

Appendices

Appendix A – Nearshore Sampling Tabulated Exceedances

Table A1 Nearshore *Enterococci* Levels, Exceedance of ANZECC (2000) Recreational Water Quality Guidelines

Location (Date)	Enterococci (MPN/100mL)	Exceed - ANZECC (2000) Recreational Primary Contact – Lower Limit – 35 cfu/100 mL	Exceed – ANZECC (2000) Recreational Secondary Contact – Upper Limit – 100 cfu/100mL	Exceed –ANZECC (2000) Secondary Contact Lower Limit – 230 cfu/100mL	Exceed – ANZECC (2000) Secondary Contact – Upper Limit – 730 cfu/100mL
Point Moore (9/4/2013)	41	Yes	No	No	No
Pages Beach (9/4/2013)	73	Yes	No	No	No
Point Moore (8/1/2014)	54	Yes	No	No	No
Point Moore (15/1/2015)	84	Yes	No	No	No
Pages Beach (15/04/2015)	170	Yes	Yes	No	No
Pages Beach (12/03/2015)	230	Yes	Yes	Yes	No
Pages Beach (3/02/2016)	910	Yes	Yes	Yes	Yes
Pages Beach (19/04/2016)	97	Yes	No	No	No

Table A2 Nearshore *Enterococci* Levels, Exceedance of Criteria that Define NHMRC (2008) Recreational Water Quality Categories

Location (Date)	Enterococci (MPN/100mL)	Exceed – NHMRC Category A – 40 cfu/100 mL	Exceed – NHMRC (2008) Category B lower limit – 41 cfu/100mL	Exceed –NHMRC (2008) Category B – Upper Limit – 200 cfu/100 mL	Exceed – NHMRC (2008) – Category C – 201 cfu/100 mL	Exceed – NHMRC – Category D - >500 cfu/100mL
Point Moore (9/4/2013)	41	Yes	Yes	No	No	No
Pages Beach (9/4/2013)	73	Yes	Yes	No	No	No
Point Moore (8/1/2014)	54	Yes	Yes	No	No	No
Point Moore (15/1/2015)	84	Yes	Yes	No	No	No
Pages Beach (15/04/2015)	170	Yes	Yes	No	No	No
Pages Beach (12/03/2015)	230	Yes	Yes	Yes	No	No
Pages Beach (3/02/2016)	910	Yes	Yes	Yes	Yes	Yes
Pages Beach (19/04/2016)	97	Yes	Yes	No	No	No

Basis of the derivation of the limits for each category provided in Table A2 are provided in Table A3.

Table A3 Basis of derivation of percentile values for determining microbial water quality categories (NHMRC, 2008)

Category ^a	95 th percentile value for intestinal enterococci/ 100 mL (rounded values)	Basis of derivation	Estimation of probability
A	≤40	This value is below the NOAEL in most epidemiological studies.	GI illness risk: < 1% AFRI risk: < 0.3% The upper 95th percentile value of 40/100 mL relates to an average probability of less than one case of gastroenteritis in every 100 exposures. The AFRI burden would be negligible.
B	41–200	The 200/100 mL value is above the threshold of illness transmission reported in most epidemiological studies that have attempted to define a NOAEL or LOAEL for GI illness and AFRI.	GI illness risk: 1–5% AFRI risk: 0.3–1.9% The upper 95 th percentile value of 200/100 mL relates to an average probability of one case of gastroenteritis in 20 exposures. The AFRI illness rate would be 19 per 1000 exposures or approximately 1 in 50 exposures.
C	201–500	This represents a substantial elevation in the probability of all adverse health outcomes for which dose–response data are available.	GI illness risk: 5–10% AFRI risk: 1.9–3.9% This range of 95 th percentile values represents a probability of 1 in 20 to 1 in 10 risk of gastroenteritis for a single exposure. Exposures in this category also suggest a risk of AFRI in the range of 19–39 per 1000 exposures or a range of approximately 1 in 50 to 1 in 25 exposures.
D	> 501	Above this level there may be a significant risk of high levels of illness transmission.	GI illness risk: > 10% AFRI risk: > 3.9% There is a greater than 10% chance of illness per single exposure. The AFRI illness rate at the guideline value of 500 enterococci per 100 mL would be 39 per 1000 exposures or approximately 1 in 25 exposures.

Appendix B – Point Moore Inundation and Coastal Processes Study Summary Report

Point Moore Inundation & Coastal Processes Study

In Western Australia, coastal development is guided by State Planning Policy 2.6: The State Coastal Planning Policy (SPP2.6). This policy outlines the general requirements for new development on the coastline in terms of avoiding or managing risks caused by coastal inundation (flooding) or coastal erosion.



SPP2.6 outlines that new development should be safe from coastal inundation caused by an extreme inundation event that has a 0.2% chance of occurring each year. In other words, this event would occur once every 500 years on average. Another way to say this is that the event would have an Average Recurrence Interval (abbreviated to ARI) of 500 years.

For coastal erosion, SPP2.6 states that new development should be safe from an erosion event that has a 1% chance of occurring each year (or would occur once every 100 years on average – i.e. the 100 year ARI event).

In addition to these storm events, the potential impacts of sea level rise and ongoing changes to the shoreline need to be considered when determining appropriate areas for new development.

While the SPP2.6 guidelines relate mainly to the requirements for new development, where existing development does not meet the guidelines there is a general requirement to take action in order to reduce any risks to acceptable levels.

In 2015 a study was completed in order to understand which areas of Point Moore could be impacted by coastal inundation and erosion. This study was completed in accordance with the requirements of SPP2.6. The study involved detailed modelling and assessment of the following items:

- Detailed cyclone storm surge modelling to determine the potential inundation caused by severe cyclones.
- Analysis of available water level records to determine the potential inundation caused by non-cyclonic events.
- Modelling the potential beach and dune erosion caused by severe events.
- Assessment of historical and potential future shoreline movement caused by the action of natural coastal processes.
- Assessment of the effects of potential sea level rise (assuming 0.9 metres of sea level rise by year 2110 as required by SPP2.6) on the coastal inundation and erosion.

The results of this study are summarised on the attached plans. Further details and description of these plans are provided overleaf.

The attached plans show the areas that could be impacted by coastal erosion or inundation for the Present Day, as well as the years 2030, 2070 and 2110. A description of what these plans mean, and how to read them, is provided below.

Coastal Processes Allowance Plan

The Coastal Processes Allowance Plan shows 4 different coloured lines. Each of these lines represents the extent of possible impact of coastal erosion over each planning horizon. The locations of these lines have been determined in accordance with the requirements of SPP2.6. As an example, anything on the ocean side of the **red** line could be vulnerable to coastal erosion by the year 2110.

Coastal Inundation Mapping Plans

The Inundation Mapping Plans show areas that could be inundated by different events for each of the timeframes outlined above. Each of the different plots represents a different timeframe. The different colours represent the potential areas of inundation associated with different event severities. On each of the plots, the area that is shaded **purple** represents the area that would be inundated during the 20 year ARI event; the area that is shaded **blue** represents the additional area that would be inundated during the 100 year ARI event; and the area that is shaded **green** represents the additional area that could be inundated by the 500 year ARI event.

The difference between the plots (as each plot represents a different time), is caused by the potential impact of sea level rise.

Coastal Inundation Depth Plans

The Inundation Depth Plans have been prepared to show the potential depth of inundation caused by the 20, 100 and 500 year ARI events at the year 2030, as well as the 500 year ARI event in 2110. The different colours on these plans show the different inundation depths, as indicated on the legend. For example, anything that is shaded **pink** on the plan would have an inundation depth of between 2.0 and 2.5 metres.

Combined Coastal Vulnerability Mapping Plans

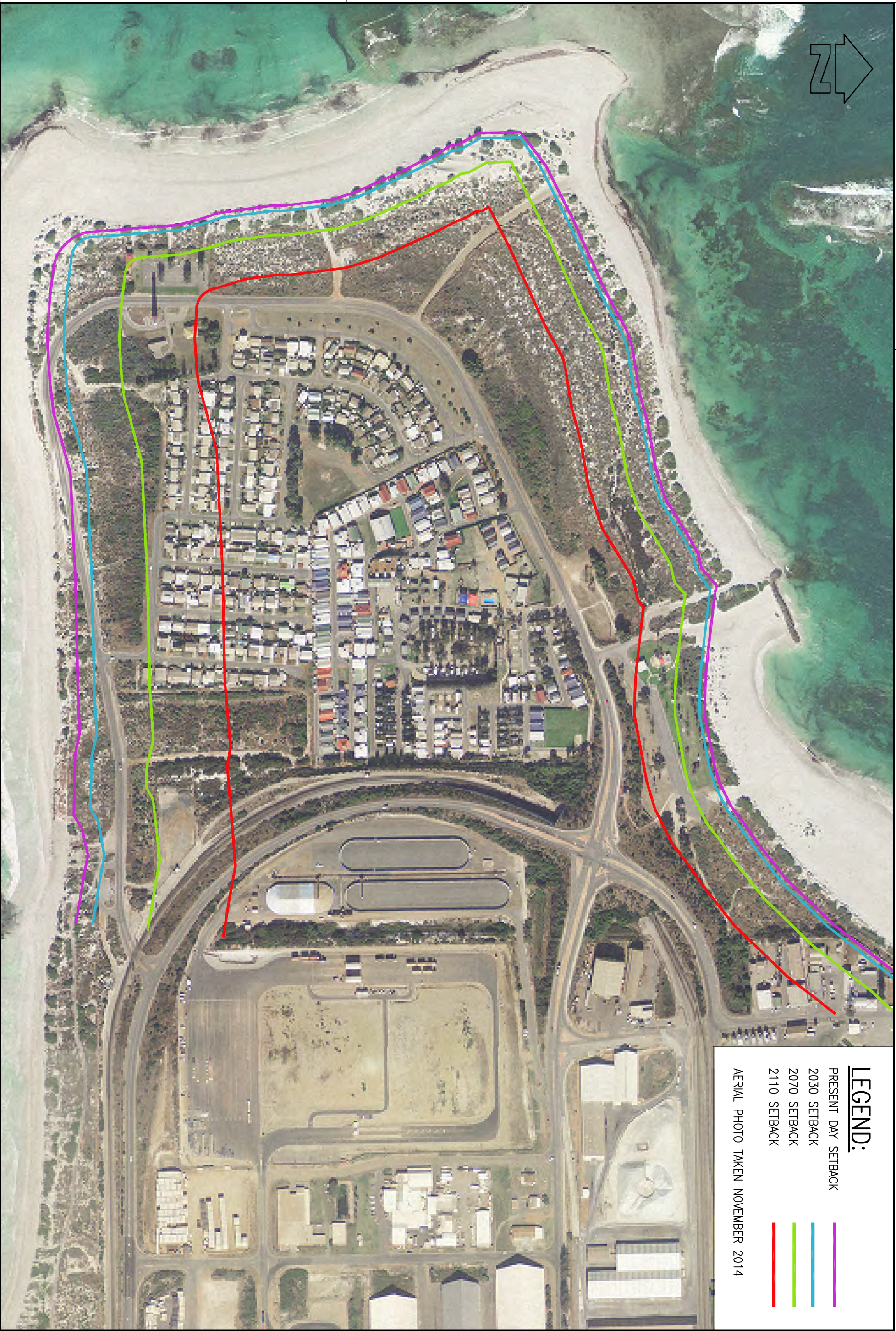
The Combined Coastal Vulnerability Mapping Plans identify the areas that would be impacted by the 500 year ARI inundation event and/or the Coastal Processes Allowance for each timeframe. For example, on the plan depicting the year 2030, the shading depicts the area that would be subject to inundation during the 500 year ARI event as well as the area that would be potentially vulnerable to coastal erosion by 2030 (as shown on the Coastal Processes Allowance Plan).

The significance of these combined plans is that the shaded areas represent the areas that would not be developable under SPP2.6 for each of the different timeframes.

m p rogers & associates pl

www.coastsandports.com.au

AT CORRECT SCALE THIS IS 100 mm



LEGEND:

- PRESENT DAY SETBACK
- 2030 SETBACK
- 2070 SETBACK
- 2110 SETBACK

AERIAL PHOTO TAKEN NOVEMBER 2014

AT CORRECT SCALE THIS IS 100 mm

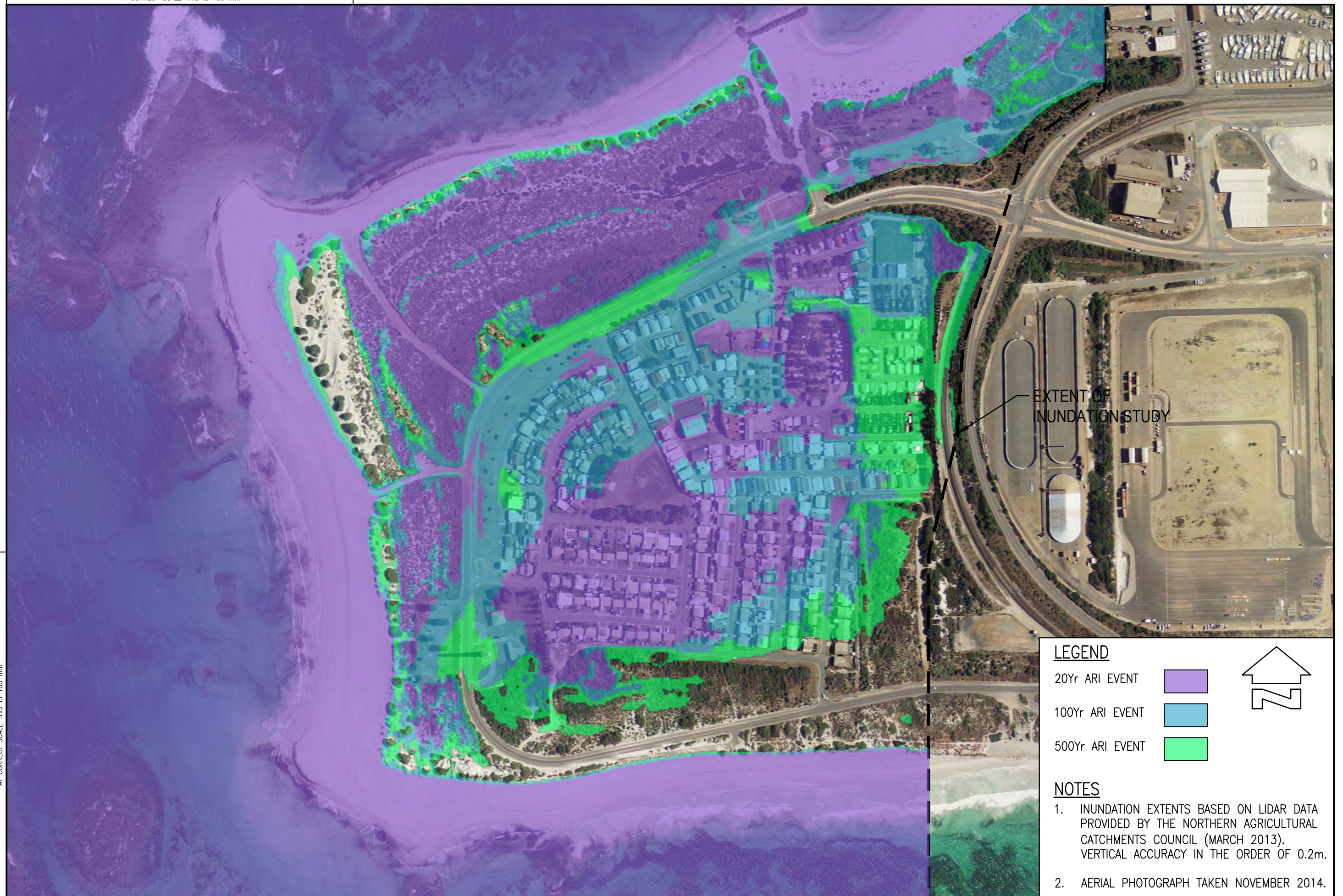
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coastal and port engineers

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POINT MOORE COASTAL EROSION AND INUNDATION STUDY
COASTAL PROCESSES ALLOWANCES

SCALE
AT A3 1:4,000

DECEMBER 2015
D1242-01-02(D)



LEGEND

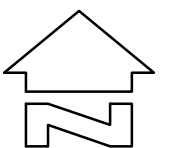
20Yr ARI EVENT



100Yr ARI EVENT

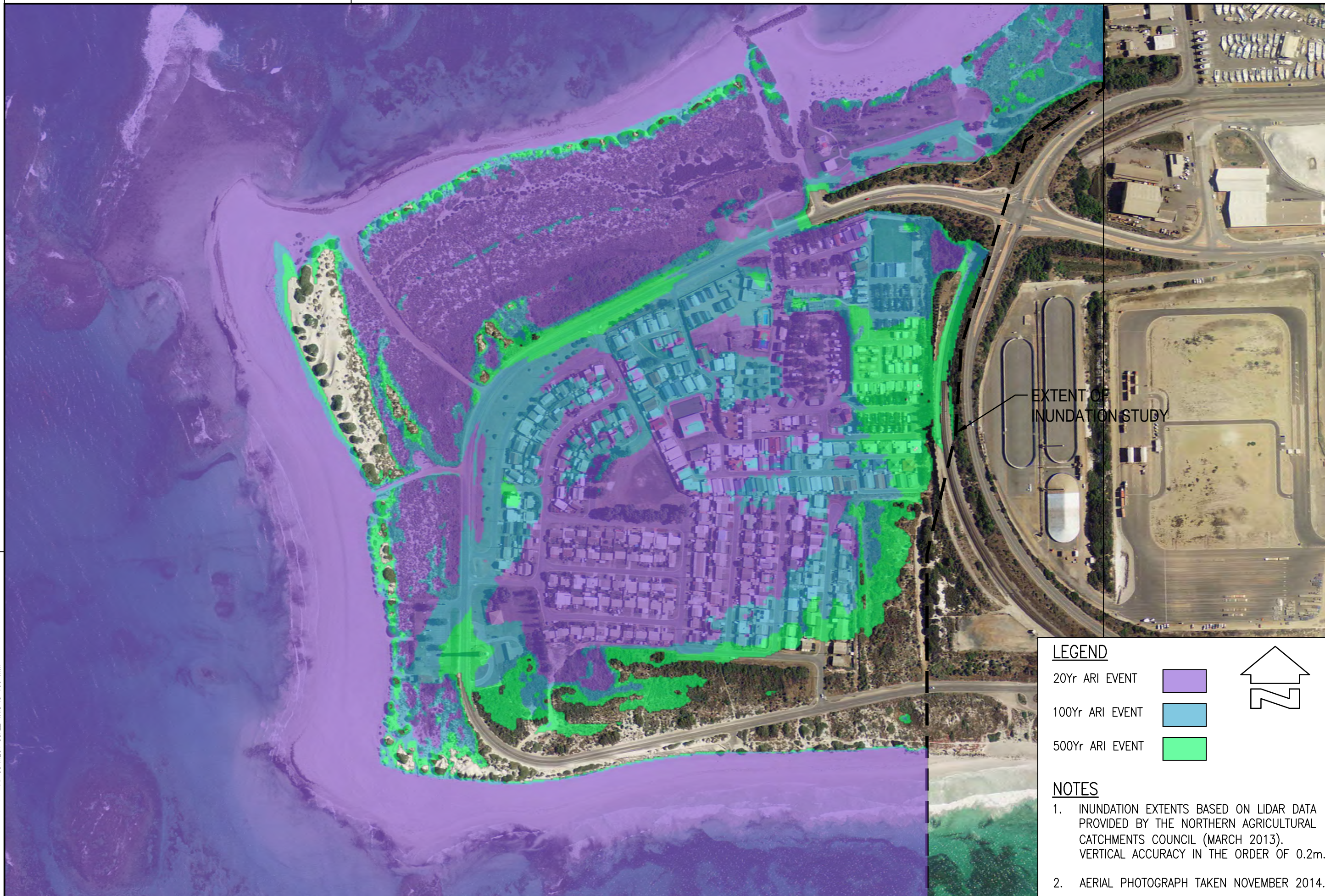


500Yr ARI EVENT



NOTES

1. INUNDATION EXTENTS BASED ON LIDAR DATA PROVIDED BY THE NORTHERN AGRICULTURAL CATCHMENTS COUNCIL (MARCH 2013). VERTICAL ACCURACY IN THE ORDER OF 0.2m.
2. AERIAL PHOTOGRAPH TAKEN NOVEMBER 2014.



LEGEND

20Yr ARI EVENT



100Yr ARI EVENT

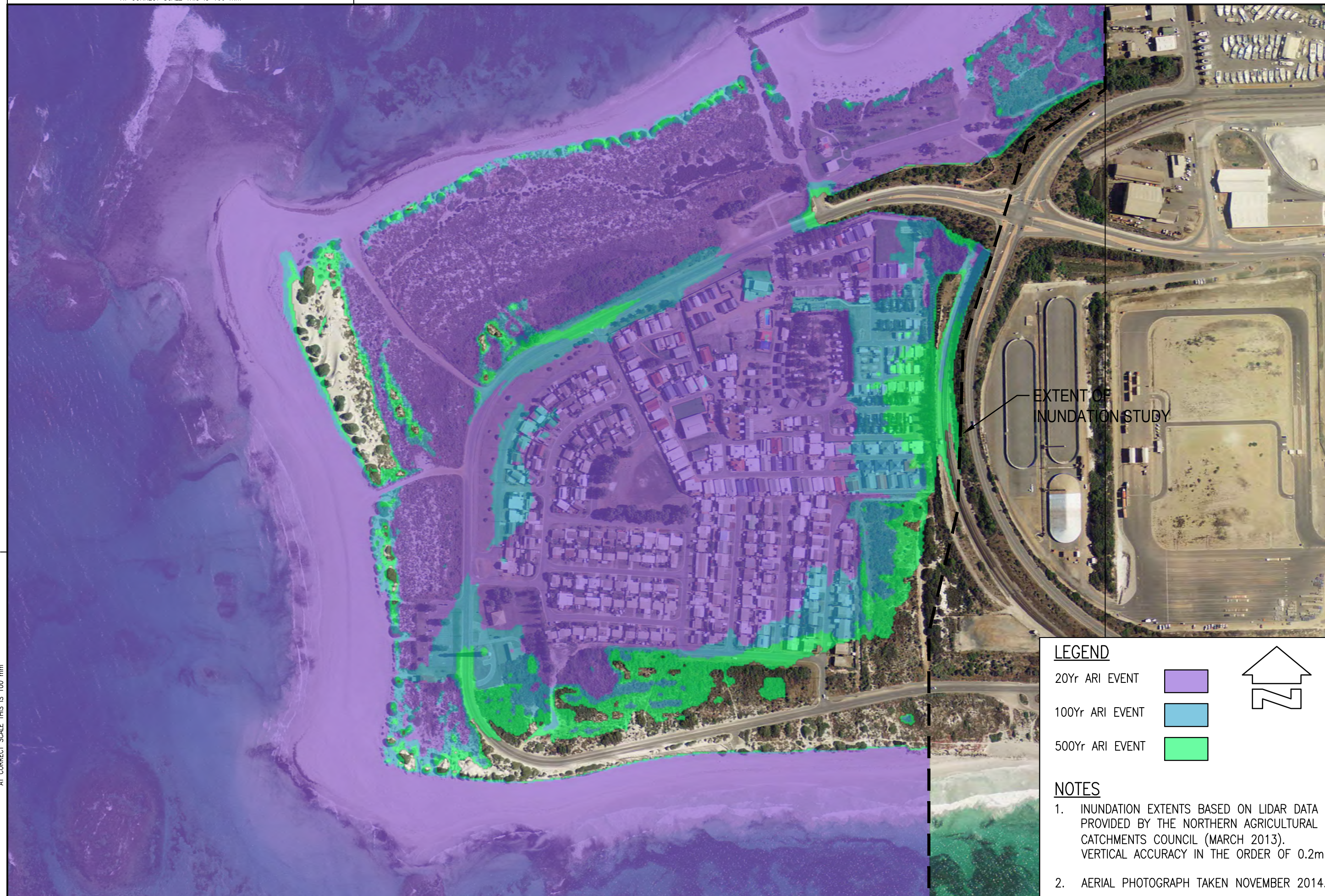


500Yr ARI EVENT



NOTES

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2. AERIAL PHOTOGRAPH TAKEN NOVEMBER 2014.



