10	<10	<10
<b>EA033-C: Acid Neutralising Capacity</b>								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	----	----	----	<b>0.24</b>	----
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	----	----	----	<b>47</b>	----
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	----	----	----	<b>0.08</b>	----
<b>EA033-E: Acid Base Accounting</b>								
ANC Fineness Factor	----	0.5	-	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	<1	<1	<1

**APPENDIX IX**

**DATA LOGGER INSTALLATION DATA**



James Price Point Monitoring Bore Completion Report  
Levellogger Installation Details

HOLE ID	Logger Serial No.	Logger Depth (m bts)	Install Date	Install Water Level (m bts)	Interval Time (min)
AD-16	0042000350	25.00	12/10/2011	20.88	15
AD-20	0042000357	23.00	12/12/2011	20.28	15
AD-28	0042000356	22.00	14/12/2011	18.56	15
AE-10	0042000360	24.00	12/01/2011	22.00	15
AP-12	0032001848	30.00	12/07/2011	25.70	15
AP-14	0032001850	30.00	12/08/2011	26.68	15
AP-20	0042000347	28.00	14/12/2011	25.77	15
AP-24	0042000363	28.00	13/12/2011	24.55	15
AP-28	0032001837	28.00	13/12/2011	23.27	15
AP-32	0042000339	24.00	13/12/2011	22.09	15
AP-36	0042000345	23.50	14/12/2011	21.37	15
F-14	0032001784	12.50	12/09/2011	9.23	15
I-16	0042000372	15.00	12/09/2011	10.35	15
N-4	0042000358	17.00	13/12/2011	13.83	15
O-10	0042000366	17.00	11/12/2011	14.81	15
P-17	0042000341	15.50	12/10/2011	13.55	15
P-21	0042000359	15.00	26/11/2011	12.96	15
P-25	0042000342	15.00	13/12/2011	12.13	15
P-29	0042000378	13.25	26/11/2011	11.27	15
U-10	0042000367	20.00	12/01/2011	17.93	15
U-16	0042000361	20.00	12/04/2011	16.40	15
U-20	0042000343	18.25	26/11/2011	16.24	15
U-31	0042000353	18.35	11/12/2011	13.17	15
V-25	0042000365	18.00	12/10/2011	15.24	15

**APPENDIX X**

**WATER LEVEL DATA**



HOLE ID	BORE TYPE	Site Coordinates			Reference Points Data			WL date	WL time	Water Level Data			
		Ground Level (m AHD)	Easting mE	Northing mN	Block m agl	Steel m agl	PVC m agl			WL mbgl	WL mbtoc - pvc	WL mbtoc - steel	WL mAHD
AD-10	Extraction							1/10/2011	14:33	20.94			
AD-16	Deep / Stygo	23.3	411223	8063749	0.05	0.55	0.49	24/11/2011	8:41			20.90	2.95
AD-16	Deep / Stygo	23.3	411223	8063749	0.05	0.55	0.49	29/11/2011	10:46			20.89	2.96
AD-16	Deep / Stygo	23.3	411223	8063749	0.05	0.55	0.49	8/12/2011	7:35			20.90	2.95
AD-16	Deep / Stygo	23.3	411223	8063749	0.05	0.55	0.49	10/12/2011	14:20			20.88	2.97
AD-16	Deep / Stygo	23.3	411223	8063749	0.05	0.55	0.49	14/12/2011	10:12			20.88	2.97
AD-20	Shallow	22.5	411220	8063554	0.075	0.805	0.735	29/11/2011	10:54			20.27	3.04
AD-20	Shallow	22.5	411220	8063554	0.075	0.805	0.735	11/12/2011	7:15			20.28	3.03
AD-20	Shallow	22.5	411220	8063554	0.075	0.805	0.735	12/12/2011	13:00			20.28	3.03
AD-28	Deep	21.0	411221	8063164	0.12	0.57	0.45	24/11/2011	8:52			18.92	2.65
AD-28	Deep	21.0	411221	8063164	0.12	0.57	0.45	29/11/2011	11:22			18.89	2.68
AD-28	Deep	21.0	411221	8063164	0.12	0.57	0.45	13/12/2011	7:20			18.56	3.01
AD-28	Deep	21.0	411221	8063164	0.12	0.57	0.45	14/12/2011	8:53			18.56	3.01
AE-10	Shallow	24.3	411228	8064055	0.14	0.65	0.44	1/10/2011	9:33	21.32			2.99
AE-10	Shallow	24.3	411228	8064055	0.14	0.65	0.44	7/10/2011	8:55			21.95	3.00
AE-10	Shallow	24.3	411228	8064055	0.14	0.65	0.44	8/10/2011				21.95	3.00
AE-10	Shallow	24.3	411228	8064055	0.14	0.65	0.44	11/10/2011				21.96	2.99
AE-10	Shallow	24.3	411228	8064055	0.14	0.65	0.44	12/10/2011				21.96	2.99
AE-10	Shallow	24.3	411228	8064055	0.14	0.65	0.44	13/10/2011				21.96	2.99
AE-10	Shallow	24.3	411228	8064055	0.14	0.65	0.44	2/11/2011	14:10			21.97	2.98
AE-10	Shallow	24.3	411228	8064055	0.14	0.65	0.44	4/11/2011	8:03			21.98	2.97
AE-10	Shallow	24.3	411228	8064055	0.14	0.65	0.44	8/11/2011	8:33			21.99	2.96
AE-10	Shallow	24.3	411228	8064055	0.14	0.65	0.44	21/11/2011	8:02			22.00	2.95
AE-10	Shallow	24.3	411228	8064055	0.14	0.65	0.44	24/11/2011	7:54			22.00	2.95
AE-10	Shallow	24.3	411228	8064055	0.14	0.65	0.44	29/11/2011	8:56			22.01	2.94
AE-10	Shallow	24.3	411228	8064055	0.14	0.65	0.44	1/12/2011	8:43			22.00	2.95
AP-10	Extraction							30/09/2011	16:47	23.28			
AP-10	Extraction							3/11/2011	8:05			23.94	
AP-10	Extraction							8/11/2011	8:26			23.95	
AP-12	Shallow	28.5	411824	8063949	0.075	0.535	0.44	7/12/2011	13:55			25.70	3.34
AP-12	Shallow	28.5	411824	8063949	0.075	0.535	0.44	5/11/2011				24.98	4.06
AP-12	Shallow	28.5	411824	8063949	0.075	0.535	0.44	8/11/2011	8:20			25.69	3.35
AP-12	Shallow	28.5	411824	8063949	0.075	0.535	0.44	24/11/2011	8:02			25.72	3.32
AP-12	Shallow	28.5	411824	8063949	0.075	0.535	0.44	29/11/2011	9:25			25.72	3.32
AP-12	Shallow	28.5	411824	8063949	0.075	0.535	0.44	4/12/2011	10:47			25.72	3.32
AP-14	Deep	29.1	411823	8063850	0.05	0.98	0.95	20/11/2011	8:56			26.71	3.37
AP-14	Deep	29.1	411823	8063850	0.05	0.98	0.95	24/11/2011	8:11			24.71	5.37
AP-14	Deep	29.1	411823	8063850	0.05	0.98	0.95	29/11/2011	9:52			26.71	3.37