LEGEND

20Yr ARI EVENT



100Yr ARI EVENT

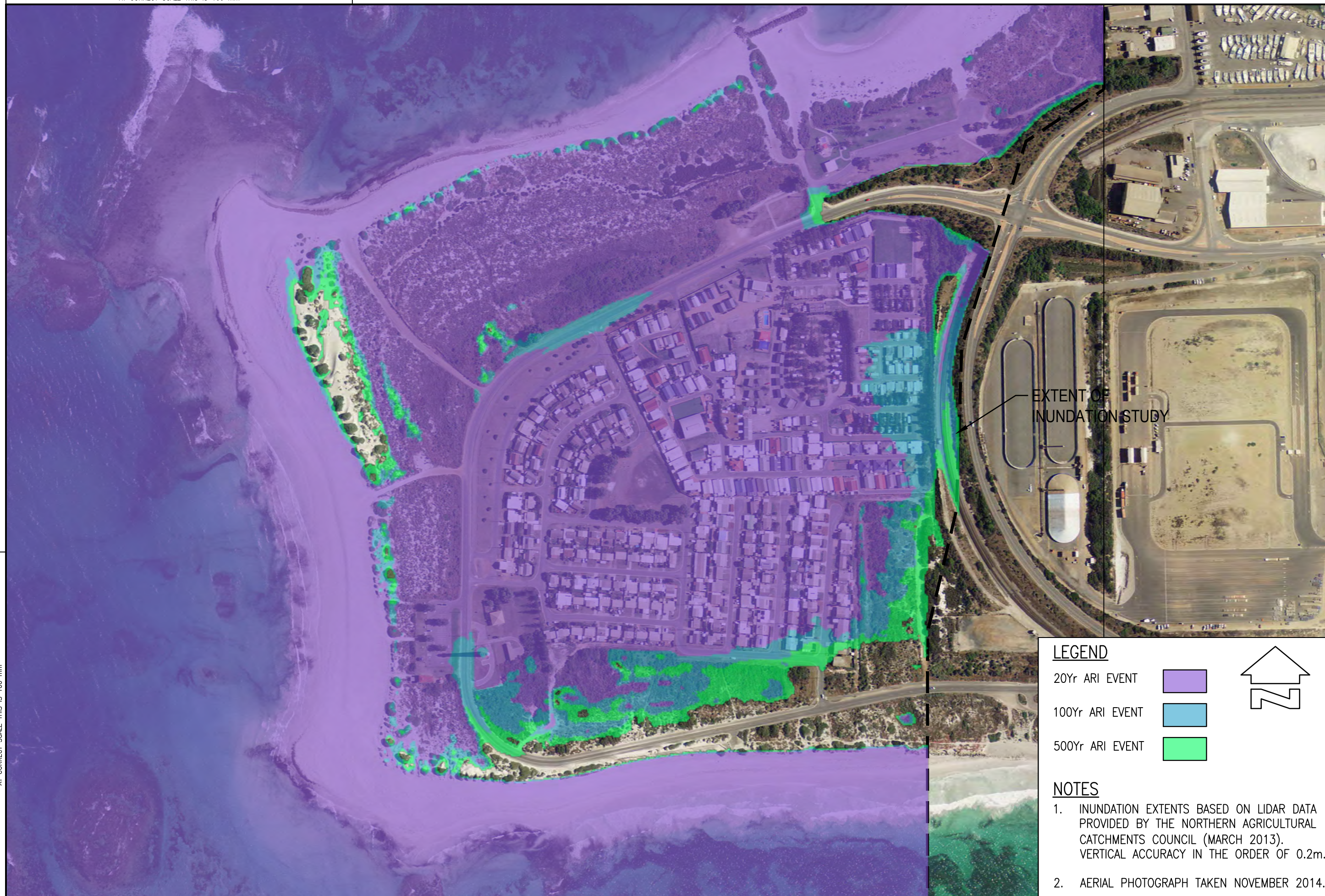


500Yr ARI EVENT



NOTES

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2. AERIAL PHOTOGRAPH TAKEN NOVEMBER 2014.



LEGEND

20Yr ARI EVENT



100Yr ARI EVENT

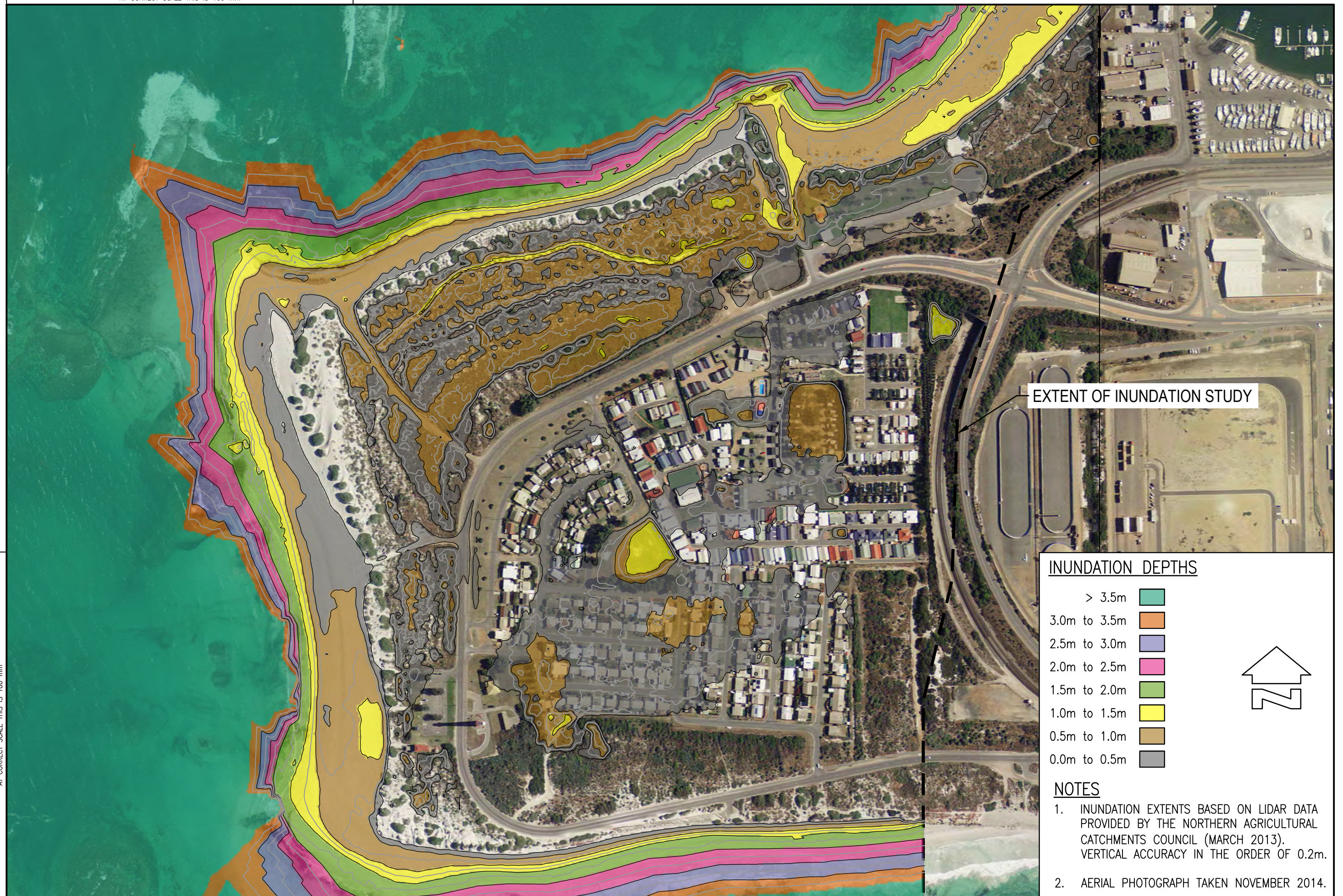


500Yr ARI EVENT



NOTES

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2. AERIAL PHOTOGRAPH TAKEN NOVEMBER 2014.



EXTENT OF INUNDATION STUDY

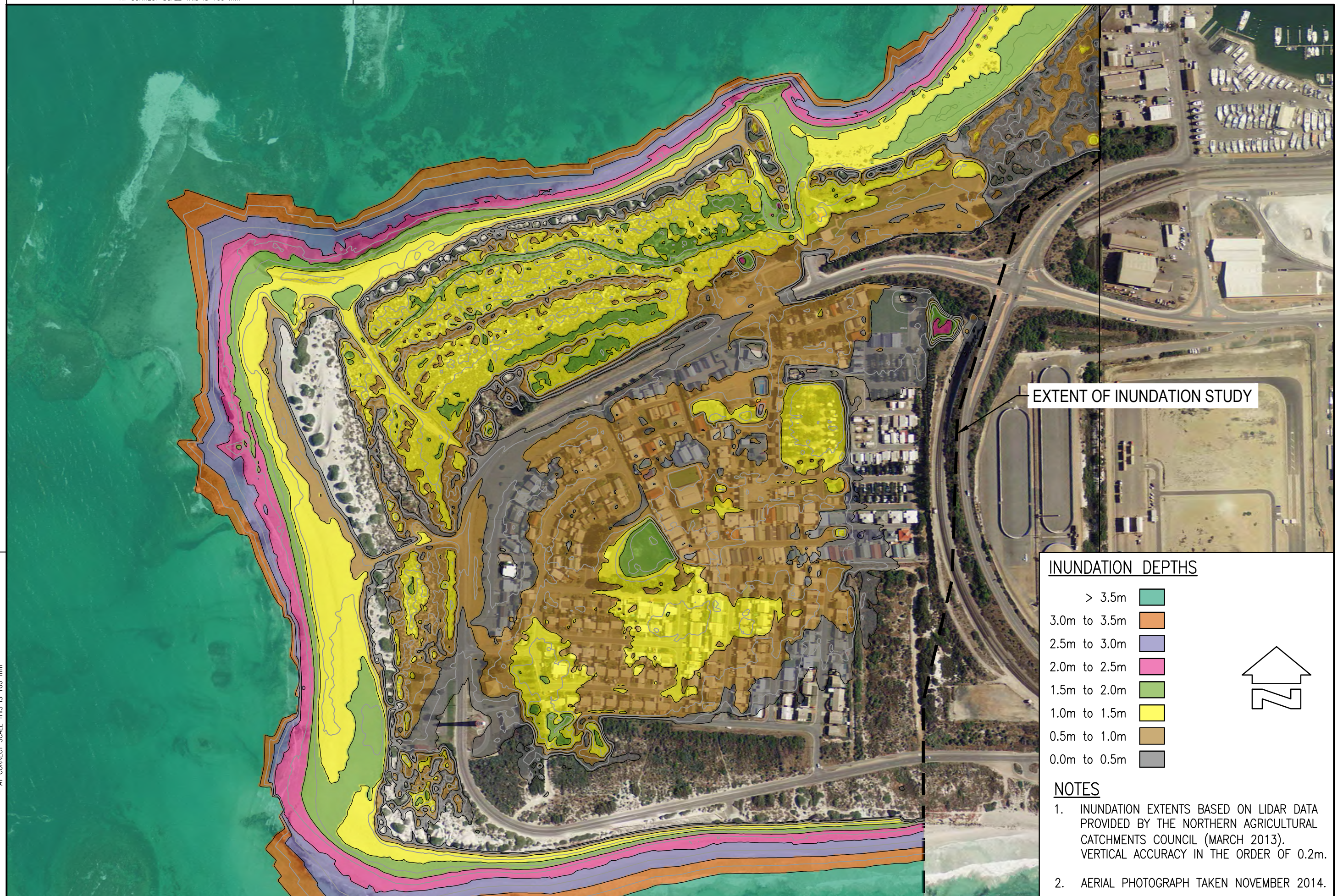
INUNDATION DEPTHS

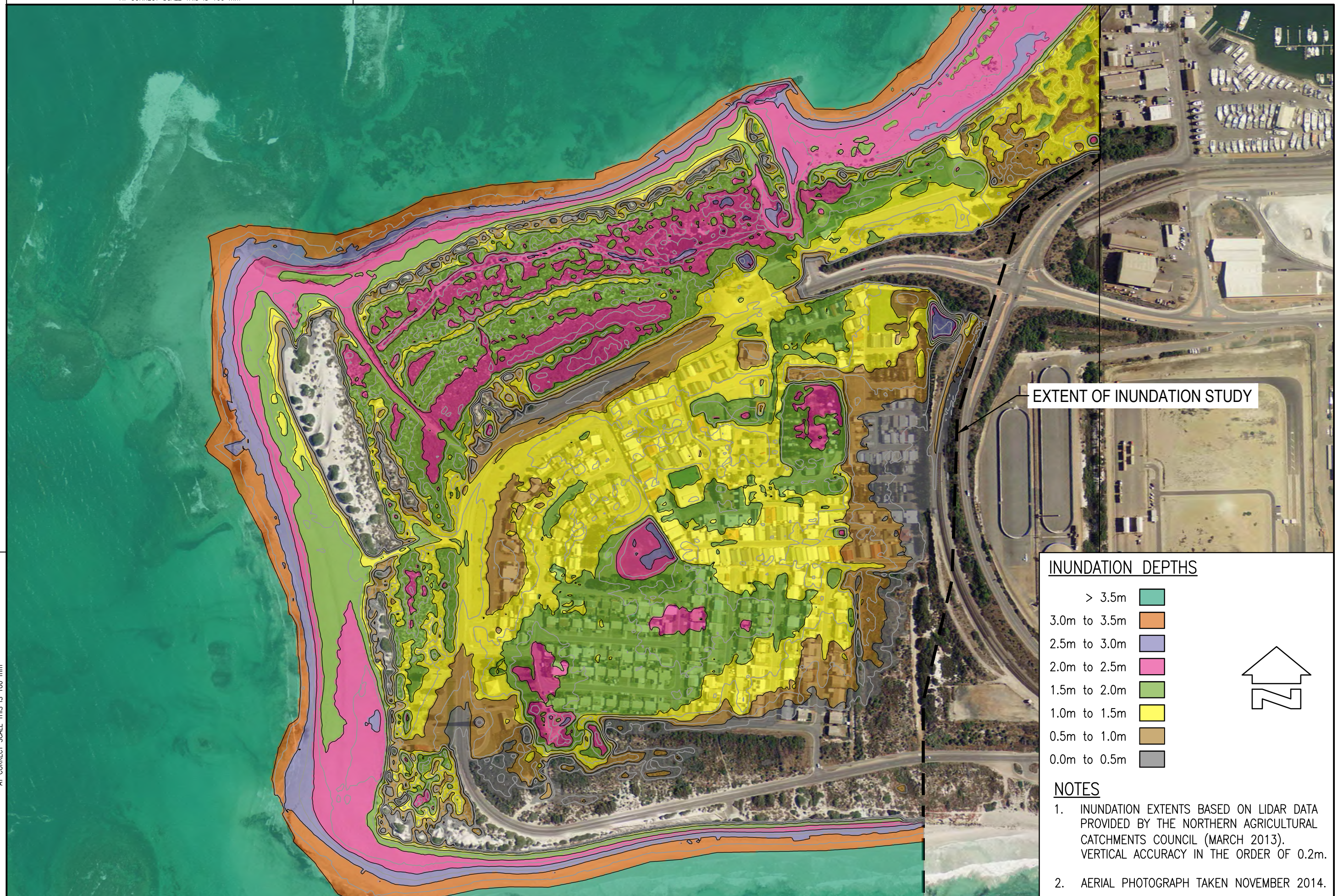
> 3.5m	
3.0m to 3.5m	
2.5m to 3.0m	
2.0m to 2.5m	
1.5m to 2.0m	
1.0m to 1.5m	
0.5m to 1.0m	
0.0m to 0.5m	



NOTES

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2. AERIAL PHOTOGRAPH TAKEN NOVEMBER 2014.





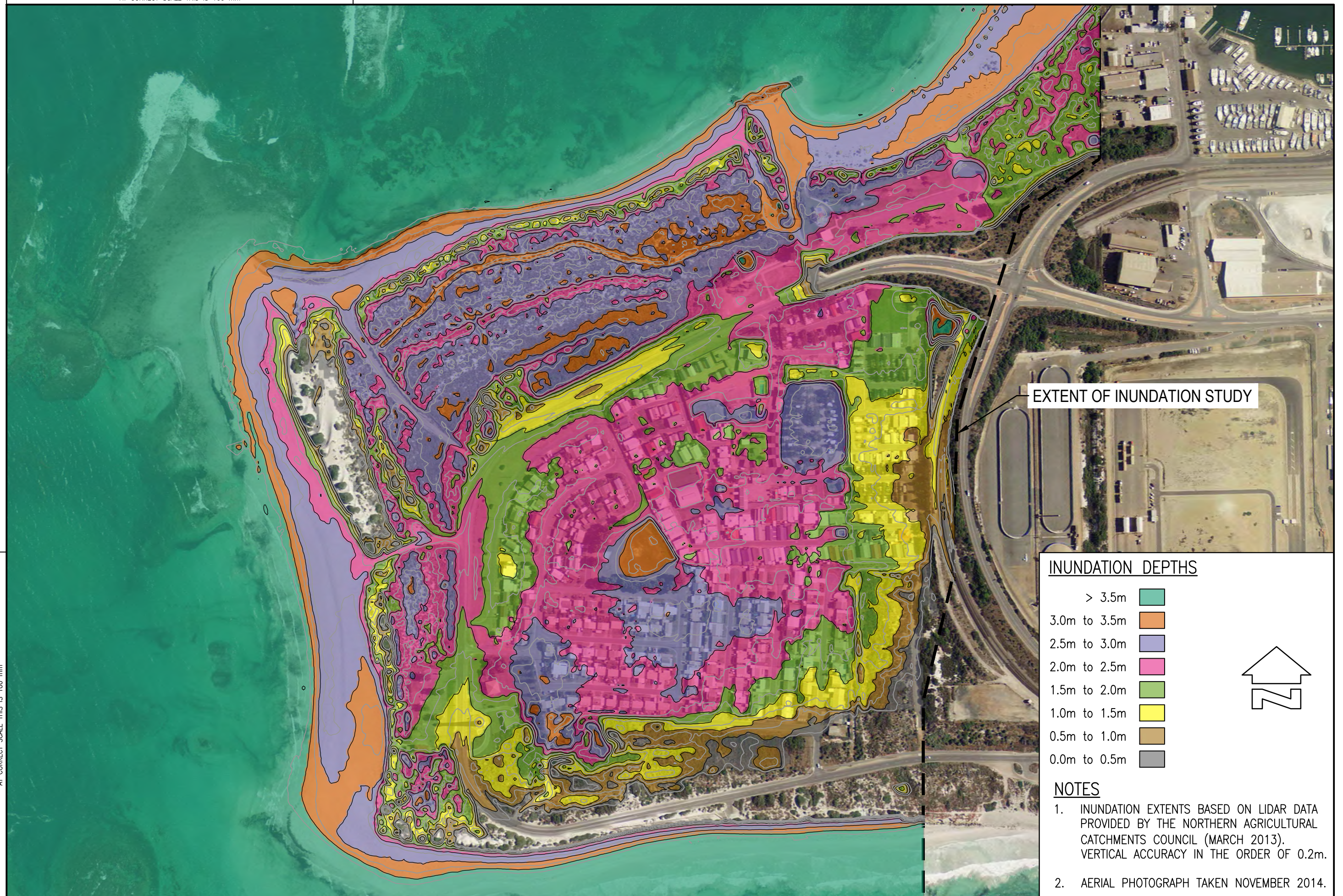
INUNDATION DEPTHS

> 3.5m	
3.0m to 3.5m	
2.5m to 3.0m	
2.0m to 2.5m	
1.5m to 2.0m	
1.0m to 1.5m	
0.5m to 1.0m	
0.0m to 0.5m	



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2. AERIAL PHOTOGRAPH TAKEN NOVEMBER 2014.



EXTENT OF INUNDATION STUDY

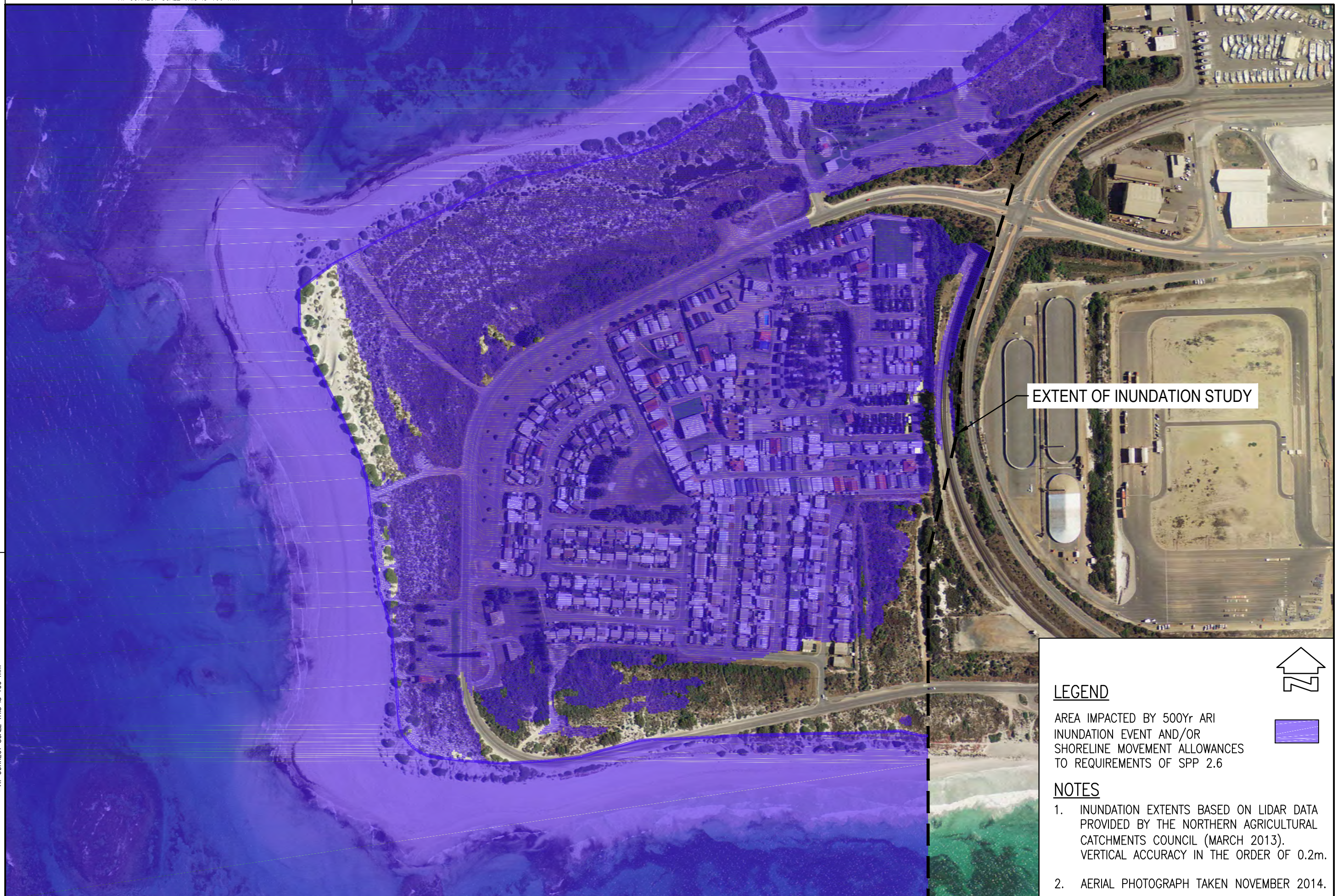
INUNDATION DEPTHS

> 3.5m	
3.0m to 3.5m	
2.5m to 3.0m	
2.0m to 2.5m	
1.5m to 2.0m	
1.0m to 1.5m	
0.5m to 1.0m	
0.0m to 0.5m	



NOTES

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2. AERIAL PHOTOGRAPH TAKEN NOVEMBER 2014.



EXTENT OF INUNDATION STUDY

LEGEND

AREA IMPACTED BY 500Yr ARI
INUNDATION EVENT AND/OR
SHORELINE MOVEMENT ALLOWANCES
TO REQUIREMENTS OF SPP 2.6



NOTES

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EXTENT OF INUNDATION STUDY

LEGEND

AREA IMPACTED BY 500Yr ARI
INUNDATION EVENT AND/OR
SHORELINE MOVEMENT ALLOWANCES
TO REQUIREMENTS OF SPP 2.6



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EXTENT OF INUNDATION STUDY

LEGEND

AREA IMPACTED BY 500Yr ARI
INUNDATION EVENT AND/OR
SHORELINE MOVEMENT ALLOWANCES
TO REQUIREMENTS OF SPP 2.6



NOTES

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2. AERIAL PHOTOGRAPH TAKEN NOVEMBER 2014.



EXTENT OF INUNDATION STUDY

LEGEND

AREA IMPACTED BY 500Yr ARI
INUNDATION EVENT AND/OR
SHORELINE MOVEMENT ALLOWANCES
TO REQUIREMENTS OF SPP 2.6



NOTES

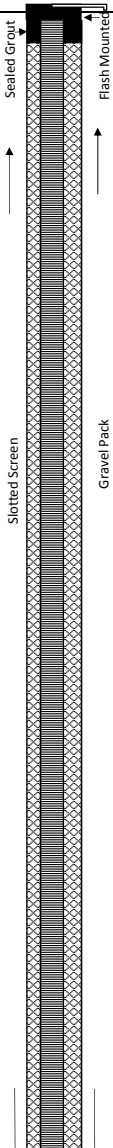
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2. AERIAL PHOTOGRAPH TAKEN NOVEMBER 2014.