AP-14	Deep	29.1	411823	8063850	0.05	0.98	0.95	7/12/2011	7:33			26.69	3.39
AP-14	Deep	29.1	411823	8063850	0.05	0.98	0.95	8/12/2011	14:04			26.68	3.40
AP-14	Deep	29.1	411823	8063850	0.05	0.98	0.95	14/12/2011	12:13			26.69	3.39

AP-20	Shallow	28.4	411822	8063550	0.05	0.81	0.62	14/11/2011	11:25	25.75	3.46
AP-20	Shallow	28.4	411822	8063550	0.05	0.81	0.62	24/11/2011	8:17	25.78	3.43
AP-20	Shallow	28.4	411822	8063550	0.05	0.81	0.62	29/11/2011	10:18	25.76	3.45
AP-20	Shallow	28.4	411822	8063550	0.05	0.81	0.62	11/12/2011	9:16	25.77	3.44
AP-20	Shallow	28.4	411822	8063550	0.05	0.81	0.62	14/12/2011	11:3	25.77	3.45
AP-24	Shallow	27.2	411828	8063346	0.16	0.78	no grout to 3.2m	9/12/2011	7:30	23.08	4.91
AP-24	Shallow	27.2	411828	8063346	0.16	0.78	no grout to 3.2m	12/12/2011	9:55	24.56	3.44
AP-24	Shallow	27.2	411828	8063346	0.16	0.78	no grout to 3.2m	13/12/2011	13:04	24.55	3.44
AP-28	Deep	26.2	411823	8063159	0.12	0.51	0.455	12/11/2011		18.28	8.43
AP-28	Deep	26.2	411823	8063159	0.12	0.51	0.455	17/11/2011	9:35	22.87	3.84
AP-28	Deep	26.2	411823	8063159	0.12	0.51	0.455	24/11/2011	8:25	23.41	3.30
AP-28	Deep	26.2	411823	8063159	0.12	0.51	0.455	12/12/2011	7:50	23.29	3.42
AP-28	Deep	26.2	411823	8063159	0.12	0.51	0.455	13/12/2011	12:17	23.27	3.44
AP-32	Shallow	24.9	411825	8062943	0.18	0.74	0.61	10/11/2011	7:30	21.65	3.99
AP-32	Shallow	24.9	411825	8062943	0.18	0.74	0.61	24/11/2011	8:29	22.08	3.56
AP-32	Shallow	24.9	411825	8062943	0.18	0.74	0.61	12/12/2011	11:25	22.09	3.55
AP-32	Shallow	24.9	411825	8062943	0.18	0.74	0.61	13/12/2011	11:20	22.09	3.55
AP-36	Shallow	24.0	411828	8062763	0.1	0.805	0.665	14/11/2011	11:45	21.10	3.71
AP-36	Shallow	24.0	411828	8062763	0.1	0.805	0.665	24/11/2011	8:34	21.35	3.46
AP-36	Shallow	24.0	411828	8062763	0.1	0.805	0.665	13/12/2011	9:20	21.36	3.45
AP-36	Shallow	24.0	411828	8062763	0.1	0.805	0.665	14/12/2011	10:59	21.37	3.44
F-14	Shallow	10.7	410027	8063852	0.06	0.73	0.7				
F-14	Shallow	10.7	410027	8063852	0.06	0.73	0.7	29/11/2011	8:29	9.17	2.26
F-14	Shallow	10.7	410027	8063852	0.06	0.73	0.7	4/12/2011	7:27	9.22	2.21
F-14	Shallow	10.7	410027	8063852	0.06	0.73	0.7	9/12/2011	14:08	9.23	2.20
I-16	Deep	11.7	410178	8063746	0.16	0.95	0.82	23/11/2011	7:59	10.88	1.77
I-16	Deep	11.7	410178	8063746	0.16	0.95	0.82	24/11/2011	7:35	10.95	1.70
I-16	Deep	11.7	410178	8063746	0.16	0.95	0.82	29/11/2011	8:23	10.88	1.77
I-16	Deep	11.7	410178	8063746	0.16	0.95	0.82	7/12/2011	10:57	10.36	2.29
I-16	Deep	11.7	410178	8063746	0.16	0.95	0.82	9/12/2011	14:40	10.35	2.30