Appendix C – Groundwater Monitoring Well Logs

Bore Log

ENVIRONMENTAL

Groundwater Well: MW1
Page: 1 of 3

Client		City of Greater Geraldton		Drill Co:		Harrington drilling		Easting		263, 938				
Project		Point Moore ROETDS		Driller:		James Harrington		Northing		6,814,127				
Job No.		6134536		Rig Type:		HD1		Grid Ref						
Location		Point Moore		Total Depth:		6		Elevation		2.608 (top of casing, mAHD)				
Date		15/08/2016		Diameter (mm):		50		Logged by		S Petts				
								Checked by		A. Nagle				
Depth (metres)	Drilling Method	Sample ID	Water	Well Details		Graphic	Lithological Description					Consistency	Moisture	CONTAMINANT INDICATORS
						Log	Soil Type (Classification Group Symbol); Particle ; Size; Colour; Secondary/Minor Component							
0.1		MW1_0.5					SM Fine Sand Brown Sub-angular Layer Quartz Weakly Cemented Minor loam Loam (gravel)						D	No odour, no signs of contamination
0.5													D	No sampling beyond 3 m, inadequate sample amount.
1.0		MW1_1.0											M	No odours or stains
1.5		MW1_1.5												No odours or stains
2.0		MW1_2.0											M	No odours or stains
2.5		MW1_2.5					SW Coarse Sand White Sub-angular Layer Quartz Weakly Cemented						W	No odours or stains
3.0		MW1_3.0											W	No odours or stains
3.5		MW1_3.5											W	No odours or stains
4.0		ns											W	No odours or stains
4.5		ns											W	No odours or stains
5.0		ns											W	No odours or stains
5.5		ns											W	No odours or stains
													W	No odours or stains

Bore Log

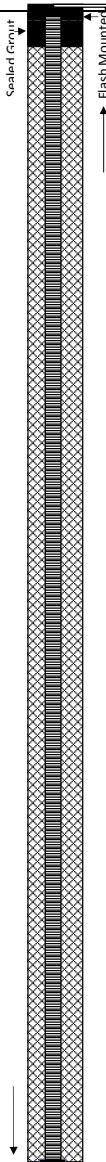
ENVIRONMENTAL

Groundwater Well: MW2
Page: 2 of 3

Client	City of Greater Geraldton			Drill Co:	Harrington Drilling		Easting	263,709	
Project	Point Moore ROETDS			Driller:	James Harrington		Northing	6,813,860	
Job No.	6134536			Rig Type:	HD1		Grid Ref		
Location	Point Moore			Total Depth:	6		Elevation	2.151 (top of casing, mAHD)	
Date	15/08/2016			Diameter (mm):	50		Logged by	S Petts	Checked by A. Nagle
Depth (metres)	Drilling Method	Sample ID	Water	Well Details	Graphic Log	Lithological Description	Consistency	Moisture	CONTAMINANT INDICATORS
						Soil Type (Classification Group Symbol); Particle; Size; Colour Secondary/ Minor Component			
0.1						SM Fine Fine Sand Brown Sub-angular Layer Quartz Weakly Cemented Minor Loam		D	No odours or stains
0.5		MW2_0.5 QC01 QC02						D	No odours or stains
1.0		MW2_1.0						M	No odours or stains
1.5		MW2_1.5							No odours or stains
2.0		MW2_2.0						M	No odours or stains
2.5		MW2_2.5				SW Medium Medium Sand brown to Layer Quartz White Sub-angular Weakly Cemented		W	No odours or stains
3.0		ns no sample retrievable						W	No odours or stains
3.5		MW2_3.5						W	No odours or stains
4.0		MW2_4.0						W	No odours or stains
4.5		MW2_4.5				SW Coarse Coarse Sand Grey Sub-angular Layer Quartz Weakly Cemented		W	No odours or stains
5.0		MW2_5.0						W	No odours or stains
5.5		MW2_5.5						W	No odours or stains
		MW2_6.0						W	No odours or stains

Bore Log
ENVIRONMENTAL

Groundwater Well: MW3
Page: 3 of 3

Client	City of Greater Geraldton			Drill Co:	Harrington Drilling		Easting	263,934				
Project	Point Moore ROETDs			Driller:	James Harrington		Northing	6,813,674				
Job No.	6134536			Rig Type:	HD1		Grid Ref					
Location	Point Moore			Total Depth:	6m		Elevation	3.009 (top of casing, mAHD)				
Date	15/08/2016			Diameter (mm):	50		Logged by	S Petts				
							Checked by	A. Nagle				
Depth (metres)	Drilling Method	Sample ID	Water	Well Details	Graphic Log	Lithological Description				Consistency	Moisture	CONTAMINANT INDICATORS Odours, staining, waste materials separate phase, liquids, imported fill, ash.
						Soil Type (Classification Group Symbol); Particle; Size; Colour; Secondary/Minor Component						
0.1						SP Fine Fine Sand Brown Sub-angular Layer Quartz Weakly Cemented very minor loam					D	No odours or stains
0.5		MW3_0.5 QC03 QC04									D	No odours or stains
1.0		MW3_1.0									M	No odours or stains
1.5		MW3_1.5										No odours or stains
2.0		MW3_2.0				SP Fine Medium Sand White Sub-angular Layer Quartz Weakly Cemented					M	No odours or stains
2.5		MW3_2.5									W	No odours or stains
3.0		MW3_3.0	↓								W	No odours or stains
3.5		MW3_3.5									W	No odours or stains
4.0		MW3_4.0				SW Coarse Coarse Sand Grey Sub-angular Layer Quartz Weakly Cemented shell grit					W	No odours or stains
4.5		MW3_4.5									W	No odours or stains
5.0		MW3_5.0				SM Fine Fine Sand Grey Sub-angular Layer Quartz					W	No odours or stains
5.5		MW3_5.5									W	No odours or stains
		MW3_6.0				Limestone Layer					W	

Appendix D – Groundwater Quality Field Data Sheets



Groundwater Monitoring – Data Sheet

Client: CGG							BORE ID: MW1							
Project: Point Moore Groundwater Assessment							Job No.: 6134772							
Location: Marine Terrace			Casing diameter:		50 mm		Total Depth: 5.99 m							
BORE CONSTRUCTION														
Head-works	☒ Flush		☐ Monument		☐ Casing		☐ Locked		Datum Point	☒ Cover/ Monument		☐ Inner Casing		Datum Elev.: 2.608m ☐ Local ☒ AHD
PURGING DETAILS														
Method:		Date: 2016				Undertaken By: S.Petts			Flow Rate: 0.005 L/S					
PID reading: N/A		Water Column: 3.57 m				Req Purge Vol. ¹: N/A			Actual Vol. Purged:					
	Time	Depth to LNAPL (m)		Depth to water (m)		Depth to DNAPL (m)								
Start	0830	-		2.36		-								
Finish	0930	-		2.36		-								
PURGING MEASUREMENTS ²														
Vol. Purged (L)	Elapsed Time (min)	Spec. Cond. (µS/cm)	Act. Cond. (µS/cm)	TDS (ppt)	Temp. (°C)	Salinity (ppt)	pH	DO %Sat	DO (mg/L)	ORP (mV)	Comments – Turbidity, Colour, Odour, etc.			
1	5	20,050	18,085	13.03	20.2	12.1	7.31	98.45	9.20	-164	Colourless, minor sulphur type odour			
2	10	19,116	17,708	56.2	21.1	11.5	7.33	94.20	6.14	-199				
3	12	18,647	17,451	51.2	21.5	11.2	7.34	86.14	5.59	-202				
4	15	17,233	18,439	42.1	21.6	11.0	7.35	55.64	5.03	-207				
5	17	17,910	16,782	45.3	21.7	10.7	7.36	50.96	4.60	-210				
		+/-3.0%			+/-3.0%		+/- 0.1	+/-10%	+/-3.0%	+/- 10 mV				
Comments (e.g. condition of headworks, colour, odour):														
SAMPLING DETAILS						Sample ID: MW1								
Date		Time:				Undertaken By: S Petts								
PID reading: N/A		Depth to LNAPL: N/A				Depth to Water: 2.42m		Depth to DNAPL: N/A						
Flow Rate: 0.005 L/s		Vol. Removed: 5L				Sampling Method: Low Flow								
Temp.: 21.7 °C		DO: 4.60 mg/L				pH: 7.36		Spec. Cond: 17,910 uS/cm		ORP: -210 mV				
DO: 50.9%Sat		Salinity: 10.7 ppt				TDS: 45.3 ppt								
Comments (e.g. containers, filtration): QC01 - Blind, QC02 – Split, QC03 – Rinsate, QC04 – Field Blank														
CoC Number: 24082015						Checked by: Steven Petts			Date: 24/08/2016					

- 1 Bores to be purged dry, until pH, T and EC readings stabilise or a minimum of 3 to 5 times the water column volumes. Water column volumes can be calculated from the following casing volumes per unit length: 40 mm ID - 1 L/m; 50 mm ID – 2 L/m; 100 mm ID 8 L/m.
- 2 Calibration details to be recorded in the instrument –specific calibration book, or in field notes as required by local procedures.



Groundwater Monitoring – Data Sheet

Client: CGG						BORE ID: MW2					
Project: Point Moore Groundwater Assessment						Job No.: 6134772					
Location: Captains Cres			Casing diameter: 50 mm			Total Depth: 6.10 m					
BORE CONSTRUCTION											
Head-works	☒ Flush		☐ Monument		☐ Casing	☐ Locked	Datum Point	☒ Cover/ Monument		☐ Inner Casing	Datum Elev.: 2.151m ☐ Local ☒ AHD
PURGING DETAILS											
Method: Low Flow		Date: 24/08/2016				Undertaken By: S.Petts			Flow Rate: 0.008 L/S		
PID reading: N/A		Water Column: 4.24 m				Req Purge Vol. ¹: N/A			Actual Vol. Purged:		
	Time	Depth to LNAPL (m)		Depth to water (m)		Depth to DNAPL (m)					
Start	1000	-		1.78		-					
Finish	1100	-		1.78		-					
PURGING MEASUREMENTS ²											
Vol. Purged (L)	Elapsed Time (min)	Spec. Cond. (µS/cm)	Act. Cond. (µS/cm)	TDS (ppt)	Temp. (°C)	Salinity (ppt)	pH	DO %Sat	DO (mg/L)	ORP (mV)	Comments – Turbidity, Colour, Odour, etc.
1	2	15,159	12,459	234.4	15.6	8.88	8.42	86.6	8.99	-164	Colourless, minor H ₂ S odour
2	4	2,637	2,274	755.3	17.8	1.37	8.34	61.7	6.1	-162	
3	6	2,970	3,283	64.87	20.2	1.73	7.47	29.6	2.8	-205	
4	8	3,408	3,107	72.1	20.4	1.81	7.37	24.5	2.3	-206	
5	10	3,419	3,125	74.0	20.5	1.81	7.43	22.1	2.1	-207	
6	12	3,450	3,128	74.2	20.6	1.81	7.48	22.5	2.2	-207	
7	14	3,500	3,150	75.1	20.6	1.81	7.45	22.2	2.1	-206	
		+/-3.0%			+/-3.0%		+/- 0.1	+/-10%	+/-3.0%	+/- 10 mV	
Comments (e.g. condition of headworks, colour, odour):											
SAMPLING DETAILS						Sample ID: MW2					
Date: 24/08/2016		Time: 11:00		Undertaken By: S Petts							
PID reading: N/A		Depth to LNAPL: N/A		Depth to Water: 1.86 m			Depth to DNAPL: N/A				
Flow Rate: 0.008 L/s		Vol. Removed: 7 L		Sampling Method: Low Flow							
Temp.: 21.7 °C		DO: 2.08 mg/L		pH: 7.43		Spec. Cond: 3,419 uS/cm			ORP: -207 mV		
DO: 22.1 %Sat		Salinity: 1.81 ppt		TDS: 2.22 ppt							
Comments (e.g. containers, filtration):											
CoC Number: 24082015						Checked by: Steven Petts			Date: 24/08/2016		

- Bores to be purged dry, until pH, T and EC readings stabilise or a minimum of 3 to 5 times the water column volumes. Water column volumes can be calculated from the following casing volumes per unit length: 40 mm ID - 1 L/m; 50 mm ID - 2 L/m; 100 mm ID 8 L/m.
- Calibration details to be recorded in the instrument –specific calibration book, or in field notes as required by local procedures.



Groundwater Monitoring – Data Sheet

Client: CGG							BORE ID: MW3				
Project: Point Moore Groundwater Assessment							Job No.: 6134772				
Location: Astrolabe Ln			Casing diameter:			50 mm	Total Depth: 5.84 m				
BORE CONSTRUCTION											
Head-works	☒ Flush	☐ Monument	☐ Casing	☐ Locked	Datum Point	☒ Cover/ Monument	☐ Inner Casing	Datum Elev.: 3.009m ☐ Local ☒ AHD			
PURGING DETAILS											
Method: Low Flow		Date: 24/08/2016			Undertaken By: S.Petts			Flow Rate: 0.004 L/S			
PID reading: N/A		Water Column: 3.13 m			Req Purge Vol. ¹ : N/A			Actual Vol. Purged:			
	Time	Depth to LNAPL (m)		Depth to water (m)			Depth to DNAPL (m)				
Start	1100	-		2.67			-				
Finish	1200	-		2.67			-				
PURGING MEASUREMENTS ²											
Vol. Purged (L)	Elapsed Time (min)	Spec. Cond. (µS/cm)	Act. Cond. (µS/cm)	TDS (ppt)	Temp. (°C)	Salinity (ppt)	pH	DO %Sat	DO (mg/L)	ORP (mV)	Comments – Turbidity, Colour, Odour, etc.
1	4	2,333	2,259	41.3	23.3	1.21	7.84	22.6	2.1	-192	Minor particulates, colourless, H ₂ S odour
2	8	2,415	2,300	42.0	23.4	1.21	7.83	22.7	2.1	-193	
3	12	2,336	2,261	36.4	23.3	1.21	7.81	22.6	2.05	-196	
4	16	2,314	2,248	33.1	23.4	1.20	7.83	17.9	1.69	-204	
5	20	2,219	2,233	34.9	23.7	1.19	7.83	14.2	1.28	-211	
		+/-3.0%			+/-3.0%		+/- 0.1	+/-10%	+/-3.0%	+/- 10 mV	
Comments (e.g. condition of headworks, colour, odour):											
SAMPLING DETAILS						Sample ID: MW3					
Date: 24/08/2016		Time: 1145		Undertaken By: S Petts							
PID reading: N/A		Depth to LNAPL: N/A		Depth to Water: 2.71 m			Depth to DNAPL: N/A				
Flow Rate: 0.04 L/s		Vol. Removed: 5L		Sampling Method: Low Flow							
Temp.: 23.7 °C		DO: 1.28 mg/L		pH: 7.83		Spec. Cond: 2,219 uS/cm			ORP: -211 mV		
DO: 14.2%Sat		Salinity: 1.19 ppt		TDS: 34.9 ppt							
Comments (e.g. containers, filtration):											
CoC Number: 24082015				Checked by: Steven Petts				Date: 24/08/2016			

- 1 Bores to be purged dry, until pH, T and EC readings stabilise or a minimum of 3 to 5 times the water column volumes. Water column volumes can be calculated from the following casing volumes per unit length: 40 mm ID - 1 L/m; 50 mm ID – 2 L/m; 100 mm ID 8 L/m.
- 2 Calibration details to be recorded in the instrument –specific calibration book, or in field notes as required by local procedures.



Groundwater Monitoring – Data Sheet

Client: CGG						BORE ID: SHP8					
Project: Point Moore Groundwater Assessment						Job No.: 6134772					
Location: Coxswain Park			Casing diameter: 50 mm			Total Depth: 4.72 m					
BORE CONSTRUCTION											
Head-works	☐ Flush		☒ Monument		☒ Casing	☐ Locked	Datum Point	☒ Cover/ Monument	☐ Inner Casing	Datum Elev.: 2.427m	
										☐ Local ☒ AHD	
PURGING DETAILS											
Method: Low Flow		Date: 24/08/2016				Undertaken By: S.Petts			Flow Rate: 0.005 L/S		
PID reading: N/A		Water Column: 2.42 m				Req Purge Vol. ¹: N/A			Actual Vol. Purged:		
	Time	Depth to LNAPL (m)		Depth to water (m)		Depth to DNAPL (m)					
Start	1230	-		2.1		-					
Finish	1330	-		2.1		-					
PURGING MEASUREMENTS ²											
Vol. Purged (L)	Elapsed Time (min)	Spec. Cond. (µS/cm)	Act. Cond. (µS/cm)	TDS (ppt)	Temp. (°C)	Salinity (ppt)	pH	DO %Sat	DO (mg/L)	ORP (mV)	Sal(ppt) Comments – Turbidity, Colour, Odour, etc.
1	5	6,410	5,917	6.99	20.98	3.54	7.72	31.2	3.2	-221	Colourless, H ₂ S odour
2	7	6,497	5,987	5.58	20.95	3.57	7.72	30.2	3.1	-222	
3	9	6,587	5,974	5.01	20.91	3.58	7.73	30.1	3.1	-221	
4	11	6,588	5,879	5.01	20.91	3.58	7.73	29.3	3.01	-221	
5	13	6,496	5,988	4.22	20.91	3.59	7.73	29.3	3.01	-221	
		+/-3.0%			+/-3.0%		+/- 0.1	+/-10%	+/-3.0%	+/- 10 mV	
Comments (e.g. condition of headworks, colour, odour):											
SAMPLING DETAILS						Sample ID: SHP8					
Date: 24/08/2016		Time: 13:20				Undertaken By: S Petts					
PID reading: N/A		Depth to LNAPL: N/A				Depth to Water: 2.3 m		Depth to DNAPL: N/A			
Flow Rate: -L/s		Vol. Removed: 5 L				Sampling Method: Low Flow					
Temp.: 20.9 °C		DO: 29.32 mg/L				pH: 7.73		Spec. Cond: 6,696 uS/cm		ORP: -221 mV	
DO: 29.3% Sat		Salinity: 3.59 ppt				TDS: 24.80 ppt					
Comments (e.g. containers, filtration):											
CoC Number: 24082015						Checked by: Steven Petts				Date: 24/08/2016	

- 1 Bores to be purged dry, until pH, T and EC readings stabilise or a minimum of 3 to 5 times the water column volumes. Water column volumes can be calculated from the following casing volumes per unit length: 40 mm ID - 1 L/m; 50 mm ID – 2 L/m; 100 mm ID 8 L/m.
- 2 Calibration details to be recorded in the instrument –specific calibration book, or in field notes as required by local procedures



Groundwater Monitoring – Data Sheet

Client: CGG				BORE ID: MW1					
Project: Point Moore Groundwater Assessment				Job No.: 6134772					
Location: Marine Terrace		Casing diameter:		Location: Marine		Total Depth: 5.93			
BORE CONSTRUCTION									
Head-works	☒ Flush	☐ Monument	☐ Casing	☐ Locked	Datum Point	☐ Cover/ Monument	☒ Inner Casing		
					Datum Elev.:	m	☐ Local ☒ AHD		
PURGING DETAILS									
Method: Low Flow Pump		Date: 2016		Undertaken By: S.Petts		Flow Rate: L/s			
PID reading: N/Appm		Water Column: 3.5m		Req Purge Vol. ¹: -L		Actual Vol. Purged: -L			
	Time	Depth to LNAPL (m)		Depth to water (m)		Depth to DNAPL (m)			
Start	09:00	-		2.43		-			
Finish	10:15	-		2.43		-			
PURGING MEASUREMENTS ²									
Vol. Purged (L)	Elapsed Time (min)	EC (mS/cm)	Temp. (°C)	Salinity (ppm)	pH	DO %Sat	DO (ppm)	Eh (mV)	Comments – Turbidity, Colour, Odour, etc.
1	10	31.6	28.1	-	6.94	-	1.08	-282	SO ₂ odour, colourless, suspended solids
2	14	31.7	28.1	-	6.97	-	0.3	-283	
3	18	31.7	28.1	-	6.96	-	0.36	-276	
4	23	31.6	28.3	-	6.93	-	0.4	-273	
		+/-3.0%	+/-3.0%		+/- 0.1	+/-10%	+/-3.0%	+/- 10 mV	
Comments (e.g. condition of headworks, colour, odour):									
SAMPLING DETAILS					Sample ID: MW1				
Date 22/09/2016		Time: 10:00			Undertaken By: S Petts				
PID reading: - ppm		Depth to LNAPL: - m			Depth to Water: 2.43 m		Depth to DNAPL - m		
Flow Rate: 0.09L/s	Vol. Removed: 4L			Sampling Method: Low Flow					
Temp.: 28.3°C	DO: 0.4 -ppm mg/L			pH: 6.93		EC: 31.6 mS/cm		Eh: -273 mV	
	DO:- %Sat					Salinity: -ppm mg/L			
Comments (e.g. containers, filtration): QC01_20160922, RB - QC03_20160922, FB - QC04_20160922									
CoC Number: 20160922				Checked by: S Petts			Date: 22/09/2016		

- 1 Bores to be purged dry, until pH, T and EC readings stabilise or a minimum of 3 to 5 times the water column volumes. Water column volumes can be calculated from the following casing volumes per unit length: 40 mm ID - 1 L/m; 50 mm ID – 2 L/m; 100 mm ID 8 L/m.
- 2 Calibration details to be recorded in the instrument –specific calibration book, or in field notes as required by local procedures.



Groundwater Monitoring – Data Sheet

Client: CGG				BORE ID: MW2					
Project: Point Moore Groundwater Assessment				Job No.: 6134772					
Location: Captain Cres		Casing diameter: 50 mm		Total Depth: 6.03					
BORE CONSTRUCTION									
Head-works	☒ Flush	☐ Monument	☐ Casing Locked	Datum Point	☐ Cover/ Monument	☒ Inner Casing	Datum Elev.: m ☒ AHD		
PURGING DETAILS									
Method: Low Flow Pump		Date: 22/09/2016		Undertaken By: S.Petts		Flow Rate: 0.07L/s			
PID reading: N/Appm		Water Column: 4.2m		Req Purge Vol. ¹ : -L		Actual Vol. Purged: -L			
	Time	Depth to LNAPL (m)		Depth to water (m)		Depth to DNAPL (m)			
Start	10:15	-		1.83		-			
Finish	11:30	-		1.83					
PURGING MEASUREMENTS ²									
Vol. Purged (L)	Elapsed Time (min)	EC (mS/cm)	Temp. (°C)	Salinity (ppm)	pH	DO %Sat	DO (ppm)	Eh (mV)	Comments – Turbidity, Colour, Odour, etc.
1	4	2.63	25.7	-	7.06	-	1.02	-33	Colourless, Odourless, some suspended solids
2	8	2.6	25.7	-	7.05	-	1.02	-30	
3	13	2.4	25.8	-	7.04	-	0.94	-36	
4	17	2.41	25.7	-	7.06	-	0.94	-35	
5	20	2.36	25.6	-	7.07	-	0.93	-35	
6	24	2.38	25.5	-	7.10	-	0.91	-37	
7	29	2.38	25.4	-	7.11	-	0.88	-39	
		+/-3.0%	+/-3.0%		+/- 0.1	+/-10%	+/-3.0%	+/- 10 mV	
Comments (e.g. condition of headworks, colour, odour):									
SAMPLING DETAILS					Sample ID: MW2				
Date 22/09/2016		Time: 11:00		Undertaken By: S Petts					
PID reading: - ppm		Depth to LNAPL: - m		Depth to Water: 1.83 m		Depth to DNAPL - m			
Flow Rate: 0.07L/s		Vol. Removed: 7L		Sampling Method: Low Flow					
Temp.: 25.4 °C		DO: 0.88 -ppm mg/L		pH: 6.11		EC: 2.38 mS/cm		Eh: -39mV	
		DO: -% Sat				Salinity: -ppm mg/L			
Comments (e.g. containers, filtration):									
CoC Number: 20160922			Checked by: S Petts			Date: 22/09/2016			

1 Bores to be purged dry, until pH, T and EC readings stabilise or a minimum of 3 to 5 times the water column volumes. Water column volumes can be calculated from the following casing volumes per unit length: 40 mm ID - 1 L/m; 50 mm ID – 2 L/m; 100 mm ID 8 L/m.



Groundwater Monitoring – Data Sheet

Client: CGG				BORE ID: MW3					
Project: Point Moore Groundwater Assessment				Job No.: 6134772					
Location: Astrolabe Ln		Casing diameter: 50 mm		Total Depth: 5.90 m					
BORE CONSTRUCTION									
Head-works	☒ Flush	☐ Monument	☐ Casing	☐ Locked	Datum Point	☐ Cover/ Monument	☒ Inner Casing		
					Datum Elev.: m	☐ Local	☒ AHD		
PURGING DETAILS									
Method: Low Flow		Date: 2016		Undertaken By: S.Petts		Flow Rate: 0.09L/s			
PID reading: N/Appm		Water Column: m		Req Purge Vol. ¹ : L		Actual Vol. Purged: L			
	Time	Depth to LNAPL (m)		Depth to water (m)		Depth to DNAPL (m)			
Start	1200	-		2.68		-			
Finish	1240	-		2.68					
PURGING MEASUREMENTS ²									
Vol. Purged (L)	Elapsed Time (min)	EC (mS/cm)	Temp. (°C)	Salinity (ppm)	pH	DO %Sat	DO (ppm)	Eh (mV)	Comments – Turbidity, Colour, Odour, etc.
1	10	2.84	27.9	-	7.42	-	0.42	-170	Colourless, SO ₂ odour, suspended solids
2	14	2.80	28.0	-	7.39	-	0.21	-202	
3	18	2.72	28.1	-	7.35	-	0.13	-227	
4	22	2.62	28.1	-	7.34	-	0.09	-240	
5	26	2.56	28.1	-	7.34	-	0.06	-249	
		+/-3.0%	+/-3.0%		+/- 0.1	+/-10%	+/-3.0%	+/- 10 mV	
Comments (e.g. condition of headworks, colour, odour):									
SAMPLING DETAILS					Sample ID: MW3				
Date 22/09/2016		Time:12:30			Undertaken By: S Petts				
PID reading: - ppm		Depth to LNAPL: - m			Depth to Water: 2.68 m		Depth to DNAPL - m		
Flow Rate: 0.09 L/s	Vol. Removed: 9L		Sampling Method: Low Flow Pump						
Temp.: 27.8 °C	DO: -ppm mg/L		pH: 5.95		EC: 5.95 mS/cm		Eh: -10mV		
	DO: 71.8%Sat				Salinity: -ppm mg/L				
Comments (e.g. containers, filtration):									
All metals field filtered									
CoC Number: 20160922			Checked by: S Petts			Date: 22/09/2016			

- 1 Bores to be purged dry, until pH, T and EC readings stabilise or a minimum of 3 to 5 times the water column volumes. Water column volumes can be calculated from the following casing volumes per unit length: 40 mm ID - 1 L/m; 50 mm ID - 2 L/m; 100 mm ID 8 L/m.
- 2 Calibration details to be recorded in the instrument –specific calibration book, or in field notes as required by local procedures.



Groundwater Monitoring – Data Sheet

Client: CGG				BORE ID: SHP8					
Project: Point Moore Groundwater Assessment				Job No.: 6134772					
Location: Coxswain Park		Casing diameter: 50 mm		Total Depth: 4.76 m					
BORE CONSTRUCTION									
Head-works	☐ Flush	☒ Monument	☐ Casing Locked	Datum Point	☐ Cover/ Monument	☒ Inner Casing	Datum Elev.: m ☒ AHD		
PURGING DETAILS									
Method: Low Flow		Date: 2016		Undertaken By: S.Petts		Flow Rate: L/s			
PID reading: N/A ppm		Water Column: 1.8 m		Req Purge Vol. ¹ : -L		Actual Vol. Purged: 8L			
	Time	Depth to LNAPL (m)		Depth to water (m)		Depth to DNAPL (m)			
Start	1310	-		2.08		-			
Finish	1340	-		2.08					
PURGING MEASUREMENTS ²									
Vol. Purged (L)	Elapsed Time (min)	EC (mS/cm)	Temp. (°C)	Salinity (ppm)	pH	DO %Sat	DO (ppm)	Eh (mV)	Comments – Turbidity, Colour, Odour, etc.
1	5	11.49	27.6	-	6.89		0.67	-285	Colourless, SO ₂ odour, suspended solids
2	10	8.95	27.5		6.74		0.2	301	
3	15	8.94	28		6.73		0.09	-308	
4	17	9.04	27.7		6.67		0.16	287	
5	20	9.06	27.7		6.63		0.07	300	
6	23	8.97	27.7		6.58		0.05	-306	
		+/-3.0%	+/-3.0%		+/- 0.1	+/-10%	+/-3.0%	+/- 10 mV	
Comments (e.g. condition of headworks, colour, odour):									
SAMPLING DETAILS					Sample ID: SHP8				
Date 22/09/2016		Time: 1330		Undertaken By: S Petts					
PID reading: - ppm		Depth to LNAPL: - m		Depth to Water: 2.08 m		Depth to DNAPL - m			
Flow Rate: 0.06L/s	Vol. Removed: 6L		Sampling Method: Low Flow						
Temp.: 27.7 °C	DO: 0.05 -ppm mg/L		pH: 6.58	EC: 8.97 mS/cm		Eh: -306mV			
	DO: -%Sat			Salinity: -ppm mg/L					
Comments (e.g. containers, filtration):									
All metals field filtered									
CoC Number: 20160310			Checked by: S Petts			Date: 22/9/16			

- Bores to be purged dry, until pH, T and EC readings stabilise or a minimum of 3 to 5 times the water column volumes. Water column volumes can be calculated from the following casing volumes per unit length: 40 mm ID - 1 L/m; 50 mm ID – 2 L/m; 100 mm ID 8 L/m.
- Calibration details to be recorded in the instrument –specific calibration book, or in field notes as required by local procedures.



Groundwater Monitoring – Data Sheet

Client: CGG				BORE ID: MW1					
Project: Point Moore Groundwater Assessment				Job No.: 6134772					
Location: Marine Terrace		Casing diameter:		Location: Marine		Total Depth: 5.91			
BORE CONSTRUCTION									
Head-works	☒ Flush	☐ Monument	☐ Casing	☐ Locked	Datum Point	☐ Cover/ Monument	☒ Inner Casing		
					Datum Elev.:	☐ Local	☒ AHD		
PURGING DETAILS									
Method: Low Flow Pump		Date: 2016		Undertaken By: S.Petts		Flow Rate: 0.006L/s			
PID reading: N/Appm		Water Column: 3.51 m		Req Purge Vol. ¹: -L		Actual Vol. Purged: -L			
	Time	Depth to LNAPL (m)		Depth to water (m)		Depth to DNAPL (m)			
Start	8:30	-		2.41		-			
Finish	1000	-		2.41		-			
PURGING MEASUREMENTS ²									
Vol. Purged (L)	Elapsed Time (min)	EC (mS/cm)	Temp. (°C)	Turbidity (NTU)	pH	DO %Sat	DO (ppm)	Eh (mV)	Comments – Turbidity, Colour, Odour, etc.
1	5	20.7	28.1	6.7	7.34	7.4	-	-289	S2O odour, some TSS, colourless
2	8	17.23	27.9	9.7	7.32	11.4	-	-279	
3	10	16.26	27.9	9.1	7.44	23.6	-	-274	
4	12	16.11	27.9	7.5	7.46	14.8	-	-273	
5	15	15.89	27.9	8.4	7.48	15.4	-	-272	
6	18	15.82	27.9	5.2	7.50	15.4	-	-271	
		+/-3.0%	+/-3.0%		+/- 0.1	+/-10%	+/-3.0%	+/- 10 mV	
Comments (e.g. condition of headworks, colour, odour):									
SAMPLING DETAILS					Sample ID: MW1				
Date: 18/10/2016		Time: 10:00			Undertaken By: S Petts				
PID reading: - ppm		Depth to LNAPL: - m			Depth to Water: 2.41 m		Depth to DNAPL - m		
Flow Rate: 0.006 L/s	Vol. Removed: 6L			Sampling Method: Low Flow					
Temp.: 27.9 °C	DO: -ppm mg/L			pH: 7.50		EC: 15.82 mS/cm		Eh: -271 mV	
	DO: 15.4 %Sat					Turbidity 5.2 NTU			
Comments (e.g. containers, filtration): QC01_20161018(blind), QC02_20161018(split), QC03_20161018 (RB)									
QC04_20161018(FB)									
CoC Number: 20161018			Checked by: S Petts			Date: 18/10/2016			

- 1 Bores to be purged dry, until pH, T and EC readings stabilise or a minimum of 3 to 5 times the water column volumes. Water column volumes can be calculated from the following casing volumes per unit length: 40 mm ID - 1 L/m; 50 mm ID - 2 L/m; 100 mm ID 8 L/m.
- 2 Calibration details to be recorded in the instrument –specific calibration book, or in field notes as required by local procedures.



Groundwater Monitoring – Data Sheet

Client: CGG				BORE ID: MW2					
Project: Point Moore Groundwater Assessment				Job No.: 6134772					
Location: Captain Cres		Casing diameter: 50 mm		Total Depth: 6.02					
BORE CONSTRUCTION									
Head-works	☒ Flush	☐ Monument	☐ Casing Locked	Datum Point	☐ Cover/ Monument	☒ Inner Casing	Datum Elev.: m ☒ AHD		
PURGING DETAILS									
Method: Low Flow Pump		Date: 18/10/2016		Undertaken By: S.Petts		Flow Rate: 0.005L/s			
PID reading: N/Appm		Water Column: 4.12 m		Req Purge Vol. ¹: -L		Actual Vol. Purged: -L			
	Time	Depth to LNAPL (m)		Depth to water (m)		Depth to DNAPL (m)			
Start	1015	-		1.90		-			
Finish	1050	-		1.90					
PURGING MEASUREMENTS ²									
Vol. Purged (L)	Elapsed Time (min)	EC (mS/cm)	Temp. (°C)	Turbidity (NTU)	pH	DO %Sat	DO (ppm)	Eh (mV)	Comments – Turbidity, Colour, Odour, etc.
1	5	2.17	20.2	-0.8	7.84	17.1	-	-179	S2O Odour, colourless, slight SS
2	8	2.16	20.3	-1.7	7.91	20	-	-177	
3	11	2.16	20.3	-0.3	8.09	19.0	-	-180	
4	14	2.18	20.3	-0.7	7.97	18.5	-	-180	
5	17	2.17	20.4	-0.8	7.94	18.2	-	-182	
6	20	2.17	20.4	-1.5	7.90	19.0	-	-183	
		+/-3.0	+/-1.0		+/- 0.1	+/-10%	+/-1.0	+/- 10 mV	
Comments (e.g. condition of headworks, colour, odour):									
SAMPLING DETAILS					Sample ID: MW2				
Date: 18/10/2016		Time: 10:40			Undertaken By: S Petts				
PID reading: - ppm		Depth to LNAPL: - m			Depth to Water: 1.90 m		Depth to DNAPL: - m		
Flow Rate: 0.005 L/s		Vol. Removed: 6L			Sampling Method: Low Flow				
Temp.: 20.4 °C		DO: -ppm mg/L			pH: 7.84		EC: 2.17 mS/cm		Eh: -183 mV
		DO: 19.0% Sat					Turbidity -1.5 NTU		
Comments (e.g. containers, filtration):									
CoC Number: 20161018				Checked by: S Petts			Date: 18/10/2016		

¹ Bores to be purged dry, until pH, T and EC readings stabilise or a minimum of 3 to 5 times the water column volumes. Water column volumes can be calculated from the following casing volumes per unit length: 40 mm ID - 1 L/m; 50 mm ID – 2 L/m; 100 mm ID 8 L/m.



Groundwater Monitoring – Data Sheet

Client: CGG				BORE ID: MW3					
Project: Point Moore Groundwater Assessment				Job No.: 6134772					
Location: Astrolabe Ln		Casing diameter: 50 mm		Total Depth: 5.87 m					
BORE CONSTRUCTION									
Head-works	☒ Flush	☐ Monument	☐ Casing Locked	Datum Point	☐ Cover/ Monument	☒ Inner Casing	Datum Elev.: m ☒ AHD		
PURGING DETAILS									
Method: Low Flow		Date: 2016		Undertaken By: S.Petts		Flow Rate: 0.004 L/s			
PID reading: N/Appm		Water Column: 3.16 m		Req Purge Vol. ¹: L		Actual Vol. Purged: L			
	Time	Depth to LNAPL (m)		Depth to water (m)		Depth to DNAPL (m)			
Start	1100	-		2.71		-			
Finish	1140	-		2.71		-			
PURGING MEASUREMENTS ²									
Vol. Purged (L)	Elapsed Time (min)	EC (uS/cm)	Temp. (°C)	Turbidity (NTU)	pH	DO %Sat	DO (ppm)	Eh (mV)	Comments – Turbidity, Colour, Odour, etc.
1	5	2.24	22.7	21.2	7.96	17.4	-	-137	No odour colourless, some SS
2	9	2.22	22.7	17.3	-	23.6	-	-147	
3	12	2012	22.8	9.7	-	25.1	-	-145	
4	15	2055	22.7	8.3	7.65	25.9	-	-147	
5	19	2063	22.7	8.5	8.02	25.3	-	-149	
6	23	2062	22.7	6.4	7.96	26.0	-	-151	
		+/-3.0%	+/-3.0%		+/- 0.1	+/-10%	+/-3.0%	+/- 10 mV	
Comments (e.g. condition of headworks, colour, odour):									
Water meter issues, pH reading error									
SAMPLING DETAILS					Sample ID: MW3				
Date: 18/10/2016		Time: 11:30			Undertaken By: S Petts				
PID reading: - ppm		Depth to LNAPL: - m			Depth to Water: 2.71 m		Depth to DNAPL: - m		
Flow Rate: 0.004 L/s	Vol. Removed: 6 L			Sampling Method: Low Flow Pump					
Temp.: 22.7 °C	DO: -ppm mg/L			pH: 7.96		EC: 2062 uS/cm		Eh: -151 mV	
	DO: 26.0 %Sat					Turbidity 6.4 NTU			
Comments (e.g. containers, filtration):									
All metals field filtered									
CoC Number: 20161018				Checked by: S Petts			Date: 18/10/2016		

- Bores to be purged dry, until pH, T and EC readings stabilise or a minimum of 3 to 5 times the water column volumes. Water column volumes can be calculated from the following casing volumes per unit length: 40 mm ID - 1 L/m; 50 mm ID - 2 L/m; 100 mm ID 8 L/m.
- Calibration details to be recorded in the instrument –specific calibration book, or in field notes as required by local procedures.



Groundwater Monitoring – Data Sheet

Client: CGG				BORE ID: SHP8					
Project: Point Moore Groundwater Assessment				Job No.: 6134772					
Location: Coxswain Park		Casing diameter:		50 mm		Total Depth:		5.85 m	
BORE CONSTRUCTION									
Head-works	☐ Flush	☒ Monument	☐ Casing Locked	Datum Point	☐ Cover/Monument	☒ Inner Casing	Datum Elev.:	m	☐ Local ☒ AHD
PURGING DETAILS									
Method: Low Flow		Date: 2016		Undertaken By: S.Petts		Flow Rate: 0.004 L/s			
PID reading: N/A ppm		Water Column: 3.68 m		Req Purge Vol. ¹ : -L		Actual Vol. Purged: 8L			
	Time	Depth to LNAPL (m)		Depth to water (m)		Depth to DNAPL (m)			
Start	1145			2.17		-			
Finish	1230			2.17					
PURGING MEASUREMENTS ²									
Vol. Purged (L)	Elapsed Time (min)	EC (mS/cm)	Temp. (°C)	Turbidity (NTU)	pH	DO %Sat	DO (ppm)	Eh (mV)	Comments – Turbidity, Colour, Odour, etc.
1	5	3.69	20.2	-3.7	7.63	11.1	-	-226	Colourless, slight S2O odour, some SS
2	9	3.71	20.3	-3.2	7.66	13.8	-	-225	
3	14	3.74	20.3	-3.2	7.65	13.8	-	-224	
4	17	3.77	20.2	-3.2	7.69	15.6	-	-223	
5	20	3.79	20.2	-3.7	7.70	16.3	-	-222	
		+/-3.0%	+/-3.0%		+/- 0.1	+/-10%	+/-3.0%	+/- 10 mV	
Comments (e.g. condition of headworks, colour, odour):									
SAMPLING DETAILS					Sample ID: SHP8				
Date 18/10/2016		Time: 1220		Undertaken By: S Petts					
PID reading: - ppm		Depth to LNAPL: - m		Depth to Water: 2.17 m		Depth to DNAPL - m			
Flow Rate: 0.004 L/s	Vol. Removed: 5L		Sampling Method: Low Flow						
Temp.: 20.2 °C	DO: -ppm mg/L		pH: 7.70	EC: 3.79 mS/cm		Eh: -222 mV			
	DO: 16.3 %Sat				Turbidity -3.7 NTU				
Comments (e.g. containers, filtration):									
All metals field filtered									
CoC Number: 20161018			Checked by: S Petts			Date: 18/10/2016			

- 1 Bores to be purged dry, until pH, T and EC readings stabilise or a minimum of 3 to 5 times the water column volumes. Water column volumes can be calculated from the following casing volumes per unit length: 40 mm ID - 1 L/m; 50 mm ID – 2 L/m; 100 mm ID 8 L/m.
- 2 Calibration details to be recorded in the instrument –specific calibration book, or in field notes as required by local procedures.

Appendix E – Quality Assurance and Quality Control

E1 Introduction

The Quality Assurance/Quality Control (QA/QC) procedures are based on the DER Assessment and management of contaminated sites (DER 2014), ASC NEPM (NEPC 1999), AS 4482.1 – 2005 (Standards Australia 2005), AS 4482.2 – 1999 (Standards Australia 1999) and AS 5667 – 1998 (Standards Australia 1998). QA involves all of the actions, procedures, checks and decisions, undertaken to ensure the representativeness and integrity of samples and accuracy and reliability of analytical results. QC involves protocols to monitor and measure the effectiveness of QA procedures.

E2 Field Work Program

E2.1 Field Quality Assurance Procedures

All field work was conducted with reference to the DER (2014) and GHD's Standard Field Operating Procedures, which ensures all environmental samples are collected by a set of uniform and systematic methods, as required by GHD's QA system. The procedures undertaken as part of the soil and groundwater assessments includes:

- Decontamination Procedures: Included the use of new disposable gloves for the collection of each sample, decontamination of the sampling equipment between each sampling event and the use of sampling containers provided by the laboratory;
- Sample Identification Procedures: Collected samples are immediately transferred to sample containers of appropriate composition and preservation for the required laboratory analysis. All sample containers were clearly labelled with a sample number, sample location, sample depth, sample date and sampler's initials. The sample containers were transferred to a chilled esky for sample preservation prior to and during shipment to the testing laboratory;
- Chain of Custody Information Requirements: A chain of custody form was completed and forwarded to the testing laboratory with all sample batches and in some instances emailed separately to the laboratory prior to the Esky's arrival to the laboratories. The purpose of this was to provide the laboratory notification of samples requiring extraction upon arrival; and
- Sample blind duplicate and split duplicate, rinsate blank and field blank frequency.

E2.2 Groundwater Sampling and Analysis Quality Control

The DER Contaminated Sites Management Guidelines outlines the requirements for Quality Control (QC) sampling protocols. The QC samples collected during the investigation are described below and presented in **Table E1**.

Blind (Intra-laboratory) Duplicates

Blind (Intra-laboratory) duplicate samples were used to identify the variation in the analyte concentration between samples collected from the same sampling point and the repeatability of the laboratory's analysis.

Split (Inter-laboratory) Duplicates

Inter-laboratory duplicate samples provide an indication of the repeatability of the results between laboratories.

Rinsate Blanks

Rinsate blank samples are water samples collected from decontaminated, re-used field equipment and used primarily to assess whether the decontamination procedure is effective and if cross-contamination has led to positive observations in subsequent samples.

Rinsate samples were collected by pouring laboratory supplied ultra-high purity rinsate water over the probe of water quality meters and interface probes or running it through the pump and collecting it in laboratory supplied containers. Rinsate samples are then transferred to a chilled esky for sample preservation prior to and during shipment to the testing laboratory.

Field Blanks

Field blank samples were used to estimate contamination of a sample during the collection procedure.

Field blank samples are collected by pouring laboratory supplied rinsate water into laboratory supplied bottles onsite. Field blank samples are then transferred to a chilled esky for sample preservation prior to and during shipment to the testing laboratory.

Table E1 Quality Control Sampling Frequency

Sample	Sample Collection Frequency
Blind (Intra-laboratory) Duplicates	1:20 samples
Split (Inter-laboratory) Duplicates	1:20 samples
Equipment Rinsate Blanks	1 per matrix per day
Field Blanks	1 per matrix per day

E2.3 Relative Percent Difference Calculations

Blind and split duplicate samples were assessed by calculating the relative percentage difference (RPD) between the primary, blind and split samples.

A quantitative measure of the accuracy of the analytical results reported was made by calculating the RPDs between the primary, blind and split results in accordance with the procedure described in AS 4482.1 - 2005. According to AS 4482.1 - 2005 typical RPDs are expected to range between 30% and 50%; however, this may be higher for organics and for low concentrations of analytes. GHD uses 50% as the general assessment criteria.

Where a result was reported below the laboratory limit of reporting (LOR) for one of the duplicate pair samples, the sample will be assigned the concentration of the LOR for RPD calculation purposes.

E3 Laboratory Program

Samples were dispatched to various nominated NATA accredited laboratories for the analytes of concern, with Chain of Custody documentation acknowledging the transference of samples from the Site to the laboratory. The primary and blind duplicate samples were dispatched to ALS Laboratory Group. The split duplicate samples were dispatched to SGS Environmental.

E3.1 Laboratory Analytical Methods

Laboratory methods used by the primary and secondary laboratories are considered suitable for environmental contaminant analysis and are based on established internationally recognised procedures. Each of the laboratories were NATA accredited for the proposed analysis.

Table E2 Laboratory Methods, LORs and Laboratory Holding Times for Groundwater Analysis

Analyte	Method	Limits of Reporting (LOR)	Holding Times
Ammonia	APHA 4500-NH ₃ B/C	0.05 mg/L	1 day
Nitrite	APHA 4110/4500-NO ₂	0.05 mg/L	2 days
Nitrate	APHA 4110	0.05 mg/L	2 days
Total Nitrogen	APHA 4500-N	0.05 mg/L	28 days
Total Dissolved Solids	APHA 2540C	10 µg/L	7 days
E. coli (MF)	AS4275:21-2005	1 cfu/100 mL	24 hours

E3.2 Laboratory Quality Control Procedures

The following laboratory QC procedures were used during the investigation.

Laboratory Duplicate Samples

Laboratory duplicate sample analysis were the analysis of a laboratory derived duplicate sample from the process batch, at a rate equivalent to one in twenty samples per analytical batch, or one sample per batch if less than twenty samples are analysed in a batch. A laboratory duplicate provides data on the analytical precision and reproducibility of the analytical results.

The permitted ranges for the RPD of Laboratory Duplicates, as specified in ALS Method QWI-EN/38 are dependent on the magnitude of results in comparison to the level of reporting. For RPD results that are less than ten times the limit of reporting (LOR) there are no limits, for results between ten and twenty times the LOR the adopted criteria are 0% - 50% and for results greater than twenty times LOR the criteria are 0% - 20%.

Method Blank Samples

Method or analysis blank sample analysis is the analysis of a sample that is as free as possible of the analytes of interest, but has been prepared the same as the samples under investigation. The analysis is to ascertain if laboratory reagents, glassware and other laboratory consumables contribute to the observed concentration of analytes in the process batch. If below the maximum acceptable method blank (20% of the practical quantitation limit), the contribution is subtracted from the gross analytical signal for each analysis before calculating the sample analyte concentration. GHD notes that the subtraction of the method blank concentration is not appropriate for some organic analytes.

Laboratory Control Spike Samples

Laboratory control spike analysis is the analysis of either a reference material or a control matrix fortified with analytes representative of the analyte class. The purpose of laboratory control spike samples is to monitor method precision and accuracy independent of the sample matrix. Typically, the percent recovery of the laboratory control spike sample is compared to the dynamic recovery limits based on the statistical analysis of the processed laboratory control spike sample analysis.

Matrix Spike Samples

Matrix spike sample analysis is the analysis of one or more replicate portions of samples from the batch, after fortifying the additional portion(s) with known quantities of the analyte(s) of interest. The percent recovery of target analyte(s) from matrix spike samples is used to determine the bias of the method in the specific sample matrix.

Surrogate Spike Samples

Surrogate spike samples are samples with known additions of known amounts of compounds, which are similar to the analytes of interests in terms of extractability, recovery through clean-up procedures and response to chromatographic or other measurement. Surrogate compounds may be alkylated or halogenated analogues or structural isomers of analytes of interest. The purpose of surrogate spikes, which are added immediately before the sample extraction step, is to provide a check for every analysis that no gross processing errors have occurred, which could have led to significant analyte loss or faulty calculation.

Internal Standards

Internal standards are known additions of known amounts of compounds which are not found in real samples, will not interfere with quantification of analytes of interest and may be separately and independently quantified. The purpose of internal standards in instrumental techniques is to provide independent signals, which serve to check the consistency of the analytical step. Internal standards are often used for organic compounds and some inorganic compounds.

E4 Data Management

Laboratory results were reviewed within five working days of receipt from the laboratory.

The individual testing laboratory conducted an assessment of the laboratory QC program, internally, however the results will also be independently reviewed and assessed by GHD, to ensure that no issues exist with the data prior to undertaking any data interpretation. GHD reviewed the Laboratories' quality control certificate and identified any outliers. The outliers identified are discussed in the sections below.

Following receipt of data, the groundwater results were converted to ESDAT format and compared against the adopted criteria provided in Section 6.1. Subsequent to this the ESDAT format was modified to ensure that only test pits location relevant to the Site were presented. All data will be stored in an electronic format as well as produced in hard copy. The hard copies were stored along with chain of custody (CoC) forms in the project file. The CoC forms and laboratory certificates are presented in Appendix F.

E5 Sampling and Analysis Quality Control Results: Groundwater

E5.1 Sample Duplicates

The blind and split duplicated QC samples collected for the 2016 GME is listed in Table E3. The split sample was not analysed for microbes as a result of issues associated with sample receipts department. The split sample was processed outside the 24 hour holding and therefore the laboratory was advised not to proceed with analysing this sample for microbes.

Table E3 Sample Duplicates

Primary Sample	QC Sample	Description	Date	Analyses
MW1	QC01_20160824	Blind – ALS	24/08/2016	Ammonia, BOD, E. coli, Faecal coliforms, total coliforms, nitrates, nitrite, TDS, TKN, total nitrogen, total phosphorus
MW1	QC02_20160824	Split – SGS	24/08/2016	Ammonia, BOD, nitrates, nitrite, TDS, TKN, total nitrogen, total phosphorus
MW1	QC01_20160923	Blind – ALS	23/09/2016	Ammonia, BOD, E. coli, Faecal coliforms, total coliforms, nitrates, nitrite, TDS, TKN, total nitrogen, total phosphorus
MW1	QC02_20160923	Split – mpl	23/09/2016	Ammonia, BOD, E. coli, Faecal coliforms, total coliforms, nitrates, nitrite, TDS, TKN, total nitrogen, total phosphorus
MW1	QC01_20161018	Blind – ALS	18/10/2016	Ammonia, BOD, E. coli, Faecal coliforms, total coliforms, nitrates, nitrite, TDS, TKN, total nitrogen, total phosphorus
MW1	QC02_20161018	Split – mpl	18/10/2016	Ammonia, BOD, E. coli, Faecal coliforms, total coliforms, nitrates, nitrite, TDS, TKN, total nitrogen, total phosphorus

Rinsate and Field Blanks

The rinsate and field blanks collected during the groundwater investigation undertaken in 2016 are listed in Table E4.