N-4	Shallow	15.7	410428	8064346	0	0.68	0.44	8/12/2011	11:40	13.84	2.49
N-4	Shallow	15.7	410428	8064346	0	0.68	0.44	13/12/2011	13:54	13.83	2.50
N-4	Shallow	15.7	410428	8064346	0	0.68	0.44	14/12/2011	12:21	13.84	2.49
O-10	Shallow	16.7	410478	8064046	0	0.71	0.6915	8/12/2011	10:05	14.81	2.59
O-10	Shallow	16.7	410478	8064046	0	0.71	0.6915	11/12/2011	11:54	14.81	2.59
P-17	Shallow	15.5	410525	8063705	0.1	0.575	0.505			13.97	2.04
P-17	Shallow	15.5	410525	8063705	0.1	0.575	0.505			13.99	2.02
P-17	Shallow	15.5	410525	8063705	0.1	0.575	0.505			13.99	2.02
P-17	Shallow	15.5	410525	8063705	0.1	0.575	0.505			14.00	2.01
P-17	Shallow	15.5	410525	8063705	0.1	0.575	0.505				
P-17	Shallow	15.5	410525	8063705	0.1	0.575	0.505	2/11/2011	7:50	13.43	2.65
P-17	Shallow	15.5	410525	8063705	0.1	0.575	0.505	4/11/2011	7:42	13.53	2.55
P-17	Shallow	15.5	410525	8063705	0.1	0.575	0.505	8/11/2011	8:49	13.56	2.52
P-17	Shallow	15.5	410525	8063705	0.1	0.575	0.505	17/11/2011	9:20	13.55	2.53
P-17	Shallow	15.5	410525	8063705	0.1	0.575	0.505	24/11/2011	7:20	13.58	2.50
P-17	Shallow	15.5	410525	8063705	0.1	0.575	0.505	10/12/2011	9:21	13.59	2.49
P-17	Shallow	15.5	410525	8063705	0.1	0.575	0.505	10/12/2011	14:58	13.56	2.52

P-21	Shallow	14.8	410524	8063502	0.03	0.635	0.465	3/10/2011	16:30	11.79	3.01
P-21	Shallow	14.8	410524	8063502	0.03	0.635	0.465	7/10/2011	8:33		2.54
P-21	Shallow	14.8	410524	8063502	0.03	0.635	0.465	12/10/2011			2.49
P-21	Shallow	14.8	410524	8063502	0.03	0.635	0.465	13/10/2011			2.49
P-21	Shallow	14.8	410524	8063502	0.03	0.635	0.465	1/11/2011	13:08		2.53
P-21	Shallow	14.8	410524	8063502	0.03	0.635	0.465	4/11/2011	7:35		2.53
P-21	Shallow	14.8	410524	8063502	0.03	0.635	0.465	8/11/2011	8:51		2.49
P-21	Shallow	14.8	410524	8063502	0.03	0.635	0.465	18/11/2011	8:30		2.51
P-21	Shallow	14.8	410524	8063502	0.03	0.635	0.465	24/11/2011	9:32		2.48
P-21	Shallow	14.8	410524	8063502	0.03	0.635	0.465	26/11/2011	9:53		2.48
P-21	Shallow	14.8	410524	8063502	0.03	0.635	0.465	29/11/2011	8:07		2.50
P-25	Shallow	14.8	410524	8063502	0.03	0.635	0.465	8/11/2011	9:03		3.29
P-25	Shallow	14.8	410524	8063502	0.03	0.635	0.465	24/11/2011	9:39		3.29
P-25	Shallow	14.8	410524	8063502	0.03	0.635	0.465	29/11/2011	8:02		3.30
P-25	Shallow	14.8	410524	8063502	0.03	0.635	0.465	1/12/2011	13:15		3.32
P-25	Shallow	14.8	410524	8063502	0.03	0.635	0.465	9/12/2011	8:50		3.26
P-25	Shallow	14.8	410524	8063502	0.03	0.635	0.465	10/12/2011	11:10		3.28