Table E4 Rinsate and Field Blanks

QC Sample	Description	Date	Analysis
QC03_20160824	Rinsate blank	24/08/2016	Ammonia, BOD, Nitrate, Nitrite, TDS, TKN, total nitrogen and total phosphorus
QC04_20160824	Field blank	24/08/2016	Ammonia, BOD, Nitrate, Nitrite, TDS, TKN, total nitrogen and total phosphorus
QC03_20160922	Rinsate blank	23/09/2016	Ammonia, BOD, Nitrate, Nitrite, TDS, TKN, total nitrogen and total phosphorus
QC04_20160922	Field blank	23/09/2016	Ammonia, BOD, Nitrate, Nitrite, TDS, TKN, total nitrogen and total phosphorus
QC03_20161018	Rinsate blank	18/10/2016	Ammonia, BOD, Nitrate, Nitrite, TDS, TKN, total nitrogen and total phosphorus
QC03_20161018	Field blank	18/10/2016	Ammonia, BOD, Nitrate, Nitrite, TDS, TKN, total nitrogen and total phosphorus

A summary of the reported detects within field and rinsate blank samples is provided:

- QC03_20160824 (rinsate sample) detected BOD above the LOR (5 mg/L). Primary samples reported BOD to range between 4 mg/L and 7 mg/L. Considering two primary samples reported BOD below 5 mg/L, it is unlikely that this detect would impact the overall integrity of the data;
- QC03_20160922 (rinsate sample) detected TDS above the LOR (20 mg/L). Considering the concentrations of Primary samples which reported TDS to range between 1,320 mg/L to 22,400 mg/L, which were reported in three orders of magnitude greater this QC sample; therefore, it is considered that this would no impact on the integrity of the data;
- QC03_20161018 (rinsate sample) and QC04_20161018 (field blank) reported total dissolved solids, ammonia marginally above the LOR. It is likely that the source of this contamination is associated within laboratory supplied water and therefore it is considered that this would no impact on the integrity of the data;

- QC04_20161018 (field blank) reported nitrate and nitrite, the source of this contamination is unknown. Notwithstanding this, the detects are equal to the LOR and considering that two primary samples reported both these CoPC below the LOR. It is therefore considered unlikely that this detect would impact the overall integrity of the data;

Relative Percentage Difference Calculation Results

During the 2016 GME, 79 RPDs were calculated on field samples with six RPDs exceeding the recovery limit of 50%. RPDs for the groundwater investigation are presented in Appendix G and the RPD exceedances are summarised in Table E5.

Table E5 Groundwater RPDs Greater than 50%

Primary/Duplicate Sample Name	Analytes with RPD exceeding 50%	Comment
MW1/QC01_20160824	Coliform (200%)	The primary sample (250, 000 cfu/100 mL) was reported higher than the blind sample (200 cfu/100 mL). These two samples are in four orders of magnitude and the difference between the two samples is a result of the primary sample having a higher amount of particulate matter than the blind sample.
	Faecal Coliform (138%)	The blind sample (1100 cfu/100mL) was higher than the primary (200 cfu/100mL). The difference between the primary and blind is a result higher level of particulate, which may be masked by overgrowth of non-target organisms.
	<i>E. coli</i> (138%)	
MW1/QC02_20160923	BOD (144%)	The primary sample reported a concentration (31 mg/L) above the LOR, while the split duplicated reported a concentration below the LOR (<1 mg/L). The elevated RPD suggested that the primary laboratory may have over reported the BOD concentration. By considering the primary sample concentration when evaluating the groundwater quality, GHD considers that a conservative approach has been implemented in this regard and secondary laboratory is unlikely to have impacted upon data quality and the overall conclusions drawn.
	Plate Count 36°C (67%)	The split sample (340 cfu/100 mL) was higher than the primary. The different incubation temperatures used by the primary and secondary laboratory, likely has attributed to the different plate count. With consideration to the above, the elevated RPD value for this duplicate is not considered to have significantly impacted upon the overall data quality.
	Plate Count 22°C (67%)	The split sample (260 cfu/100 mL) was higher than the primary. The different incubation temperatures used by the primary and secondary laboratory, likely has attributed to the different plate count. With consideration to the above, the elevated RPD value for this duplicate is not considered to have significantly impacted upon the overall data quality.

Primary/Duplicate Sample Name	Analytes with RPD exceeding 50%	Comment
	Nitrite as N (197%)	The primary sample was reported below the LOR (0.01 mg/L) while the secondary reported a concentration above the LOR (0.006 mg/L). The RPD is a reflection of the different LOR used by the primary and secondary. The secondary utilises a low LOR, as the detected concentration in secondary is below the primary laboratory's LOR. With consideration to the above, the elevated RPD value for this duplicate is not considered to have significantly impacted upon the overall data quality.
	Nitrate as N (195%)	The primary sample reported a concentration (0.05 mg/L) above the LOR, while the split duplicated reported a concentration below the LOR (<0.005 mg/L). The difference between the primary and secondary are the laboratory limit of reporting. Notwithstanding this, the elevated RPD suggested that the primary laboratory may have over reported the BOD concentration. By considering the primary sample concentration when evaluating the groundwater quality, GHD considers that a conservative approach has been implemented in this regard and secondary laboratory is unlikely to have impacted upon data quality and the overall conclusions drawn.
MW1	BOD (81%)	The primary sample (33 mg/L) was higher than the split sample (14 mg/L). The elevated RPD suggested that the primary laboratory may have over reported the BOD concentration. By considering the primary sample concentration when evaluating the groundwater quality, GHD considers that a conservative approach has been implemented in this regard and secondary laboratory is unlikely to have impacted upon data quality and the overall conclusions drawn

E5.2 Laboratory Quality Control Results

Laboratory Duplicates

There were no RPD outliers for laboratory duplicate samples reported by ALS or SGS

Method Blank Samples

There were no method blank recovery value outliers reported by ALS or SGS. GHD considers that the analyses methods used were free from potential laboratory contamination and that the data is suitable for Site soil characterisation.

Laboratory Control Spike Samples

There were no laboratory control outliers reported by ALS or SGS. GHD considers the results from all analyses performed to be sufficiently accurate and independent of the sample matrix and therefore the data is suitable for soil characterisation.

Matrix Spike Samples

There were no matrix spike outliers reported by ALS or SGS for the 2016 groundwater investigation.

Surrogate Spike Samples

There were no surrogate recovery outliers reported by ALS or SGS for the 2016 GME.

E5.3 Review of Sample Management

Laboratory Holding Times

Analysis of samples within analyte specific holding times serves as a measure of QA. The official certificates of analysis and sample receipt notifications obtained from the contracted laboratories reported groundwater analysis was generally completed within specified holding times, with the non-conformance presented in Table E6.

Table E6 Holding Time Non-conformance

Analysis	Samples	Due for Analysis	Date Analysed	Comment
Nitrate Nitrogen and Nitrite Nitrogen	QC02	28/09/2016	29/09/2016	GHD compared the QC02 results with the primary. The reported concentrations appear to be in a similar order of magnitude.
Total Dissolved Solids	QC02	31/08/2016	1/09/2016	

Chain of Custody Forms and Sample Receipts

GHD used Chain of Custody (CoC) forms during the groundwater investigations to establish the traceability of samples and these are attached in Appendix F. A review of the CoC forms by GHD indicates that all prescribed sample transfer, transport and storage protocols were complied with. Sample receipts are presented in Appendix F.

E6 Quality Control and Quality Assurance Summary

The review of the QA/QC results indicates that, overall, the data reported is considered to be of an acceptable quality upon which to draw meaningful conclusions regarding impacts to groundwater at the Site and are within the scope of this investigation for the following reasons:

- **Data Representativeness:** The sampling methodology provided a uniform and systematic approach to the collection of all environmental samples. Laboratory and field QA/QC procedures were carried out to measure data representativeness. Consequently, data representativeness is considered to have been satisfied;
- **Completeness:** It is considered that the field QA/QC procedures carried out, such as the blind and split sample duplicate collection frequencies, and the analytes tested provides completeness in terms of the required number of field duplicate samples. Laboratory QA/QC sample analysis is considered sufficient to provide a complete overview of QA/QC procedures;
- **Precision:** GHD considers that laboratory results are acceptable for interpretation with regards to the suitability of the site for the proposed land use;
- **Accuracy:** Sampling procedures ensured that collection, preservation and laboratory analytical techniques are appropriate for analysis of environmental contaminants.
 - Rinsate blank, field blank and trip blank sample results have been discussed and results indicate that cross-contamination of samples through collection or transport of the samples to the laboratory is unlikely to have occurred and therefore is not considered to have impacted interpretation of contamination at the site.
- **Comparability:** All field work was conducted with reference to the DER Contaminated Sites Management Series Guidelines and GHD Standard Operating Procedures, which ensured all samples were collected by a set of uniform and systematic methods, as required by GHD's QA system. GHD considers that the laboratory data are of a suitable quality for assessing the environmental status of the site.

Consequently, the review of QA procedures and QC results from the primary and secondary laboratories indicates that the analytical data are considered to be of an acceptable quality upon which to draw meaningful conclusions regarding the impacts to soil and groundwater at the site within the scope of this investigation. Any laboratory issues have been listed above and discussed within their relevant sections.

Appendix F – Chain of Custody and Laboratory Reports

GHD House 239
Adelaide Terrace Perth WA PO Box Y3106 Telephone 08 6222 8222 Facsimile 08 6222
6004 Perth WA 6832 8555

COC No.

[illegible]

[illegible]

CERTIFICATE OF ANALYSIS

Work Order : **EP1607778**
Client : **GHD PTY LTD**
Contact : **MR ANDREW NAGLE**
Address : **999 HAY STREET**
PERTH WA 6000
Telephone : **+61 08 6222 8222**
Project : **61/34772 Point Moore Groundwater Assessment**
Order number : **----**
C-O-C number : **----**
Sampler : **STEVEN PETTS**
Site : **----**
Quote number : **----**
No. of samples received : **7**
No. of samples analysed : **7**

Page : 1 of 4
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 10 Hod Way Malaga WA Australia 6090
Telephone : 08 9209 7655
Date Samples Received : 25-Aug-2016 09:20
Date Analysis Commenced : 25-Aug-2016
Issue Date : 31-Aug-2016 16:11



Accreditation No. 825
 Accredited for compliance with
 ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Alini Goundar	Senior Analyst	Perth Microbiology, Malaga, WA
Jeremy Truong	Laboratory Manager	Perth Inorganics, Malaga, WA
Tyrone Cole	Inorganics Preparation Supervisor	Perth Inorganics, Malaga, WA



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- CFU = colony forming unit
- MF = membrane filtration
- 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.
- MW002: estimate (~) is reported where the growth of bacteria is counted <10cfu and or >300cfu.
- MW006, estimate (~) is reported where the growth of presumptive bacteria on the filtered membrane is counted <10 cfu and/or >100 cfu.
- MW002 is ALS's internal code and is equivalent to AS4276.3.1.
- MW006 is ALS's internal code and is equivalent to AS4276.7.
- MW007 is ALS's internal code and is equivalent to AS4276.5.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MW1	QC01_20160824	MW2	MW3	SHP8
Client sampling date / time					[24-Aug-2016]	[24-Aug-2016]	[24-Aug-2016]	[24-Aug-2016]	[24-Aug-2016]
Compound	CAS Number	LOR	Unit		EP1607778-001	EP1607778-002	EP1607778-003	EP1607778-004	EP1607778-005
					Result	Result	Result	Result	Result
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		8890	8800	1480	1090	3320
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		2.68	2.86	0.53	0.57	0.36
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	0.20	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.19	0.18	13.8	0.02	0.02
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		0.19	0.18	14.0	0.02	0.02
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		3.0	2.9	3.1	0.7	1.5
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		3.2	3.1	17.1	0.7	1.5
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.29	0.30	0.21	0.06	0.31
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		6	6	7	4	4
MW002: Heterotrophic Plate Count									
Heterotrophic Plate Count (22°C)	----	1	CFU/mL		~49000	~60000	~13000	~70000	910
Heterotrophic Plate Count (36°C)	----	1	CFU/mL		~46000	~49000	~11000	~68000	110
MW006: Faecal Coliforms & E.coli by MF									
Faecal Coliforms	----	1	CFU/100mL		~200	1100	~400	~400	~100
Escherichia coli	----	1	CFU/100mL		~200	1100	~400	~400	~100
MW007: Coliforms by MF									
Coliforms	----	1	CFU/100mL		250000	~200	~1000	~3000	~200



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC03_20160824	QC04_20160824	----	----	----
Client sampling date / time					[24-Aug-2016]	[24-Aug-2016]	----	----	----
Compound	CAS Number	LOR	Unit		EP1607778-006	EP1607778-007	-----	-----	-----
				Result	Result		----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		<10	<10	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		<0.01	<0.01	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	<0.01	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<0.1	<0.1	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		<0.1	<0.1	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		<0.01	<0.01	----	----	----
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		5	<2	----	----	----
MW002: Heterotrophic Plate Count									
Heterotrophic Plate Count (22°C)	----	1	CFU/mL		----	----	----	----	----
Heterotrophic Plate Count (36°C)	----	1	CFU/mL		----	----	----	----	----
MW006: Faecal Coliforms & E.coli by MF									
Faecal Coliforms	----	1	CFU/100mL		----	----	----	----	----
<i>Escherichia coli</i>	----	1	CFU/100mL		----	----	----	----	----
MW007: Coliforms by MF									
Coliforms	----	1	CFU/100mL		----	----	----	----	----

QUALITY CONTROL REPORT

Work Order : **EP1607778**

Page : 1 of 4

Client : **GHD PTY LTD**

Contact : **MR ANDREW NAGLE**

Address : **999 HAY STREET
PERTH WA 6000**

Telephone : **+61 08 6222 8222**

Project : **61/34772 Point Moore Groundwater Assessment**

Order number : ----

C-O-C number : ----

Sampler : **STEVEN PETTS**

Site : ----

Quote number : ----

No. of samples received : **7**

No. of samples analysed : **7**

Laboratory : **Environmental Division Perth**

Contact : **Lauren Biagioni**

Address : **10 Hod Way Malaga WA Australia 6090**

Telephone : **08 9209 7655**

Date Samples Received : **25-Aug-2016**

Date Analysis Commenced : **25-Aug-2016**

Issue Date : **31-Aug-2016**



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

Signatories	Position	Accreditation Category
Alini Goundar	Senior Analyst	Perth Microbiology, Malaga, WA
Jeremy Truong	Laboratory Manager	Perth Inorganics, Malaga, WA
Tyrone Cole	Inorganics Preparation Supervisor	Perth Inorganics, Malaga, WA



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

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

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 564719)									
EP1607760-009	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	6310	6080	3.81	0% - 20%
EP1607760-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	6260	6170	1.45	0% - 20%
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 562898)									
EP1607778-001	MW1	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	2.68	2.72	1.60	0% - 20%
EP1607791-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.04	0.09	73.8	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 562895)									
EP1607778-001	MW1	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 562899)									
EP1607778-001	MW1	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.19	0.17	10.2	0% - 50%
EP1607791-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.25	0.22	12.1	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 566331)									
EP1607775-011	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.3	2.4	6.62	0% - 50%
EP1607778-006	QC03_20160824	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	0.1	0.00	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 566330)									
EP1607775-011	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.22	0.21	0.00	0% - 50%
EP1607778-006	QC03_20160824	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 562689)									
EP1607769-001	Anonymous	EP030: Biochemical Oxygen Demand	----	2	mg/L	4	4	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 564719)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	99.0	83	111
				<10	293 mg/L	107	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 562898)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	109	87	115
EK057G: Nitrite as N by Discrete Analyser (QCLot: 562895)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	99.2	86	112
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 562899)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	112	92	112
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 566331)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	84.8	82	110
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 566330)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	86.8	70	130
EP030: Biochemical Oxygen Demand (BOD) (QCLot: 562689)								
EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	198 mg/L	92.8	78	117

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%) MS	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number			Low	High
EK055G: Ammonia as N by Discrete Analyser (QCLot: 562898)							
EP1607778-002	QC01_20160824	EK055G: Ammonia as N	7664-41-7	1 mg/L	96.8	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 562895)							
EP1607778-002	QC01_20160824	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	107	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 562899)							
EP1607778-002	QC01_20160824	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	111	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 566331)							
EP1607775-011	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	90.2	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 566330)							
EP1607775-011	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	97.6	70	130



QA/QC Compliance Assessment to assist with Quality Review

Work Order : **EP1607778**

Page : 1 of 6

Client : **GHD PTY LTD**
Contact : **MR ANDREW NAGLE**
Project : **61/34772 Point Moore Groundwater Assessment**
Site : **----**
Sampler : **STEVEN PETTS**
Order number : **----**

Laboratory : **Environmental Division Perth**
Telephone : **08 9209 7655**
Date Samples Received : **25-Aug-2016**
Issue Date : **31-Aug-2016**
No. of samples received : **7**
No. of samples analysed : **7**

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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



Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Clear Plastic Bottle - Natural (EA015H) MW1, QC01_20160824, MW2, MW3, SHP8, QC03_20160824, QC04_20160824	24-Aug-2016	----	----	----	29-Aug-2016	31-Aug-2016	✓	
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) MW1, QC01_20160824, MW2, MW3, SHP8, QC03_20160824, QC04_20160824	24-Aug-2016	----	----	----	25-Aug-2016	21-Sep-2016	✓	
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G) MW1, QC01_20160824, MW2, MW3, SHP8, QC03_20160824, QC04_20160824	24-Aug-2016	----	----	----	25-Aug-2016	26-Aug-2016	✓	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G) MW1, QC01_20160824, MW2, MW3, SHP8, QC03_20160824, QC04_20160824	24-Aug-2016	----	----	----	25-Aug-2016	21-Sep-2016	✓	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G) MW1, QC01_20160824, MW2, MW3, SHP8, QC03_20160824, QC04_20160824	24-Aug-2016	31-Aug-2016	21-Sep-2016	✓	31-Aug-2016	21-Sep-2016	✓	



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G)								
MW1,	QC01_20160824,	24-Aug-2016	31-Aug-2016	21-Sep-2016	✔	31-Aug-2016	21-Sep-2016	✔
MW2,	MW3,							
SHP8,	QC03_20160824,							
QC04_20160824								
EP030: Biochemical Oxygen Demand (BOD)								
Clear Plastic Bottle - Natural (EP030)								
MW1,	QC01_20160824,	24-Aug-2016	----	----	----	25-Aug-2016	26-Aug-2016	✔
MW2,	MW3,							
SHP8,	QC03_20160824,							
QC04_20160824								
MW002: Heterotrophic Plate Count								
Sterile Plastic Bottle - Sodium Thiosulfate (MW002)								
MW1,	QC01_20160824,	24-Aug-2016	----	----	----	25-Aug-2016	25-Aug-2016	✔
MW2,	MW3,							
SHP8								
MW006: Faecal Coliforms & E.coli by MF								
Sterile Plastic Bottle - Sodium Thiosulfate (MW006)								
MW1,	QC01_20160824,	24-Aug-2016	----	----	----	25-Aug-2016	25-Aug-2016	✔
MW2,	MW3,							
SHP8								
MW007: Coliforms by MF								
Sterile Plastic Bottle - Sodium Thiosulfate (MW007)								
MW1,	QC01_20160824,	24-Aug-2016	----	----	----	25-Aug-2016	25-Aug-2016	✔
MW2,	MW3,							
SHP8								



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Ammonia as N by Discrete analyser	EK055G	2	19	10.53	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	9	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	7	14.29	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Ammonia as N by Discrete analyser	EK055G	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	9	11.11	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	7	14.29	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	9	11.11	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	7	14.29	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	7	14.29	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of 'filterable' residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G. Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined separately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Biochemical Oxygen Demand (BOD)	EP030	WATER	In house: Referenced to APHA 5210 B. The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM (2013) Schedule B(3)
Heterotrophic (Total) Plate Count @ 22C and 36C	MW002	WATER	In house: Referenced to AS4276.3.1- 2007
Thermotolerant Coliforms & E.coli by Membrane Filtration	MW006	WATER	In house: Referenced to AS 4276.7 2007
Coliforms by Membrane Filtration	MW007	WATER	In house: Referenced to AS 4276.5 - 2007
Preparation Methods	Method	Matrix	Method Descriptions



Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)

IB / ICE / None
Temp: 12 °C

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 Order Number **61/34772**
 Samples 1

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 SGS Reference **PE110063 R0**
 Date Received 24 Aug 2016
 Date Reported 02 Sep 2016

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(898/20210).

SIGNATORIES



Louise Hope
 Laboratory Technician



Michael McKay
 Inorganics and ARD Supervisor



Rachel Harrison
 Inorganics Team Leader



ANALYTICAL REPORT

PE110063 R0

Sample Number	PE110063.001
Sample Matrix	Water
Sample Date	24 Aug 2016
Sample Name	QC02

Parameter	Units	LOR
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Total Dissolved Solids (TDS) in water Method: AN113 Tested: 1/9/2016

Total Dissolved Solids Dried at 175-185°C	mg/L	10	7500
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CBOD5 Method: AN183 Tested: 26/8/2016

Biochemical Oxygen Demand (CBOD5)	mg/L	5	<5
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Nitrate Nitrogen and Nitrite Nitrogen (NOx) by FIA Method: AN258 Tested: 29/8/2016

Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	0.17
Nitrite, NO ₂ as NO ₂	mg/L	0.2	<0.2
Nitrate, NO ₃ as NO ₃	mg/L	0.2	0.7

Ammonia Nitrogen by FIA Method: AN261 Tested: 29/8/2016

Ammonia, NH ₃	mg/L	0.05	2.9
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TKN Kjeldahl Digestion by Discrete Analyser Method: AN281 Tested: 31/8/2016

Total Kjeldahl Nitrogen	mg/L	0.05	3.1
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Total Phosphorus by Kjeldahl Digestion DA in Water Method: AN279/AN293(Sydney only) Tested: 31/8/2016

Total Phosphorus (Kjeldahl Digestion)	mg/L	0.02	0.19
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ANALYTICAL REPORT

PE110063 R0

Sample Number PE110063.001
Sample Matrix Water
Sample Date 24 Aug 2016
Sample Name QC02

Parameter Units LOR

Calculated Nitrogen Forms - TN, organic N, inorganic N Method: AN281/292 Tested: 2/9/2016

Total Nitrogen (calc)	mg/L	0.05	3.2
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MB blank results are compared to the Limit of Reporting

LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.

DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Ammonia Nitrogen by FIA Method: ME-(AU)-[ENV]AN261

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Ammonia, NH ₃	LB121813	mg/L	0.05	<0.05	0%	NA

CBOD5 Method: ME-(AU)-[ENV]AN183

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Biochemical Oxygen Demand (CBOD5)	LB121787	mg/L	5	<5	4%	88 - 90%

Nitrate Nitrogen and Nitrite Nitrogen (NOx) by FIA Method: ME-(AU)-[ENV]AN258

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Nitrate/Nitrite Nitrogen, NOx as N	LB121813	mg/L	0.05	<0.05	0 - 5%	102 - 107%

TKN Kjeldahl Digestion by Discrete Analyser Method: ME-(AU)-[ENV]AN281

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Total Kjeldahl Nitrogen	LB121936	mg/L	0.05	<0.05	0 - 6%	105%

Total Dissolved Solids (TDS) in water Method: ME-(AU)-[ENV]AN113

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery	MS %Recovery	MSD %RPD
Total Dissolved Solids Dried at 175-185°C	LB121986	mg/L	10	<10	1%	104%	102%	2%

Total Phosphorus by Kjeldahl Digestion DA in Water Method: ME-(AU)-[ENV]AN279/AN293(Sydney only)

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Total Phosphorus (Kjeldahl Digestion)	LB121936	mg/L	0.02	<0.02	0 - 4%	103%

METHOD

METHODOLOGY SUMMARY

Nitrate and Nitrite by FIA: In an acidic medium, nitrate is reduced quantitatively to nitrite by cadmium metal. This nitrite plus any original nitrite is determined as an intense red-pink azo dye at 540 nm following diazotisation with sulphanilamide and subsequent coupling with N-(1-naphthyl) ethylenediamine dihydrochloride. Without the cadmium reduction only the original nitrite is determined. Reference APHA 4500-NO₃- F.

AN106

Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Total Dissolved Salts can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. SGS use 0.6. Reference APHA 2510 B.

AN113

Total Dissolved Solids: A well-mixed filtered sample of known volume is evaporated to dryness at 180°C and the residue weighed. Approximate methods for correlating chemical analysis with dissolved solids are available. Reference APHA 2540 C.

AN183

BOD: Serial dilutions of the sample are firstly combined with various reagents to aid bacterial growth and the sample is incubated for 5 days at 20°C. The difference between the initial and final oxygen contents of the sample is the amount of oxygen consumed by the bacteria. This is related to the organic loading of the sample therefore cBOD is the measure of the digestibility or bioavailability of organic matter in the sample. Reference APHA 5210 B. Internal Reference AN183

AN261

Ammonia by Continuous Flow Analyser: Ammonium in a basic medium forms ammonia gas, which is separated from the sample matrix by diffusion through a polypropylene membrane. The ammonia is reacted with phenol and hypochlorite to form indophenol blue at an intensity proportional to the ammonia concentration. The blue colour is intensified with sodium nitroprusside and the absorbance measured at 630 nm. The sensitivity of the automated method is 10-20 times that of the macro method. Reference APHA 4500-NH₃ H.

AN279/AN293(Sydney)

The sample is digested with Sulphuric acid, K₂SO₄ and CuSO₄. All forms of phosphorus are converted into orthophosphate. The digest is cooled and placed on the discrete analyser for colorimetric analysis.

AN281

An unfiltered water or soil sample is first digested in a block digester with sulfuric acid, K₂SO₄ and CuSO₄. The ammonia produced following digestion is then measured colourimetrically using the Aquakem 250 Discrete Analyser. A portion of the digested sample is buffered to an alkaline pH, and interfering cations are complexed. The ammonia then reacts with salicylate and hypochlorite to give a blue colour whose absorbance is measured at 660nm and compared with calibration standards. This is proportional to the concentration of Total Kjeldahl Nitrogen in the original sample.

AN281/292

Calculation of total nitrogen and organic nitrogen.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
**	Indicative data, theoretical holding time exceeded.	QFL	QC result is below the lower tolerance
		-	The sample was not analysed for this analyte
		NVL	Not Validated

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the "Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.