P-25	Shallow	14.8	410524	8063502	0.03	0.635	0.465	12/12/2011	14:22		3.33
P-25	Shallow	14.8	410524	8063502	0.03	0.635	0.465	13/12/2011	14:38		3.31
P-29	Shallow	13.1	410528	8063097	0.03	0.52	0.31	3/10/2011	16:18	8.83	4.27
P-29	Shallow	13.1	410528	8063097	0.03	0.52	0.31	8/10/2011			2.39
P-29	Shallow	13.1	410528	8063097	0.03	0.52	0.31	11/10/2011			2.36
P-29	Shallow	13.1	410528	8063097	0.03	0.52	0.31	12/10/2011			2.37
P-29	Shallow	13.1	410528	8063097	0.03	0.52	0.31	13/10/2011			2.37
P-29	Shallow	13.1	410528	8063097	0.03	0.52	0.31	1/11/2011	11:15		2.40
P-29	Shallow	13.1	410528	8063097	0.03	0.52	0.31	4/11/2011	7:25		2.42
P-29	Shallow	13.1	410528	8063097	0.03	0.52	0.31	8/11/2011	13:46		2.41
P-29	Shallow	13.1	410528	8063097	0.03	0.52	0.31	17/11/4114	8:10		2.39
P-29	Shallow	13.1	410528	8063097	0.03	0.52	0.31	19/11/2011	8:32		2.39
P-29	Shallow	13.1	410528	8063097	0.03	0.52	0.31	24/11/2011	9:43		2.37
P-29	Shallow	13.1	410528	8063097	0.03	0.52	0.31	26/11/2011	9:14		2.35
P-29	Shallow	13.1	410528	8063097	0.03	0.52	0.31	29/11/2011	7:48		2.22
U-10	Shallow / Stygo	19.9	410770	8064054	0.71	0.7	0.46	30/09/2011	16:00	17.14	2.76
U-10	Shallow / Stygo	19.9	410770	8064054	0.71	0.7	0.46	7/10/2011	8:45		2.69
U-10	Shallow / Stygo	19.9	410770	8064054	0.71	0.7	0.46	8/10/2011			2.69
U-10	Shallow / Stygo	19.9	410770	8064054	0.71	0.7	0.46	11/10/2011			2.68
U-10	Shallow / Stygo	19.9	410770	8064054	0.71	0.7	0.46	12/10/2011			2.68
U-10	Shallow / Stygo	19.9	410770	8064054	0.71	0.7	0.46	13/10/2011			2.68
U-10	Shallow / Stygo	19.9	410770	8064054	0.71	0.7	0.46	2/11/2011	12:40		2.69
U-10	Shallow / Stygo	19.9	410770	8064054	0.71	0.7	0.46	4/11/2011	7:55		2.67
U-10	Shallow / Stygo	19.9	410770	8064054	0.71	0.7	0.46	8/11/2011	8:40		2.66
U-10	Shallow / Stygo	19.9	410770	8064054	0.71	0.7	0.46	24/11/2011	7:50		2.65
U-10	Shallow / Stygo	19.9	410770	8064054	0.71	0.7	0.46	21/11/2011	7:21		2.66
U-10	Shallow / Stygo	19.9	410770	8064054	0.71	0.7	0.46	29/11/2011	8:43		2.66
U-10	Shallow / Stygo	19.9	410770	8064054	0.71	0.7	0.46	1/12/2011	7:51		2.67



U-16	Deep	18.5	410771	8063754	0.07	0.55	0.51	7/11/2011			16.41	2.64
U-16	Deep	18.5	410771	8063754	0.07	0.55	0.51	8/11/2011	8:43		16.41	2.65
U-16	Deep	18.5	410771	8063754	0.07	0.55	0.51	20/11/2011	8:10		16.41	2.64
U-16	Deep	18.5	410771	8063754	0.07	0.55	0.51	24/11/2011	9:27		16.41	2.64
U-16	Deep	18.5	410771	8063754	0.07	0.55	0.51	29/11/2011	12:17		16.40	2.65
U-16	Deep	18.5	410771	8063754	0.07	0.55	0.51	1/12/2011	9:49		16.39	2.66
U-16	Deep	18.5	410771	8063754	0.07	0.55	0.51	4/12/2011	10:00		16.40	2.65
U-20	Shallow	18.0	410768	8063553	0.14	0.96	0.7	7/10/2011	8:20	15.93		2.77
U-20	Shallow	18.0	410768	8063553	0.14	0.96	0.7	8/10/2011		16.10		2.60
U-20	Shallow	18.0	410768	8063553	0.14	0.96	0.7	11/10/2011		16.12		2.58
U-20	Shallow	18.0	410768	8063553	0.14	0.96	0.7	12/10/2011		16.12		2.58
U-20	Shallow	18.0	410768	8063553	0.14	0.96	0.7	13/10/2011		16.12		2.58
U-20	Shallow	18.0	410768	8063553	0.14	0.96	0.7	1/11/2011	9:17		16.21	2.75
U-20	Shallow	18.0	410768	8063553	0.14	0.96	0.7	4/11/2011	8:11		16.22	2.74
U-20	Shallow	18.0	410768	8063553	0.14	0.96	0.7	8/11/2011	9:09		16.23	2.73
U-20	Shallow	18.0	410768	8063553	0.14	0.96	0.7	20/11/2011	7:30		16.23	2.73
U-20	Shallow	18.0	410768	8063553	0.14	0.96	0.7	24/11/2011	9:21		16.25	2.71
U-20	Shallow	18.0	410768	8063553	0.14	0.96	0.7	26/11/2011	10:38		16.24	2.72
U-20	Shallow	18.0	410768	8063553	0.14	0.96	0.7	29/11/2011	12:06		16.23	2.73
U-31	Shallow	15.1	410769	8063002	0.105	0.84	0.62	7/10/2011	8:26	13.19		2.53
U-31	Shallow	15.1	410769	8063002	0.105	0.84	0.62	8/10/2011			13.16	2.78
U-31	Shallow	15.1	410769	8063002	0.105	0.84	0.62	11/10/2011			13.16	2.78
U-31	Shallow	15.1	410769	8063002	0.105	0.84	0.62	12/10/2011			13.16	2.78
U-31	Shallow	15.1	410769	8063002	0.105	0.84	0.62	13/10/2011			13.16	2.78
U-31	Shallow	15.1	410769	8063002	0.105	0.84	0.62	3/11/2011			13.13	2.81
U-31	Shallow	15.1	410769	8063002	0.105	0.84	0.62	8/11/2011	9:20		13.18	2.76
U-31	Shallow	15.1	410769	8063002	0.105	0.84	0.62	4/11/2011	8:23		13.14	2.80
U-31	Shallow	15.1	410769	8063002	0.105	0.84	0.62	19/11/2011	9:18		13.16	2.78
U-31	Shallow	15.1	410769	8063002	0.105	0.84	0.62	24/11/2011	9:13		13.19	2.75
U-31	Shallow	15.1	410769	8063002	0.105	0.84	0.62	29/11/2011	11:53		13.17	2.77
U-31	Shallow	15.1	410769	8063002	0.105	0.84	0.62	10/12/2011	7:55		13.20	2.74
U-31	Shallow	15.1	410769	8063002	0.105	0.84	0.62	11/12/2011	12:55		13.17	2.77
V-25	Deep / Stygo	17.2	410819	8063300	0.05	0.77	0.72	5/11/2011			15.27	2.70
V-25	Deep / Stygo	17.2	410819	8063300	0.05	0.77	0.72	8/11/2011	9:15		15.28	2.69
V-25	Deep / Stygo	17.2	410819	8063300	0.05	0.77	0.72	24/11/2011	9:02		15.27	2.70
V-25	Deep / Stygo	17.2	410819	8063300	0.05	0.77	0.72	29/11/2011	11:39		15.25	2.72
V-25	Deep / Stygo	17.2	410819	8063300	0.05	0.77	0.72	9/12/2011	10:55		15.26	2.71
V-25	Deep / Stygo	17.2	410819	8063300	0.05	0.77	0.72	10/12/2011	13:17		15.24	2.73