Note that in terms of units of radioactivity:

- 1 Bq is equivalent to 27 pCi
- 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : <http://www.sgs.com.au/~media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf>

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STATEMENT OF QA/QC PERFORMANCE

PE110063 R0

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Project **61/34772_Point Moore Groundwater**
Order Number **61/34772**
Samples **1**

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SGS Reference **PE110063 R0**
Date Received **24 Aug 2016**
Date Reported **02 Sep 2016**

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document and was supplied by the Client.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met with the exception of the following:

Extraction Date	Nitrate Nitrogen and Nitrite Nitrogen (NOx) by FIA	1 item
	Total Dissolved Solids (TDS) in water	1 item
Analysis Date	Nitrate Nitrogen and Nitrite Nitrogen (NOx) by FIA	1 item
	Total Dissolved Solids (TDS) in water	1 item

SAMPLE SUMMARY

Sample counts by matrix	1 water	Type of documentation received	COC
Date documentation received	26/8/2016	Samples received in good order	Yes
Samples received without headspace	Yes	Sample temperature upon receipt	12°C
Sample container provider	ALS	Turnaround time requested	Standard
Samples received in correct containers	Yes	Sufficient sample for analysis	Yes
Sample cooling method	Ice Bricks	Samples clearly labelled	Yes
Complete documentation received	Yes	Number of eskies/boxes received	1

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the sampled date is not supplied then compliance with criteria cannot be determined. If the received date is after one or both due dates then holding time will fail by default.

Ammonia Nitrogen by FIA

Method: ME-(AU)-[ENV]AN261

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC02	PE110063.001	LB121813	24 Aug 2016	24 Aug 2016	21 Sep 2016	29 Aug 2016	21 Sep 2016	29 Aug 2016

CBOD5

Method: ME-(AU)-[ENV]AN183

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC02	PE110063.001	LB121787	24 Aug 2016	24 Aug 2016	26 Aug 2016	26 Aug 2016	02 Sep 2016	31 Aug 2016

Nitrate Nitrogen and Nitrite Nitrogen (NOx) by FIA

Method: ME-(AU)-[ENV]AN258

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC02	PE110063.001	LB121813	24 Aug 2016	24 Aug 2016	28 Aug 2016	29 Aug 2016†	28 Aug 2016	29 Aug 2016†

TKN Kjeldahl Digestion by Discrete Analyser

Method: ME-(AU)-[ENV]AN281

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC02	PE110063.001	LB121936	24 Aug 2016	24 Aug 2016	21 Sep 2016	31 Aug 2016	21 Sep 2016	02 Sep 2016

Total Dissolved Solids (TDS) in water

Method: ME-(AU)-[ENV]AN113

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC02	PE110063.001	LB121986	24 Aug 2016	24 Aug 2016	31 Aug 2016	01 Sep 2016†	31 Aug 2016	01 Sep 2016†

Total Phosphorus by Kjeldahl Digestion DA in Water

Method: ME-(AU)-[ENV]AN279/AN293(Sydney only)

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
QC02	PE110063.001	LB121936	24 Aug 2016	24 Aug 2016	21 Sep 2016	31 Aug 2016	21 Sep 2016	02 Sep 2016

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifier when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No surrogates were required for this job.

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Ammonia Nitrogen by FIA

Method: ME-(AU)-[ENV]AN261

Sample Number	Parameter	Units	LOR	Result
LB121813.001	Ammonia, NH ₃	mg/L	0.05	<0.05
LB121813.025	Ammonia, NH ₃	mg/L	0.05	<0.05
LB121813.049	Ammonia, NH ₃	mg/L	0.05	<0.05
LB121813.073	Ammonia, NH ₃	mg/L	0.05	<0.05
LB121813.097	Ammonia, NH ₃	mg/L	0.05	<0.05

CBOD5

Method: ME-(AU)-[ENV]AN183

Sample Number	Parameter	Units	LOR	Result
LB121787.001	Biochemical Oxygen Demand (CBOD5)	mg/L	5	<5
LB121787.003	Biochemical Oxygen Demand (CBOD5)	mg/L	5	<5

TKN Kjeldahl Digestion by Discrete Analyser

Method: ME-(AU)-[ENV]AN281

Sample Number	Parameter	Units	LOR	Result
LB121936.001	Total Kjeldahl Nitrogen	mg/L	0.05	<0.05

Total Dissolved Solids (TDS) in water

Method: ME-(AU)-[ENV]AN113

Sample Number	Parameter	Units	LOR	Result
LB121986.001	Total Dissolved Solids Dried at 175-185°C	mg/L	10	<10

Total Phosphorus by Kjeldahl Digestion DA in Water

Method: ME-(AU)-[ENV]AN279/AN293(Sydney only)

Sample Number	Parameter	Units	LOR	Result
LB121936.001	Total Phosphorus (Kjeldahl Digestion)	mg/L	0.02	<0.02

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: $RPD = | \text{OriginalResult} - \text{ReplicateResult} | \times 100 / \text{Mean}$

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: $MAD = 100 \times \text{SDL} / \text{Mean} + \text{LR}$

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifier when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Ammonia Nitrogen by FIA

Method: ME-(AU)-[ENV]AN261

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
PE109968.007	LB121813.013	Ammonia, NH ₃	mg/L	0.05	-0.0133571428	0.0218571428	200	0
PE110086.002	LB121813.102	Ammonia, NH ₃	mg/L	0.05	0.0497857142	0.0497857142	115	0

CBOD5

Method: ME-(AU)-[ENV]AN183

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
PE110067.001	LB121787.010	Biochemical Oxygen Demand (CBOD5)	mg/L	5	324	337	17	4

Nitrate Nitrogen and Nitrite Nitrogen (NOx) by FIA

Method: ME-(AU)-[ENV]AN258

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
PE109968.007	LB121813.013	Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	0.219	0.21	38	4
PE109995.001	LB121813.028	Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	34.44	33.99	15	1
PE109995.011	LB121813.039	Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	57.106	58.26	15	2
PE110020.001	LB121813.054	Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	3.24	3.575	16	0
PE110043.001	LB121813.065	Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	4.27	4.29	16	0
PE110079.005	LB121813.080	Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	14.37	15.169	15	5
PE110079.015	LB121813.091	Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	2.902	2.901	17	0
PE110086.002	LB121813.106	Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	7.633	7.556	16	1
PE110090.002	LB121813.111	Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	1.775	1.775	18	0

TKN Kjeldahl Digestion by Discrete Analyser

Method: ME-(AU)-[ENV]AN281

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
PE109742A.001	LB121936.027	Total Kjeldahl Nitrogen	mg/L	0.05	0.016	0.083	116	50
PE109987.001	LB121936.006	Total Kjeldahl Nitrogen	mg/L	0.05	55.313	58.528	15	6
PE110035.001	LB121936.015	Total Kjeldahl Nitrogen	mg/L	0.05	82.949	82.868	15	0
PE110082.006	LB121936.035	Total Kjeldahl Nitrogen	mg/L	0.05	12	13	15	6

Total Dissolved Solids (TDS) in water

Method: ME-(AU)-[ENV]AN113

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
PE110087.004	LB121986.015	Total Dissolved Solids Dried at 175-185°C	mg/L	10	349.34281404864	192387805	16	1
PE110088.002	LB121986.023	Total Dissolved Solids Dried at 175-185°C	mg/L	10	00.11809861208	256652573	16	1

Total Phosphorus by Kjeldahl Digestion DA in Water

Method: ME-(AU)-[ENV]AN279/AN293(Sydney only)

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
PE109742A.001	LB121936.027	Total Phosphorus (Kjeldahl Digestion)	mg/L	0.02	0.013	0.012	175	0
PE109987.001	LB121936.006	Total Phosphorus (Kjeldahl Digestion)	mg/L	0.02	3.4	3.5	16	4
PE110035.001	LB121936.015	Total Phosphorus (Kjeldahl Digestion)	mg/L	0.02	8.053	7.817	15	3
PE110082.006	LB121936.035	Total Phosphorus (Kjeldahl Digestion)	mg/L	0.02	9.3	9.2	15	0

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

CBOD5

Method: ME-(AU)-[ENV]AN183

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB121787.005	Biochemical Oxygen Demand (CBOD5)	mg/L	5	180	198	80 - 120	90
LB121787.007	Biochemical Oxygen Demand (CBOD5)	mg/L	5	180	198	80 - 120	88

Nitrate Nitrogen and Nitrite Nitrogen (NOx) by FIA

Method: ME-(AU)-[ENV]AN258

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB121813.002	Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	4.1	4	85 - 115	102
LB121813.027	Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	4.2	4	85 - 115	106
LB121813.052	Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	4.2	4	85 - 115	106
LB121813.077	Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	4.2	4	85 - 115	106
LB121813.102	Nitrate/Nitrite Nitrogen, NOx as N	mg/L	0.05	4.3	4	85 - 115	107

TKN Kjeldahl Digestion by Discrete Analyser

Method: ME-(AU)-[ENV]AN281

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB121936.002	Total Kjeldahl Nitrogen	mg/L	0.05	1.0	1	80 - 120	105

Total Dissolved Solids (TDS) in water

Method: ME-(AU)-[ENV]AN113

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB121986.002	Total Dissolved Solids Dried at 175-185°C	mg/L	10	310	300	80 - 120	104

Total Phosphorus by Kjeldahl Digestion DA in Water

Method: ME-(AU)-[ENV]AN279/AN293(Sydney only)

Sample Number	Parameter	Units	LOR	Result	Expected	Criteria %	Recovery %
LB121936.002	Total Phosphorus (Kjeldahl Digestion)	mg/L	0.02	0.52	0.5	80 - 120	103

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub-sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifier when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Total Dissolved Solids (TDS) in water

Method: ME-(AU)-[ENV]AN113

QC Sample	Sample Number	Parameter	Units	LOR	Result	Original	Spike	Recovery%
PE109998.001	LB121986.004	Total Dissolved Solids Dried at 175-185°C	mg/L	10	1300	270	1000	102



MATRIX SPIKE DUPLICATES

PE110063 R0

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: $RPD = | \text{OriginalResult} - \text{ReplicateResult} | \times 100 / \text{Mean}$

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: $MAD = 100 \times \text{SDL} / \text{Mean} + \text{LR}$

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifier when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

Total Dissolved Solids (TDS) in water

Method: ME-(AU)-ENVJAN113

QC Sample	Sample Number	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
PE109998.001	LB121986.005	Total Dissolved Solids Dried at 175-185°C	mg/L	10	1300	1300	16	2

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here : <http://www.sgs.com.au/~media/Local/Australia/Documents/Technical Documents/MP-AU-ENV-QU-022 QA QC Plan.pdf>

- * NATA accreditation does not cover the performance of this service .
- Sample not analysed for this analyte.

IS Insufficient sample for analysis.
 LNR Sample listed, but not received.
 LOR Limit of reporting.
 QFH QC result is above the upper tolerance.
 QFL QC result is below the lower tolerance.

- ① At least 2 of 3 surrogates are within acceptance criteria.
- ② RPD failed acceptance criteria due to sample heterogeneity.
- ③ Results less than 5 times LOR preclude acceptance criteria for RPD.
- ④ Recovery failed acceptance criteria due to matrix interference.
- ⑤ Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
- ⑥ LOR was raised due to sample matrix interference.
- ⑦ LOR was raised due to dilution of significantly high concentration of analyte in sample.
- ⑧ Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
- ⑨ Low surrogate recovery due to the sample emulsifying during extraction.
- † Refer to Analytical Report comments for further information.

This document is issued, on the Client's behalf, by the Company under its General Conditions of Service, available on request and accessible at <http://www.sgs.com/en/terms-and-conditions>. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any other holder of this document is advised that information contained herein reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This test report shall not be reproduced, except in full.

CLIENTS • PEOPLE • PERFORMANCE

239

Death: 143A

FD-302a (Rev. 12-13-06)

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Page 1 of 1

COC No.

[illegible]

Environmental Division
Perth
Work Order Reference
EP1608944



Telephone : + 61-8-9209 7656

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP1608944

Client	: GHD PTY LTD	Laboratory	: Environmental Division Perth
Contact	: MR ANDREW NAGLE	Contact	: Lauren Biagioni
Address	: 999 HAY STREET PERTH WA 6000	Address	: 10 Hod Way Malaga WA Australia 6090
E-mail	: andrew.nagle@ghd.com	E-mail	: Lauren.biagioni@alsglobal.com
Telephone	: +61 08 6222 8222	Telephone	: 08 9209 7655
Facsimile	: +61 08 9429 6555	Facsimile	: +61-8-9209 7600
Project	: 61/34772 Point Moore Groundwater Assessment	Page	: 1 of 2
Order number	: ----	Quote number	: EP2016GHDSE0029 (EP/919/16 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: STEVEN PETTS		

Dates

Date Samples Received	: 23-Sep-2016 10:15 AM	Issue Date	: 23-Sep-2016
Client Requested Due Date	: 03-Oct-2016	Scheduled Reporting Date	: 03-Oct-2016

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Not intact.
No. of coolers/boxes	: 7	Temperature	: 18.9 - Ice Bricks present
Receipt Detail	:	No. of samples received / analysed	: 7 / 7

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (SamplesPerth@alsenviro.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (14 days), Solid (60 days) from date of completion of Work Order.
- **pH analysis should be conducted within 6 hours of sampling.**

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

- ### Summary of Sample(s) and Requested Analysis

Matrix: WATER

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER Total Dissolved Solids	WATER BOD	WATER FC, E. coli	WATER Heterotrophic Plate Count	WATER Total Nitrogen
EP1608944-001	[23-Sep-2016]	MW1	✓	✓	✓	✓	✓
EP1608944-002	[23-Sep-2016]	QC01_20160922	✓	✓	✓	✓	✓
EP1608944-003	[23-Sep-2016]	MW2	✓	✓	✓	✓	✓
EP1608944-004	[23-Sep-2016]	MW3	✓	✓	✓	✓	✓
EP1608944-005	[23-Sep-2016]	SHP8	✓	✓	✓	✓	✓
EP1608944-006	[23-Sep-2016]	QC03_20160922	✓	✓			✓
EP1608944-007	[23-Sep-2016]	QC04_20160922	✓	✓			✓

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

Email ap-fss@ghd.com

[illegible][illegible]

CERTIFICATE OF ANALYSIS

Work Order : **EP1608944**
Client : **GHD PTY LTD**
Contact : **MR ANDREW NAGLE**
Address : **999 HAY STREET**
PERTH WA 6000
Telephone : **+61 08 6222 8222**
Project : **61/34772 Point Moore Groundwater Assessment**
Order number : **----**
C-O-C number : **----**
Sampler : **STEVEN PETTS**
Site : **----**
Quote number : **----**
No. of samples received : **7**
No. of samples analysed : **7**

Page : 1 of 4
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 10 Hod Way Malaga WA Australia 6090
Telephone : 08 9209 7655
Date Samples Received : 23-Sep-2016 10:15
Date Analysis Commenced : 23-Sep-2016
Issue Date : 03-Oct-2016 20:21



Accreditation No. 825
 Accredited for compliance with
 ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Alini Goundar	Senior Analyst	Perth Microbiology, Malaga, WA
Jeremy Truong	Laboratory Manager	Perth Inorganics, Malaga, WA
Tyrone Cole	Inorganics Preparation Supervisor	Perth Inorganics, Malaga, WA
Vinitha Kesavan	Analyst	Perth Microbiology, Malaga, WA



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- CFU = colony forming unit
- MF = membrane filtration
- MW006 and MW007: estimate (~) is reported where the growth of presumptive bacteria on the filtered membrane is counted <10 cfu and/or >100 cfu and where there are many non-target colonies; the typical colonies may be masked by overgrowth of non-target organisms. It may be informative to record this fact.
- MW002 is ALS's internal code and is equivalent to AS4276.3.1.
- MW006 is ALS's internal code and is equivalent to AS4276.7.
- MW007 is ALS's internal code and is equivalent to AS4276.5.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MW1	QC01_20160922	MW2	MW3	SHP8
Client sampling date / time					[23-Sep-2016]	[23-Sep-2016]	[23-Sep-2016]	[23-Sep-2016]	[23-Sep-2016]
Compound	CAS Number	LOR	Unit		EP1608944-001	EP1608944-002	EP1608944-003	EP1608944-004	EP1608944-005
					Result	Result	Result	Result	Result
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		22300	22400	2120	1320	10300
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		6.28	6.42	0.13	0.78	2.54
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	1.85	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.05	<0.01	9.95	0.01	0.03
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		0.05	<0.01	11.8	0.01	0.03
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		6.7	6.7	2.0	0.9	3.3
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		6.8	6.7	13.8	0.9	3.3
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.81	0.90	0.14	0.08	0.38
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		31	22	4	5	22
MW002: Heterotrophic Plate Count									
Heterotrophic Plate Count (22°C)	----	1	CFU/mL		72	73	1700	2400	12
Heterotrophic Plate Count (36°C)	----	1	CFU/mL		170	140	12000	2100	17
MW006: Faecal Coliforms & E.coli by MF									
Faecal Coliforms	----	1	CFU/100mL		<1	<1	~<1	~1	<1
<i>Escherichia coli</i>	----	1	CFU/100mL		<1	<1	~<1	~1	<1
MW007: Coliforms by MF									
Coliforms	----	1	CFU/100mL		<1	<1	~10	~10	<1



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC03_20160922	QC04_20160922			
Client sampling date / time					[23-Sep-2016]	[23-Sep-2016]			
Compound	CAS Number	LOR	Unit		EP1608944-006	EP1608944-007			
				Result	Result				
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		20	<10	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		<0.01	<0.01	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	<0.01	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<0.1	<0.1	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		<0.1	<0.1	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		<0.01	<0.01	----	----	----
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		<2	<2	----	----	----
MW002: Heterotrophic Plate Count									
Heterotrophic Plate Count (22°C)	----	1	CFU/mL		----	----	----	----	----
Heterotrophic Plate Count (36°C)	----	1	CFU/mL		----	----	----	----	----
MW006: Faecal Coliforms & E.coli by MF									
Faecal Coliforms	----	1	CFU/100mL		----	----	----	----	----
<i>Escherichia coli</i>	----	1	CFU/100mL		----	----	----	----	----
MW007: Coliforms by MF									
Coliforms	----	1	CFU/100mL		----	----	----	----	----

QUALITY CONTROL REPORT

Work Order : **EP1608944**

Page : 1 of 4

Client : **GHD PTY LTD**

Contact : **MR ANDREW NAGLE**

Address : **999 HAY STREET
PERTH WA 6000**

Telephone : **+61 08 6222 8222**

Project : **61/34772 Point Moore Groundwater Assessment**

Order number : ----

C-O-C number : ----

Sampler : **STEVEN PETTS**

Site : ----

Quote number : ----

No. of samples received : **7**

No. of samples analysed : **7**

Laboratory : **Environmental Division Perth**

Contact : **Lauren Biagioni**

Address : **10 Hod Way Malaga WA Australia 6090**

Telephone : **08 9209 7655**

Date Samples Received : **23-Sep-2016**

Date Analysis Commenced : **23-Sep-2016**

Issue Date : **03-Oct-2016**



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

Signatories	Position	Accreditation Category
Alini Goundar	Senior Analyst	Perth Microbiology, Malaga, WA
Jeremy Truong	Laboratory Manager	Perth Inorganics, Malaga, WA
Tyrone Cole	Inorganics Preparation Supervisor	Perth Inorganics, Malaga, WA
Vinitha Kesavan	Analyst	Perth Microbiology, Malaga, WA



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

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

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 602290)									
EP1608944-001	MW1	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	22300	21700	2.96	0% - 20%
EP1609004-002	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	227	222	2.45	0% - 20%
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 595630)									
EP1608932-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.03	0.04	0.00	No Limit
EP1608944-002	QC01_20160922	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	6.42	6.47	0.792	0% - 20%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 595643)									
EP1608944-001	MW1	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EP1608946-004	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 595631)									
EP1608932-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EP1608944-002	QC01_20160922	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.02	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 602454)									
EP1608944-005	SHP8	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	3.3	3.3	0.00	0% - 20%
EP1608957-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	1.0	61.4	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 602453)									
EP1608944-005	SHP8	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.38	0.39	3.39	0% - 20%
EP1608957-004	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.05	0.05	0.00	No Limit
EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 595538)									
EP1608905-002	Anonymous	EP030: Biochemical Oxygen Demand	----	2	mg/L	245	253	3.13	0% - 20%
EP1608944-004	MW3	EP030: Biochemical Oxygen Demand	----	2	mg/L	5	4	24.4	No Limit



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
Method: Compound		CAS Number	LOR		Unit	Result	Spike Concentration	Spike Recovery (%) LCS
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 602290)								
EA015H: Total Dissolved Solids @180°C		----	10	mg/L	<10	2000 mg/L	96.8	83111
					<10	293 mg/L	112	70130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 595630)								
EK055G: Ammonia as N		7664-41-7	0.01	mg/L	<0.01	1 mg/L	107	87115
EK057G: Nitrite as N by Discrete Analyser (QCLot: 595643)								
EK057G: Nitrite as N		14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	107	86112
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 595631)								
EK059G: Nitrite + Nitrate as N		----	0.01	mg/L	<0.01	0.5 mg/L	110	92112
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 602454)								
EK061G: Total Kjeldahl Nitrogen as N		----	0.1	mg/L	<0.1	10 mg/L	85.4	82110
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 602453)								
EK067G: Total Phosphorus as P		----	0.01	mg/L	<0.01	4.42 mg/L	90.6	70130
EP030: Biochemical Oxygen Demand (BOD) (QCLot: 595538)								
EP030: Biochemical Oxygen Demand		----	2	mg/L	<2	198 mg/L	90.4	78117

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK055G: Ammonia as N by Discrete Analyser (QCLot: 595630)							
EP1608932-002	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	127	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 595643)							
EP1608944-002	QC01_20160922	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	91.1	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 595631)							
EP1608932-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	110	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 602454)							
EP1608944-006	QC03_20160922	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	88.1	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 602453)							
EP1608944-006	QC03_20160922	EK067G: Total Phosphorus as P	----	1 mg/L	95.9	70	130



QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EP1608944	Page	: 1 of 6
Client	: GHD PTY LTD	Laboratory	: Environmental Division Perth
Contact	: MR ANDREW NAGLE	Telephone	: 08 9209 7655
Project	: 61/34772 Point Moore Groundwater Assessment	Date Samples Received	: 23-Sep-2016
Site	: ----	Issue Date	: 03-Oct-2016
Sampler	: STEVEN PETTS	No. of samples received	: 7
Order number	: ----	No. of samples analysed	: 7

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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



Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA015: Total Dissolved Solids dried at 180 ± 5 °C								
Clear Plastic Bottle - Natural (EA015H) MW1, QC01_20160922, MW2, MW3, SHP8, QC03_20160922, QC04_20160922	23-Sep-2016	----	----	----	30-Sep-2016	30-Sep-2016	✓	
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G) MW1, QC01_20160922, MW2, MW3, SHP8, QC03_20160922, QC04_20160922	23-Sep-2016	----	----	----	23-Sep-2016	21-Oct-2016	✓	
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G) MW1, QC01_20160922, MW2, MW3, SHP8, QC03_20160922, QC04_20160922	23-Sep-2016	----	----	----	23-Sep-2016	25-Sep-2016	✓	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G) MW1, QC01_20160922, MW2, MW3, SHP8, QC03_20160922, QC04_20160922	23-Sep-2016	----	----	----	23-Sep-2016	21-Oct-2016	✓	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G) MW1, QC01_20160922, MW2, MW3, SHP8, QC03_20160922, QC04_20160922	23-Sep-2016	03-Oct-2016	21-Oct-2016	✓	03-Oct-2016	21-Oct-2016	✓	



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G)		23-Sep-2016	03-Oct-2016	21-Oct-2016	✔	03-Oct-2016	21-Oct-2016	✔
MW1,	QC01_20160922,							
MW2,	MW3,							
SHP8,	QC03_20160922,							
QC04_20160922								
EP030: Biochemical Oxygen Demand (BOD)								
Clear Plastic Bottle - Natural (EP030)		23-Sep-2016	----	----	----	23-Sep-2016	25-Sep-2016	✔
MW1,	QC01_20160922,							
MW2,	MW3,							
SHP8,	QC03_20160922,							
QC04_20160922								
MW002: Heterotrophic Plate Count								
Sterile Plastic Bottle - Sodium Thiosulfate (MW002)		23-Sep-2016	----	----	----	23-Sep-2016	24-Sep-2016	✔
MW1,	QC01_20160922,							
MW2,	MW3,							
SHP8								
MW006: Faecal Coliforms & E.coli by MF								
Sterile Plastic Bottle - Sodium Thiosulfate (MW006)		23-Sep-2016	----	----	----	23-Sep-2016	24-Sep-2016	✔
MW1,	QC01_20160922,							
MW2,	MW3,							
SHP8								
MW007: Coliforms by MF								
Sterile Plastic Bottle - Sodium Thiosulfate (MW007)		23-Sep-2016	----	----	----	23-Sep-2016	24-Sep-2016	✔
MW1,	QC01_20160922,							
MW2,	MW3,							
SHP8								



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Ammonia as N by Discrete analyser	EK055G	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	2	18	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	15	13.33	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	15	13.33	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of 'filterable' residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G. Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined separately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Biochemical Oxygen Demand (BOD)	EP030	WATER	In house: Referenced to APHA 5210 B. The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM (2013) Schedule B(3)
Heterotrophic (Total) Plate Count @ 22C and 36C	MW002	WATER	In house: Referenced to AS4276.3.1- 2007
Thermotolerant Coliforms & E.coli by Membrane Filtration	MW006	WATER	In house: Referenced to AS 4276.7 2007
Coliforms by Membrane Filtration	MW007	WATER	In house: Referenced to AS 4276.5 - 2007
Preparation Methods	Method	Matrix	Method Descriptions



Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)

GHD House 239
Adelaide Terrace Perth WA PO Box Y3106 Telephone 08 6222 8222 Facsimile 08 6222
6004 Perth WA 6832 8555

COC No.

[illegible]

SAMPLE RECEIPT ADVICE

Client Details	
Client	GHD Services Pty Ltd
Attention	A Nagle

Sample Login Details	
Your Reference	61/34772 City of Greater Geraldton
Envirolab Reference	186264
Date Sample Received	23/09/2016
Date Instructions Received	23/09/2016
Date Results Expected to be Reported	03/10/2016

Sample Condition	
Samples received in appropriate condition for analysis	YES
No. of Samples Provided	1 Water
Turnaround Time Requested	Standard
Temperature on receipt (°C)	7
Cooling Method	Ice Pack
Sampling Date Provided	NO

Comments
Samples will be held for 1 month for water samples and 2 months for soil samples from date of receipt of samples

Please direct any queries to:

Joshua Lim	Meredith Conroy
Phone: 08 9317 2505	Phone: 08 9317 2505
Fax: 08 9317 4163	Fax: 08 9317 4163
Email: jlim@mpl.com.au	Email: mconroy@mpl.com.au

Sample and Testing Details on following page



Part of the Envirolab Group



16 - 18 Hayden Court, Myaree, Western Australia 6154
PO Box 4023 Myaree BC, Western Australia 6960
Tel: +61 8 9317 2505 / Fax: +61 8 9317 4163
email: laboratory@mpl.com.au
www.mpl.com.au
Envirolab Services (WA) Pty Ltd ABN 53 140 099 207

<i>Sample Id</i>	<i>BOD</i>	<i>Total Dissolved Solids (grav)</i>	<i>Microbiological Testing</i>	<i>Nutrients in Water</i>
QC02_20160922	✓	✓	✓	✓



16-18 Hayden Court, Myaree, Western Australia 6154
PO Box 4023 Myaree BC, Western Australia 6950
tel: +61 8 9317 2505

email: lab@mpl.com.au
envirolab.com.au

Envirolab Services (WA) Pty Ltd trading as
MPL Laboratories | ABN 53 140 099 207

CERTIFICATE OF ANALYSIS 186264

Client:

GHD Services Pty Ltd
PO Box Y3106
Perth
WA 6000

Attention: A Nagle

Sample log in details:

Your Reference:	<u>61/34772 City of Greater Geraldton</u>
No. of samples:	1 Water
Date samples received:	23/09/2016
Date completed instructions received:	23/09/2016
Location:	

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last pages of this report for any comments relating to the results.

Report Details:

Date results requested by:	3/10/16
Date of Preliminary Report:	not issued
Issue Date:	30/09/16

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025 - Testing
Tests not covered by NATA are denoted with *.

Results Approved By:



Joshua Lim
Operations Manager



Jessica Miller
Micro Team Leader

MPL Reference: 186264
Revision No: R 00



Miscellaneous Inorganics		
Our Reference:	UNITS	186264-1
Your Reference	-----	QC02_20160
		922
Type of sample	-----	Water
Date prepared	-	28/09/2016
Date analysed	-	28/09/2016
BOD	mg/L	<5
Total Dissolved Solids (grav)	mg/L	22,000

Microbiological Testing		
Our Reference:	UNITS	186264-1
Your Reference	-----	QC02_20160
		922
Type of sample	-----	Water
Date testing started	-	23/09/2016
Date testing completed	-	28/09/2016
Heterotrophic Plate Count 21C	cfu/mL	340
Heterotrophic Plate Count 35C	cfu/mL	260
Total Coliforms	cfu/100mL	<1
Thermotolerant Coliforms	cfu/100mL	<1
E.coli	cfu/100mL	<1

Nutrients in Water Our Reference: Your Reference	UNITS -----	186264-1 QC02_20160 922
Type of sample	-----	Water
Date prepared	-	23/09/2016
Date analysed	-	23/09/2016
Total Nitrogen	mg/L	9.2
TKN by Discrete Analyser	mg/L	9.2
NOx as N	mg/L	0.009
Nitrate as N	mg/L	<0.005
Nitrite as N	mg/L	0.006
Ammonia as N	mg/L	5.0
Total Phosphorus	mg/L	0.78

Method ID	Methodology Summary
INORG-091	BOD - Analysed in accordance with APHA latest edition 5210 D.
INORG-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180±5°C
MICRO-001	Heterotrophic Plate Count: Microbial Water Analysis - in accordance with MICRO-001 (APHA-9215D-2005). Recommended maximums based on NHMRC and ARMC Australian Drinking Water Guidelines.
MICRO-001	Total Coliforms: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.5-2007). Recommended maximums based on NHMRC and ARMC Australian Drinking Water Guidelines.
MICRO-001	Thermotolerant Coliforms: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.7-2007). Recommended maximums based on NHMRC and ARMC Australian Drinking Water Guidelines.
MICRO-001	E. Coli: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.7-2007). Recommended maximums based on NHMRC and ARMC Australian Drinking Water Guidelines.
INORG-055	Total Nitrogen by colourimetric analysis based on APHA 4500-P J, 4500-NO3 F.
INORG-062	TKN by calculation from Total Nitrogen and NOx using APHA methodology.
INORG-055	NOx - determined colourimetrically. Soils are analysed from a water extract.
INORG-055	Nitrate - determined colourimetrically. Soils are analysed from a water extract.
INORG-055	Nitrite - determined colourimetrically. Soils are analysed from a water extract.
INORG-057	Ammonia by colourimetric analysis based on APHA latest edition 4500-NH3 F.
METALS-020	Metals in soil and water by ICP-OES.

Client Reference: 61/34772 City of Greater Geraldton

QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Miscellaneous Inorganics						Base II Duplicate II %RPD		
Date prepared	-			28/09/2016	[NT]	[NT]	LCS-1	28/09/2016
Date analysed	-			28/09/2016	[NT]	[NT]	LCS-1	28/09/2016
BOD	mg/L	5	INORG-091	<5	[NT]	[NT]	LCS-1	70%
Total Dissolved Solids (grav)	mg/L	5	INORG-018	<5	[NT]	[NT]	LCS-1	102%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank				
Microbiological Testing								
Date testing started	-			23/09/2016				
Date testing completed	-			28/09/2016				
Heterotrophic Plate Count 21C	cfu/mL	10	MICRO-001	<10				
Heterotrophic Plate Count 35C	cfu/mL	10	MICRO-001	<10				
Total Coliforms	cfu/100 mL	1	MICRO-001	<1				
Thermotolerant Coliforms	cfu/100 mL	1	MICRO-001	<1				
E.coli	cfu/100 mL	1	MICRO-001	<1				
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Nutrients in Water						Base II Duplicate II %RPD		
Date prepared	-			23/09/2016	[NT]	[NT]	LCS-1	23/09/2016
Date analysed	-			23/09/2016	[NT]	[NT]	LCS-1	23/09/2016
Total Nitrogen	mg/L	0.1	INORG-055	<0.1	[NT]	[NT]	LCS-1	118%
TKN by Discrete Analyser	mg/L	0.1	INORG-062	<0.1	[NT]	[NT]	[NR]	[NR]
NOx as N	mg/L	0.005	INORG-055	<0.005	[NT]	[NT]	LCS-1	103%
Nitrate as N	mg/L	0.005	INORG-055	<0.005	[NT]	[NT]	LCS-1	103%
Nitrite as N	mg/L	0.005	INORG-055	<0.005	[NT]	[NT]	LCS-1	106%
Ammonia as N	mg/L	0.005	INORG-057	<0.005	[NT]	[NT]	LCS-1	90%
Total Phosphorus	mg/L	0.05	METALS-020	<0.05	[NT]	[NT]	LCS-1	100%

Report Comments:

Definitions:

NT: Not tested NA: Test not required INS: Insufficient sample for this test PQL: Practical Quantitation Limit
<: Less than >: Greater than RPD: Relative Percent Difference LCS: Laboratory Control Sample
NS: Not Specified NEPM: National Environmental Protection Measure NR: Not Reported

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike: A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample): This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

CHAIN OF CUSTODY RECORD AND
ANALYSIS REQUEST



CLIENTS PEOPLE PERFORMANCE

GHD House 239
Adelaide Terrace Perth WA PO Box Y3106 Telephone 08 6222 8222 Facsimile 08 6222
6004 Perth WA 6832 8555

Page 1 of 1

COC No.

Point Moore Groundwater Assessment				Laboratory: ALS																										
Client City of Greater Geraldton				Job No. 61/34772				Address: 10 Hod Way, Malaga 6090																						
Laboratory Quote No. EP/919/16				Turnaround Time Standard				Laboratory Contact: Lauren Biagioni																						
Job Manager (Invoice) Andrew Nagle				Email Address (Results) andrew.nagle@ghd.com steven.petts@ghd.com																										
GHD Sample ID	Laboratory Sample ID	Date	Time	Sample Matrix Water / Soil / Sludge / W / A / R	Container Type: Bottle / Jar / Vial / Bag / G Glass / P-Plastic	Preservative Unpreserved / HCL H2SO4 / HNO3 / Other	No	Total Volume (mL)	NT-8	EP030	EA015H	MW002	M5																Hold	Remarks
MW1	1	18-10		W	BP	H2SO4	3	810	☒	☒	☒	☒	☒																	
QC01_20160922	2	"		W	BP	H2SO4	3	810	☒	☒	☒	☒	☒																	
MW2	3	"		W	BP	H2SO4	3	810	☒	☒	☒	☒	☒																	
MW3	4	"		W	BP	H2SO4	3	810	☒	☒	☒	☒	☒																	
SHP8	5	"		W	BP	H2SO4	3	810	☒	☒	☒	☒	☒																	
QC03_20160922	6	"		W	BP	H2SO4	2	560	☒	☒	☒																			
QC04_20160922	7	"		W	BP	H2SO4	2	560	☒	☒	☒																			
Sampled by: S. Petts				Date/Time: 18/10/2016				Relinquished by: S. Petts																Date/ Time: 18/10/2016						
Received by: <i>Andrew Nagle</i>				Date/Time: 19-10-16 0915				Relinquished by:																Date/ Time:						
Received by Lab:				Date/Time:				Courier/ Transport Company: NA																						
Sample Conditions:				Remarks:																										

Environmental Division
Perth
Work Order Reference
EP1609847



Telephone - 61-8-9209 7655

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : EP1609847

Client : GHD PTY LTD Contact : MR ANDREW NAGLE Address : 999 HAY STREET PERTH WA 6000 E-mail : andrew.nagle@ghd.com Telephone : +61 08 6222 8222 Facsimile : +61 08 9429 6555 Project : 61/34772 Point Moore Groundwater Assessment Order number : ---- C-O-C number : ---- Site : ---- Sampler : STEVEN PETTS	Laboratory : Environmental Division Perth Contact : Lauren Biagioni Address : 10 Hod Way Malaga WA Australia 6090 E-mail : Lauren.biagioni@alsglobal.com Telephone : 08 9209 7655 Facsimile : +61-8-9209 7600 Page : 1 of 2 Quote number : EP2016GHDSE0029 (EP/919/16 V2) QC Level : NEPM 2013 B3 & ALS QC Standard
--	---

Dates

Date Samples Received : 19-Oct-2016 9:25 AM	Issue Date : 19-Oct-2016
Client Requested Due : 26-Oct-2016	Scheduled Reporting Date : 26-Oct-2016
Date	

Delivery Details

Mode of Delivery : Carrier	Security Seal : Intact.
No. of coolers/boxes : 1	Temperature : 3.5 - Ice present
Receipt Detail :	No. of samples received / analysed : 7 / 7

General Comments

- This report contains the following information:
 - Sample Container(s)/Preservation Non-Compliances
 - Summary of Sample(s) and Requested Analysis
 - Proactive Holding Time Report
 - Requested Deliverables
- Please see scanned COC for sample discrepancies: extra samples , samples not received etc.
- Please direct any queries related to sample condition / numbering / breakages to Sample Receipt (SamplesPerth@alsenviro.com)
- Analytical work for this work order will be conducted at ALS Environmental Perth.
- Please direct any turnaround / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (14 days), Solid (60 days) from date of completion of Work Order.
- **pH analysis should be conducted within 6 hours of sampling.**



Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

If no sampling time is provided, the sampling time will default to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - EA015H Total Dissolved Solids - High Level	WATER - EP030 BOD	WATER - M5 - ES/EB/FM FC, E. coli & TC by MF	WATER - MW002 (22C and 36C) Heterotrophic Colony Count (22C & 36C)	WATER - NT-08 Total Nitrogen + NO2 + NO3 + NH3 + Total P
EP1609847-001	[18-Oct-2016]	MW1	✓	✓	✓	✓	✓
EP1609847-002	[18-Oct-2016]	QC01_20160922	✓	✓	✓	✓	✓
EP1609847-003	[18-Oct-2016]	MW2	✓	✓	✓	✓	✓
EP1609847-004	[18-Oct-2016]	MW3	✓	✓	✓	✓	✓
EP1609847-005	[18-Oct-2016]	SHP8	✓	✓	✓	✓	✓
EP1609847-006	[18-Oct-2016]	QC03_20160922	✓	✓			✓
EP1609847-007	[18-Oct-2016]	QC04_20160922	✓	✓			✓

Proactive Holding Time Report

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

Requested Deliverables

ANDREW NAGLE

- *AU Certificate of Analysis - NATA (COA)	Email	andrew.nagle@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	andrew.nagle@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	andrew.nagle@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	andrew.nagle@ghd.com
- A4 - AU Tax Invoice (INV)	Email	andrew.nagle@ghd.com
- Chain of Custody (CoC) (COC)	Email	andrew.nagle@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	andrew.nagle@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	andrew.nagle@ghd.com
- EDI Format - XTab (XTAB)	Email	andrew.nagle@ghd.com

STEVEN PETTS

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

CERTIFICATE OF ANALYSIS

Work Order : **EP1609847**
Amendment : **1**
Client : **GHD PTY LTD**
Contact : **MR ANDREW NAGLE**
Address : **999 HAY STREET**
PERTH WA 6000
Telephone : **+61 08 6222 8222**
Project : **61/34772 Point Moore Groundwater Assessment**
Order number : **----**
C-O-C number : **----**
Sampler : **STEVEN PETTS**
Site : **----**
Quote number : **----**
No. of samples received : **7**
No. of samples analysed : **7**

Page : 1 of 4
Laboratory : Environmental Division Perth
Contact : Lauren Biagioni
Address : 10 Hod Way Malaga WA Australia 6090
Telephone : 08 9209 7655
Date Samples Received : 19-Oct-2016 09:25
Date Analysis Commenced : 19-Oct-2016
Issue Date : 02-Nov-2016 11:53



Accreditation No. 825
 Accredited for compliance with
 ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Jeremy Truong	Laboratory Manager	Perth Inorganics, Malaga, WA
Tyrone Cole	Inorganics Preparation Supervisor	Perth Inorganics, Malaga, WA
Vinitha Kesavan	Analyst	Perth Microbiology, Malaga, WA



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- CFU = colony forming unit
- MF = membrane filtration
- This report has been amended to update the sample ID's for the QC samples, as per the client's request. There are no changes to the results.
- MW007 and MW006: estimate (~) is reported where there are many non-target colonies; the typical colonies may be masked by overgrowth of non-target organisms. It may be informative to record this fact.
- MW002 is ALS's internal code and is equivalent to AS4276.3.1.
- MW006 is ALS's internal code and is equivalent to AS4276.7.
- MW007 is ALS's internal code and is equivalent to AS4276.5.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MW1	QC01_20161018	MW2	MW3	SHP8
Client sampling date / time					[18-Oct-2016]	[18-Oct-2016]	[18-Oct-2016]	[18-Oct-2016]	[18-Oct-2016]
Compound	CAS Number	LOR	Unit		EP1609847-001	EP1609847-002	EP1609847-003	EP1609847-004	EP1609847-005
					Result	Result	Result	Result	Result
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		13100	13100	1360	1340	2290
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		3.95	4.00	1.48	0.32	0.46
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	0.27	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.46	0.46	6.06	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		0.46	0.46	6.33	<0.01	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		4.2	4.1	2.6	0.6	1.2
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		4.7	4.6	8.9	0.6	1.2
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.47	0.46	0.18	0.08	0.28
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		33	27	3	3	57
MW002: Heterotrophic Plate Count									
Heterotrophic Plate Count (22°C)	----	1	CFU/mL		4200	4400	4500	14000	2000
Heterotrophic Plate Count (36°C)	----	1	CFU/mL		4400	3600	7400	5500	980
MW006: Faecal Coliforms & E.coli by MF									
Faecal Coliforms	----	1	CFU/100mL		~<1	~<1	~<1	~<1	~<1
Escherichia coli	----	1	CFU/100mL		~<1	~<1	~<1	~<1	~<1
MW007: Coliforms by MF									
Coliforms	----	1	CFU/100mL		~<1	~<1	~<1	~<1	~<1



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC03_20161018	QC04_20161018	----	----	----
Client sampling date / time					[18-Oct-2016]	[18-Oct-2016]	----	----	----
Compound	CAS Number	LOR	Unit		EP1609847-006	EP1609847-007	-----	-----	-----
					Result	Result	----	----	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		14	16	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		0.06	0.06	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	0.01	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	0.01	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<0.1	<0.1	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		<0.1	<0.1	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		<0.01	<0.01	----	----	----
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		<2	<2	----	----	----
MW002: Heterotrophic Plate Count									
Heterotrophic Plate Count (22°C)	----	1	CFU/mL		----	----	----	----	----
Heterotrophic Plate Count (36°C)	----	1	CFU/mL		----	----	----	----	----
MW006: Faecal Coliforms & E.coli by MF									
Faecal Coliforms	----	1	CFU/100mL		----	----	----	----	----
<i>Escherichia coli</i>	----	1	CFU/100mL		----	----	----	----	----
MW007: Coliforms by MF									
Coliforms	----	1	CFU/100mL		----	----	----	----	----

QUALITY CONTROL REPORT

Work Order : **EP1609847**

Page : 1 of 4

Amendment : **1**

Client : **GHD PTY LTD**

Laboratory : Environmental Division Perth

Contact : **MR ANDREW NAGLE**

Contact : Lauren Biagioni

Address : 999 HAY STREET
PERTH WA 6000

Address : 10 Hod Way Malaga WA Australia 6090

Telephone : +61 08 6222 8222

Telephone : 08 9209 7655

Project : 61/34772 Point Moore Groundwater Assessment

Date Samples Received : 19-Oct-2016

Order number : ----

Date Analysis Commenced : 19-Oct-2016

C-O-C number : ----

Issue Date : 02-Nov-2016

Sampler : **STEVEN PETTS**

Site : ----

Quote number : ----

No. of samples received : **7**

No. of samples analysed : **7**



Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

Signatories

Position

Accreditation Category

Jeremy Truong

Laboratory Manager

Perth Inorganics, Malaga, WA

Tyrone Cole

Inorganics Preparation Supervisor

Perth Inorganics, Malaga, WA

Vinitha Kesavan

Analyst

Perth Microbiology, Malaga, WA



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

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

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QC Lot: 627327)									
EP1609847-001	MW1	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	13100	12800	2.00	0% - 20%
EP1609866-001	Anonymous	EA015H: Total Dissolved Solids @180°C	----	10	mg/L	644	684	6.01	0% - 20%
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 623447)									
EP1609847-001	MW1	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	3.95	3.93	0.520	0% - 20%
EP1609870-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.03	0.03	0.00	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 623435)									
EP1609882-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.02	0.02	0.00	No Limit
EP1609888-010	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.15	0.14	0.00	0% - 50%
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 623448)									
EP1609847-001	MW1	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.46	0.46	0.00	0% - 20%
EP1609870-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	1.56	1.50	3.98	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 628160)									
EP1608883-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.2	1.2	0.00	0% - 50%
EP1609847-003	MW2	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.6	2.6	0.00	0% - 50%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 628159)									
EP1608883-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.20	0.20	0.00	0% - 20%
EP1609847-003	MW2	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.18	0.17	8.86	No Limit
EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 625068)									
EP1609847-006	QC03_20161018	EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	<2	0.00	No Limit
EP1609931-003	Anonymous	EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	<2	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

Sub-Matrix: WATER				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
Method: Compound	CAS Number	LOR	Unit	Result				
EA015: Total Dissolved Solids dried at 180 ± 5 °C (QCLot: 627327)								
EA015H: Total Dissolved Solids @180°C	----	10	mg/L	<10	2000 mg/L	106	83	111
				<10	1000 mg/L	109	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 623447)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	101	87	115
EK057G: Nitrite as N by Discrete Analyser (QCLot: 623435)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	102	86	112
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 623448)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	109	92	112
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 628160)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	87.9	82	110
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 628159)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	91.4	70	130
EP030: Biochemical Oxygen Demand (BOD) (QCLot: 625068)								
EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	198 mg/L	90.8	78	117

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%) MS	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number			Low	High
EK055G: Ammonia as N by Discrete Analyser (QCLot: 623447)							
EP1609847-002	QC01_20161018	EK055G: Ammonia as N	7664-41-7	1 mg/L	85.1	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 623435)							
EP1609847-001	MW1	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	88.0	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 623448)							
EP1609847-002	QC01_20161018	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	105	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 628160)							
EP1608883-005	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	96.2	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 628159)							
EP1608883-005	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	85.2	70	130



QA/QC Compliance Assessment to assist with Quality Review

Work Order : EP1609847

Page : 1 of 6

Amendment : 1

Client : GHD PTY LTD

Laboratory : Environmental Division Perth

Contact : MR ANDREW NAGLE

Telephone : 08 9209 7655

Project : 61/34772 Point Moore Groundwater Assessment

Date Samples Received : 19-Oct-2016

Site : ----

Issue Date : 02-Nov-2016

Sampler : STEVEN PETTS

No. of samples received : 7

Order number : ----

No. of samples analysed : 7

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results. This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein. Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters. Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H)							
MW1, QC01_20161018,	18-Oct-2016	----	----	----	24-Oct-2016	25-Oct-2016	✓
MW2, MW3,							
SHP8, QC03_20161018,							
QC04_20161018							
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
MW1, QC01_20161018,	18-Oct-2016	----	----	----	19-Oct-2016	15-Nov-2016	✓
MW2, MW3,							
SHP8, QC03_20161018,							
QC04_20161018							
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
MW1, QC01_20161018,	18-Oct-2016	----	----	----	19-Oct-2016	20-Oct-2016	✓
MW2, MW3,							
SHP8, QC03_20161018,							
QC04_20161018							
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
MW1, QC01_20161018,	18-Oct-2016	----	----	----	19-Oct-2016	15-Nov-2016	✓
MW2, MW3,							
SHP8, QC03_20161018,							
QC04_20161018							
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
MW1, QC01_20161018,	18-Oct-2016	26-Oct-2016	15-Nov-2016	✓	26-Oct-2016	15-Nov-2016	✓
MW2, MW3,							
SHP8, QC03_20161018,							
QC04_20161018							



Matrix: **WATER**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G)								
MW1, QC01_20161018,	18-Oct-2016	26-Oct-2016	15-Nov-2016	✔	26-Oct-2016	15-Nov-2016	✔	
MW2, MW3,								
SHP8, QC03_20161018,								
QC04_20161018								
EP030: Biochemical Oxygen Demand (BOD)								
Clear Plastic Bottle - Natural (EP030)								
MW1, QC01_20161018,	18-Oct-2016	----	----	----	20-Oct-2016	20-Oct-2016	✔	
MW2, MW3,								
SHP8, QC03_20161018,								
QC04_20161018								
MW002: Heterotrophic Plate Count								
Sterile Plastic Bottle - Sodium Thiosulfate (MW002)								
MW1, QC01_20161018,	18-Oct-2016	----	----	----	19-Oct-2016	19-Oct-2016	✔	
MW2, MW3,								
SHP8								
MW006: Faecal Coliforms & E.coli by MF								
Sterile Plastic Bottle - Sodium Thiosulfate (MW006)								
MW1, QC01_20161018,	18-Oct-2016	----	----	----	19-Oct-2016	19-Oct-2016	✔	
MW2, MW3,								
SHP8								
MW007: Coliforms by MF								
Sterile Plastic Bottle - Sodium Thiosulfate (MW007)								
MW1, QC01_20161018,	18-Oct-2016	----	----	----	19-Oct-2016	19-Oct-2016	✔	
MW2, MW3,								
SHP8								



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Ammonia as N by Discrete analyser	EK055G	2	12	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	13	15.38	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Ammonia as N by Discrete analyser	EK055G	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	12	8.33	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of 'filterable' residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G. Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined separately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Biochemical Oxygen Demand (BOD)	EP030	WATER	In house: Referenced to APHA 5210 B. The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM (2013) Schedule B(3)
Heterotrophic (Total) Plate Count @ 22C and 36C	MW002	WATER	In house: Referenced to AS4276.3.1- 2007
Thermotolerant Coliforms & E.coli by Membrane Filtration	MW006	WATER	In house: Referenced to AS 4276.7 2007
Coliforms by Membrane Filtration	MW007	WATER	In house: Referenced to AS 4276.5 - 2007
Preparation Methods	Method	Matrix	Method Descriptions



Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)

GHD House 239
Adelaide Terrace Perth WA PO Box Y3106 Telephone 08 6222 8222 Facsimile 08 6222
6004 Perth WA 6832 8555

COC No.




Laboratories

Job No.- 187366

Date Rec - 19-10

Time Rec - 930

Rec By - MC

TAT Req - SAME 1/2/3 (STD)

Temp - (cool) ambient

Cooling - Ice / Ice pack / None

Security Seal - Yes / No

SAMPLE RECEIPT ADVICE

Client Details	
Client	GHD Services Pty Ltd
Attention	Andrew Nagle

Sample Login Details	
Your Reference	61/34772
Envirolab Reference	187366
Date Sample Received	19/10/2016
Date Instructions Received	19/10/2016
Date Results Expected to be Reported	26/10/2016

Sample Condition	
Samples received in appropriate condition for analysis	YES
No. of Samples Provided	1 Water
Turnaround Time Requested	Standard
Temperature on receipt (°C)	15
Cooling Method	Ice Pack
Sampling Date Provided	Yes

Comments
Samples will be held for 1 month for water samples and 2 months for soil samples from date of receipt of samples

Please direct any queries to:

Joshua Lim	Meredith Conroy
Phone: 08 9317 2505	Phone: 08 9317 2505
Fax: 08 9317 4163	Fax: 08 9317 4163
Email: jlim@mpl.com.au	Email: mconroy@mpl.com.au

Sample and Testing Details on following page



Part of the Envirolab Group



16 - 18 Hayden Court, Myaree, Western Australia 6154
PO Box 4023 Myaree BC, Western Australia 6960
Tel: +61 8 9317 2505 / Fax: +61 8 9317 4163
email: laboratory@mpl.com.au
www.mpl.com.au
Envirolab Services (WA) Pty Ltd ABN 53 140 099 207

<i>Sample Id</i>	<i>BOD</i>	<i>Total Dissolved Solids (grav)</i>	<i>Nutrients in Water</i>	<i>Microbiological Testing</i>
QC02_20160922	✓	✓	✓	✓



16-18 Hayden Court, Myaree, Western Australia 6154
PO Box 4023 Myaree BC, Western Australia 6950
tel: +61 8 9317 2505

email: lab@mpl.com.au
envirolab.com.au

Envirolab Services (WA) Pty Ltd trading as
MPL Laboratories | ABN 53 140 099 207

CERTIFICATE OF ANALYSIS 187366

Client:

GHD Services Pty Ltd
PO Box Y3106
Perth
WA 6000

Attention: Andrew Nagle

Sample log in details:

Your Reference:	<u>61/34772</u>
No. of samples:	1 Water
Date samples received:	19/10/2016
Date completed instructions received:	19/10/2016
Location:	

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last pages of this report for any comments relating to the results.

Report Details:

Date results requested by:	26/10/16
Date of Preliminary Report:	Not issued
Issue Date:	26/10/16

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Accredited for compliance with ISO/IEC 17025 - Testing

Tests not covered by NATA are denoted with *.

Results Approved By:

Joshua Lim
Operations Manager

Jessica Miller
Micro Team Leader

MPL Reference: 187366
Revision No: R 00



Miscellaneous Inorganics		
Our Reference:	UNITS	187366-1
Your Reference	-----	QC02_20160
		922
Date Sampled	-----	18/10/2016
Type of sample		Water
Date prepared	-	19/10/2016
Date analysed	-	19/10/2016
BOD	mg/L	14
Total Dissolved Solids (grav)	mg/L	14,000

Nutrients in Water Our Reference: Your Reference	UNITS -----	187366-1 QC02_20160 922
Date Sampled Type of sample	-----	18/10/2016 Water
Date prepared	-	19/10/2016
Date analysed	-	19/10/2016
Total Nitrogen	mg/L	5.7
TKN by Discrete Analyser	mg/L	5.3
NOx as N	mg/L	0.44
Nitrite as N	mg/L	<0.005
Nitrate as N	mg/L	0.44
Ammonia as N	mg/L	3.2
Total Phosphorus	mg/L	0.57

Microbiological Testing		
Our Reference:	UNITS	187366-1
Your Reference	-----	QC02_20160
		922
Date Sampled	-----	18/10/2016
Type of sample		Water
Date testing started	-	19/10/2016
Date testing completed	-	24/10/2016
Heterotrophic Plate Count 21C	cfu/mL	4,200^
Heterotrophic Plate Count 35C	cfu/mL	3,900^
Total Coliforms	cfu/100mL	3**
Thermotolerant Coliforms	cfu/100mL	<1**
E.coli	cfu/100mL	<1**

Method ID	Methodology Summary
INORG-091	BOD - Analysed in accordance with APHA latest edition 5210 D.
INORG-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180±5°C
INORG-055	Total Nitrogen by colourimetric analysis based on APHA 4500-P J, 4500-NO3 F.
INORG-062	TKN by calculation from Total Nitrogen and NOx using APHA methodology.
INORG-055	NOx - determined colourimetrically. Soils are analysed from a water extract.
INORG-055	Nitrite - determined colourimetrically. Soils are analysed from a water extract.
INORG-055	Nitrate - determined colourimetrically. Soils are analysed from a water extract.
INORG-057	Ammonia by colourimetric analysis based on APHA latest edition 4500-NH3 F.
METALS-020	Metals in soil and water by ICP-OES.
MICRO-001	Heterotrophic Plate Count: Microbial Water Analysis - in accordance with MICRO-001 (APHA-9215D-2005). Recommended maximums based on NHMRC and ARMC Australian Drinking Water Guidelines.
MICRO-001	Total Coliforms: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.5-2007). Recommended maximums based on NHMRC and ARMC Australian Drinking Water Guidelines.
MICRO-001	Thermotolerant Coliforms: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.7-2007). Recommended maximums based on NHMRC and ARMC Australian Drinking Water Guidelines.
MICRO-001	E. Coli: Microbial Water Analysis - in accordance with MICRO-001 (AS4276.7-2007). Recommended maximums based on NHMRC and ARMC Australian Drinking Water Guidelines.

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Miscellaneous Inorganics						Base II Duplicate II %RPD		
Date prepared	-			19/10/2016	[NT]	[NT]	LCS-1	19/10/2016
Date analysed	-			19/10/2016	[NT]	[NT]	LCS-1	19/10/2016
BOD	mg/L	5	INORG-091	<5	[NT]	[NT]	LCS-1	71%
Total Dissolved Solids (grav)	mg/L	5	INORG-018	<5	[NT]	[NT]	LCS-1	96%
QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Nutrients in Water						Base II Duplicate II %RPD		
Date prepared	-			19/10/2016	[NT]	[NT]	LCS-1	19/10/2016
Date analysed	-			20/10/2016	[NT]	[NT]	LCS-1	19/10/2016
Total Nitrogen	mg/L	0.1	INORG-055	<0.1	[NT]	[NT]	LCS-1	103%
TKN by Discrete Analyser	mg/L	0.1	INORG-062	<0.1	[NT]	[NT]	[NR]	[NR]
NOx as N	mg/L	0.005	INORG-055	<0.005	[NT]	[NT]	LCS-1	110%
Nitrite as N	mg/L	0.005	INORG-055	<0.005	[NT]	[NT]	LCS-1	107%
Nitrate as N	mg/L	0.005	INORG-055	<0.005	[NT]	[NT]	LCS-1	110%
Ammonia as N	mg/L	0.005	INORG-057	<0.005	[NT]	[NT]	LCS-1	108%
Total Phosphorus	mg/L	0.05	METALS-020	<0.05	[NT]	[NT]	LCS-1	113%
QUALITY CONTROL	UNITS	PQL	METHOD	Blank				
Microbiological Testing								
Date testing started	-			19/10/2016				
Date testing completed	-			24/10/2016				
Heterotrophic Plate Count 21C	cfu/mL	10	MICRO-001	<10				
Heterotrophic Plate Count 35C	cfu/mL	10	MICRO-001	<10				
Total Coliforms	cfu/100 mL	1	MICRO-001	<1				
Thermotolerant Coliforms	cfu/100 mL	1	MICRO-001	<1				
E.coli	cfu/100 mL	1	MICRO-001	<1				

Report Comments:

^ - Heterotrophic plate count is an estimate.

** - High background growth of non-coliform bacteria may underestimate Total Coliform Count.

** - High background growth of non-coliform bacteria may underestimate the Thermotolerant Coliform and E.coli Count.

Definitions:

NT: Not tested NA: Test not required INS: Insufficient sample for this test PQL: Practical Quantitation Limit

<: Less than >: Greater than RPD: Relative Percent Difference LCS: Laboratory Control Sample

NS: Not Specified NEPM: National Environmental Protection Measure NR: Not Reported

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike: A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample): This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Appendix G – Tabulated Groundwater Analytical Results



Appendix G, Table G1
Groundwater Analytical Results

City of Greater Geraldton
Point Moore
Groundwater Assessment

Parameter	Unit	Water Quality Guidelines				6134772 MW1 24/08/2016	6134772 MW1 23/09/2016	6134772 MW1 18/10/2016	6134772 MW2 24/08/2016	6134772 MW2 23/09/2016	6134772 MW2 18/10/2016	6134772 MW3 24/08/2016	6134772 MW3 23/09/2016
		ANZECC 2000 MW 95%	ANZECC 2000 Marine Inshore	ANZECC 2000 Primary Contact Recreation	ANZECC 2000 Secondary Contact Recreation								
Ammonia as N	mg/L	0.91	-	-	-	2.68	6.28	3.95	0.53	0.13	1.48	0.57	0.78
BOD	mg/L	-	-	-	-	6	31	33	7	4	3	4	5
Coliform	cfu/100 ml	-	-	-	-	250,000	<1	1	1000	10	1	3000	10
Plate Count (36°C)	CFU/mL	-	-	-	-	46,000	170	4400	11,000	12,000	7400	68,000	2100
Plate Count (22°C)	CFU/mL	-	-	-	-	49,000	72	4200	13,000	1700	4500	70,000	2400
Nitrate (as N)	mg/L	-	0.05	-	-	0.19	0.05	0.46	13.8	9.95	6.06	0.02	0.01
Nitrite + Nitrate as N	mg/L	-	-	-	-	0.19	0.05	0.46	14	11.8	6.33	0.02	0.01
Nitrite (as N)	mg/L	-	-	-	-	<0.01	<0.01	<0.01	0.2	1.85	0.27	<0.01	<0.01
Faecal Coliform	CFU/100mL	-	-	150	1000	200	<1	1	400	1	1	400	1
E. Coli	CFU/100 ml	-	-	150	1000	200	<1	1	400	1	1	400	1
Total Dissolved Solids	mg/L	-	-	-	-	8890	-	-	1480	-	-	1090	-
Total Dissolved Solids (Filtered)	mg/L	-	-	-	-	-	22,300	13,100	-	2120	1360	-	1320
Total Kjeldahl Nitrogen (as N)	mg/L	-	-	-	-	3	6.7	4.2	3.1	2	2.6	0.7	0.9
Nitrogen (Total)	mg/L	-	0.23	-	-	3.2	6.8	4.7	17.1	13.8	8.9	0.7	0.9
Phosphorus (Total)	mg/L	-	0.005	-	-	0.29	0.81	0.47	0.21	0.14	0.18	0.06	0.08

Legend

ANZECC 2000 MW 95%	Indicates a level is equal to or above the ANZECC (2000) Marine Waters 95% Species Protection Trigger Value
ANZECC 2000 Marine Inshore	Indicates a level is equal to or above the ANZECC (2000) Marine Inshore Trigger Value
ANZECC 2000 Primary Contact Recreation	Indicates a level is equal to or above the ANZECC (2000) Water Quality Guideline for Primary Contact Recreation (e.g. swimming)
ANZECC 2000 Secondary Contact Recreation	Indicates a level is equal to or above the ANZECC (2000) Water Quality Guideline for Secondary Contact Recreation (e.g. boating, fishing)



Appendix G, Table G1
Groundwater Analytical Results

City of Greater Geraldton
Point Moore
Groundwater Assessment

Parameter	Unit	Water Quality Guidelines				6134772 MW3 18/10/2016	6134772 SHP8 24/08/2016	6134772 SHP8 23/09/2016	6134772 SHP8 18/10/2016	Statistical Summary				
		ANZECC 2000 MW 95%	ANZECC 2000 Marine Inshore	ANZECC 2000 Primary Contact Recreation	ANZECC 2000 Secondary Contact Recreation					Number of Results	Minimum	Maximum	Mean	Median
Ammonia as N	mg/L	0.91	-	-	-	0.32	0.36	2.54	0.46	12	0.13	6.28	1.7	0.675
BOD	mg/L	-	-	-	-	3	4	22	57	12	3	57	15	5.5
Coliform	cfu/100 ml	-	-	-	-	1	200	<1	1	12	<1	250,000	21,185	5.5
Plate Count (36°C)	CFU/mL	-	-	-	-	5500	110	17	980	12	17	68,000	13,140	4,950
Plate Count (22°C)	CFU/mL	-	-	-	-	14,000	910	12	2000	12	12	70,000	13,483	3,300
Nitrate (as N)	mg/L	-	0.05	-	-	<0.01	0.02	0.03	<0.01	12	<0.01	13.8	2.6	0.04
Nitrite + Nitrate as N	mg/L	-	-	-	-	<0.01	0.02	0.03	<0.01	12	<0.01	14	2.7	0.04
Nitrite (as N)	mg/L	-	-	-	-	<0.01	<0.01	<0.01	<0.01	12	<0.01	1.85	0.2	0.005
Faecal Coliform	CFU/100mL	-	-	150	1000	1	100	<1	1	12	<1	400	92	1
E. Coli	CFU/100 ml	-	-	150	1000	1	100	<1	1	12	<1	400	92	1
Total Dissolved Solids	mg/L	-	-	-	-	-	3320	-	-	4	1,090	8,890	3,695	2,400
Total Dissolved Solids (Filtered)	mg/L	-	-	-	-	1340	-	10,300	2290	8	1,320	22,300	6,766	2,205
Total Kjeldahl Nitrogen (as N)	mg/L	-	-	-	-	0.6	1.5	3.3	1.2	12	0.6	6.7	2.5	2.3
Nitrogen (Total)	mg/L	-	0.23	-	-	0.6	1.5	3.3	1.2	12	0.6	17.1	5.2	3.25
Phosphorus (Total)	mg/L	-	0.005	-	-	0.08	0.31	0.38	0.28	12	0.06	0.81	0.27	0.245

Legend

ANZECC 2000 MW 95%	Indicates a level is equal to or above the ANZECC (2000) Marine Waters 95% Species Protection Trigger Value
ANZECC 2000 Marine Inshore	Indicates a level is equal to or above the ANZECC (2000) Marine Inshore Trigger Value
ANZECC 2000 Primary Contact Recreation	Indicates a level is equal to or above the ANZECC (2000) Water Quality Guideline for Primary Contact Recreation (e.g. swimming)
ANZECC 2000 Secondary Contact Recreation	Indicates a level is equal to or above the ANZECC (2000) Water Quality Guideline for Secondary Contact Recreation (e.g. boating, fishing)

Appendix G
Table G2
Field and Rinsate Blanks

City of Greater Geraldton
Point Moore
Groundwater Assessment

ChemName	output unit	Rinsate	Field Blank	Rinsate
		QC03_20160824	QC04_20160824	QC03_20160922
		24/08/2016	24/08/2016	23/09/2016
Ammonia as N	mg/L	<0.01	<0.01	<0.01
BOD	mg/L	5	<2	<2
Coliform	cfu/100 ml	-	-	-
Plate Count (36°C)	cfu/100 ml	-	-	-
PLATE COUNT 22C	cfu/100 ml	-	-	-
Nitrate (as N)	mg/L	<0.01	<0.01	<0.01
Nitrite + Nitrate as N	mg/L	<0.01	<0.01	<0.01
Nitrite (as N)	mg/L	<0.01	<0.01	<0.01
Faecal Coliform	cfu/100 ml	-	-	-
E. Coli	cfu/100 ml	-	-	-
Total Dissolved Solids	mg/L	<10	<10	-
Total Dissolved Solids (Filtered)	mg/L	-	-	20
Total Kjeldahl Nitrogen	mg/L	<0.1	<0.1	<0.1
Nitrogen (Total)	mg/L	<0.1	<0.1	<0.1
Phosphorus	mg/L	<0.01	<0.01	<0.01

Appendix G
Table G2
Field and Rinsate Blanks

City of Greater Geraldton
Point Moore
Groundwater Assessment

Field Blank	Rinsate	Field Blank
QC04_20160922	QC03_20160922	QC04_20160922
23/09/2016	18/10/2016	18/10/2016
<0.01	0.06	0.06
<2	<2	<2
-	-	-
-	-	-
-	-	-
<0.01	<0.01	0.01
<0.01	<0.01	0.01
<0.01	<0.01	<0.01
-	-	-
-	-	-
-	-	-
<10	14	16
<0.1	<0.1	<0.1
<0.1	<0.1	<0.1
<0.01	<0.01	<0.01

Appendix G
Table G3
Blind and Split RPDs

		Well	MW1	QC01_ 20160824	QC02_ 20160824	RPD	RPD	MW1	QC01_ 20160922	QC02_ 20160922	RPD	RPD	MW1	QC01_ 20161018	QC02_ 20161018	RPD	RPD
		Date	24/08/2016	24/08/2016	24/08/2016	MW1	MW1	23/09/2016	23/09/2016	23/09/2016	MW1 and	MW1 and	18/10/2016	18/10/2016	18/10/2016	MW1 and	MW1 and
						QC01	QC02				QC01	QC02				QC01	QC02
ChemName	output unit	EQL															
Ammonia as N	mg/L	0.01	2.68	2.86	2.9	6	1	6.28	6.42	5	2	-23	3.95	4	3.2	1	-21
BOD	mg/L	2	6	6	<5	0	-18	31	31	<5	0	-144	33	27	14	-20	-81
Coliform	cfu/100 ml	1	250,000	200	-	200	-	<1	<1	<1	-	-	1	1	<1	0	0
Plate Count (36°C)	CFU/mL	1	46,000	49,000	-	6	-	170	140	340	-19	67	4400	4400	4200	0	-5
PLATE COUNT 22C	CFU/mL	1	49,000	60,000	-	20	-	72	73	260	1	113	4200	3600	3900	-15	-7
Nitrate (as N)	mg/L	0.01	0.19	0.18	0.17	-5	-6	0.05	<0.01	<0.005	-133	-164	0.46	0.46	0.44	0	-4
Nitrite + Nitrate as N	mg/L	0.01	0.19	0.18	0.17	-5	-6	0.05	0.46	-	161	-	0.46	0.46	-	0	-
Nitrite (as N)	mg/L	0.01	<0.01	<0.01	<0.2	-	-	<0.01	<0.01	0.006	-	-198	<0.01	<0.01	<0.005	-	-
Faecal Coliform	CFU/100mL	1	200	1100	-	138	-	<1	<1	<1	0	0	1	1	<1	0	0
E. Coli	cfu/100 ml	1	200	1100	-	138	-	<1	<1	<1	0	0	1	1	<1	0	0
Total Dissolved Solids	mg/L	10	8890	8800	7500	-1	-16	22,300	22,400	22000	0	-1	13,100	13,100	14000	0	7
Total Kjeldahl Nitrogen	mg/L	0.1	3	2.9	3.1	-3	7	6.7	6.7	9.2	0	31	4.2	4.1	5.3	-2	23
Nitrogen (Total)	mg/L	0.1	3.2	3.1	3.2	-3	3	6.8	6.7	9.2	-1	30	4.7	4.6	5.7	-2	19
Phosphorus	mg/L	0.01	0.29	0.3	0.19	3	-45	0.81	0.9	0.78	11	-4	0.47	0.46	0.57	-2	19

Indicates Exceedance of RPD criteria (50%)

Appendix H – Calibration Certificates

RENTALS

Insitu Aqua Troll 600 Profiler Water Quality Meter

This Water Quality Meter has been performance checked / calibrated* as follows:

pH ☐ pH 6.88 ☒ pH 7.00 ☒ pH 4.00 ☐ pH 10.00 ☒ pH
 Conductivity ☒ 0.0mS/cm ☒ 1413uS/cm ☒ 12.88mS/cm ☐ 58.6mS/cm ☒ mS/cm
 TDS ☒ 0.0 ppk ☒ 36 ppk ☒ ppk
 Dissolved Oxygen ☒ 0.00ppm in Sodium Sulphite ☒ 100% Saturation in Air
 Redox (ORP)** ☒ Electrode operability test 240mV +/- 10%. Actual: 240 mV
☒ Electrodes cleaned/checked ☒ Temperature

* Calibration solution traceability information is available upon request.

**

Date: 22/8 Checked by: Avon

Signed: AD

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum \$20 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Received	Returned	Item
☒	☐	☐	AquaTroll 600 Unit. Ops check / Battery Voltage @ _____
☒	☐	☐	AquaTroll 600 Set to Time: Yes / No
☒	☐	☐	Aqua Troll 600 Cal Cup
☐	☐	☐	Troll Cable S/n: _____ Length: _____ m
☐	☐	☐	USB Cable Connect Comms Cable S/n: _____
☒	☐	☐	S/steel Sensor Protector Shroud
☐	☐	☐	Screw Drivers x3
☒	☐	☐	Turbidity Wiper
☒	☐	☐	PC Software version X.X
☒	☐	☐	Aqua Troll 600 Carry Case

Processors Signature/ Initials AD

Quote Reference	<u>CP0818</u>	Condition on return
Customer Ref		
Equipment ID	<u>AT600</u>	
Equipment serial no.		
Return Date	<u>/ /</u>	
Return Time		

RENTALS

Equipment Certification Report – TPS 90FLMV Water Quality Meter

This Water Quality Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Span 1	Span 2	Traceability Lot #	Pass?
pH	pH 7.00 / pH 4.00	7 pH	4 pH	/	☒
Conductivity	1413uS/cm	1413 mS/cm	12880 mS/cm		☒
TDS	36 ppk	0 ppk	36 ppk		☒
Dissolved Oxygen	Sodium Sulphite / Air	0 ppm in Sodium Sulphite	10 ppm Saturation in Air		☒

Check only

Redox (ORP) *	Electrode operability test	240mV +/- 10%	240 mV		☒
---------------	----------------------------	---------------	--------	--	-------------------------------------

* This meter uses an Ag/AgCl ORP electrode. To convert readings to SHE (Standard Hydrogen Electrode), add 199mV to the mV reading.

- ☒ Battery Status _____ (min 7.2V)
☒ Electrical Safety Tag attached (AS/NZS 3760)

- ☒ Temperature 21 °C
☒ Electrodes Cleaned and checked

Tag No: _____

Valid to: _____

Date: 20/9

Signed: AD

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum \$30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☒	☐	90FLMV Unit. Ops check/Battery status: _____
☒	☐	pH sensor with wetting cap, 5m
☒	☐	Conductivity/TDS/Temperature K=10 sensor, 5m
☒	☐	Dissolved oxygen YSI5739 sensor with wetting cap, 5m
☒	☐	Redox (ORP) sensor with wetting cap, 5m
☒	☐	Power supply 240V to 12V DC 200mA
☒	☐	Instruction Manual
☒	☐	Quick Guide
☒	☐	Syringe with storage solution for pH and ORP sensors
☒	☐	Carry Case
☒	☐	Check to confirm electrical safety (tag must be valid)

Date: 20/9

Signed: AD

TFS Reference	<u>CPO812</u>	Return Date:	/ /
Customer Reference		Return Time:	
Equipment ID	<u>90FLMVWAS</u>	Condition on return:	
Equipment Serial No.			

"We do more than give you great equipment... We give you great solutions!"

Phone: (Free Call) 1300 735 295		Fax: (Free Call) 1800 675 123		Email: RentalsAU@Thermofisher.com	
Melbourne Branch 5 Caribbean Drive, Scoresby 3179	Sydney Branch Level 1, 4 Talavera Road, North Ryde 2113	Adelaide Branch 27 Beulah Road, Norwood, South Australia 5067	Brisbane Branch Unit 2/5 Ross St Newstead 4006	Perth Branch 121 Beringarra Ave Malaga WA 6090	

RENTALS

Equipment Certification Report – TPS 90FLT Water Quality Meter

This Water Quality Meter has been performance checked and calibrated as follows:

Sensor	Concentration	Span 1	Span 2	Traceability Lot #	Pass?
pH	pH 4.00/ pH 7.00	4 pH	7 pH	1	☒
Conductivity	12.88mS/cm	12.88mS/cm	1413 mS/cm		☒
TDS	36.0ppk	0 ppk	36 ppk		☒
Dissolved Oxygen	Sodium Sulphite / Air	0 ppm in Sodium Sulphite	10 ppm Saturation in Air		☒
Turbidity	1000 NTU	0 NTU	1000 NTU		☒
Redox (ORP)**240mV	☒	Electrode operability test 240mV +/- 10%. Actual: 240 mV			

☒ Battery Status _____ (min 7.2V)
☒ Electrical Safety Tag attached (AS/NZS 3760)

☒ Temperature 21 °C
☒ Electrodes Cleaned and checked

Tag No: _____

Valid to: _____

Date: 14/10

Signed: AD

Please check that the following items are received and that all items are cleaned and decontaminated before return. A minimum \$30 cleaning / service / repair charge may be applied to any unclean or damaged items. Items not returned will be billed for at the full replacement cost.

Sent	Returned	Item
☒	☐	90FLMV Unit. Ops check/Battery status: _____
☒	☐	pH sensor with wetting cap, 5m
☒	☐	Conductivity/TDS/Temperature K=10 sensor, 5m
☒	☐	Dissolved oxygen YSI5739 sensor with wetting cap, 5m
☒	☐	Turbidity sensor, 5m
☒	☐	Power supply 240V to 12V DC 200mA
☒	☐	Instruction Manual
☒	☐	Quick Guide
☒	☐	Syringe with storage solution for pH and ORP sensors
☒	☐	Carry Case
☒	☐	Check to confirm electrical safety (tag must be valid)

Date: 14/10

Signed: AD

TFS Reference	<u>CQ0818</u>	Return Date: <u>/ /</u>
Customer Reference		Return Time:
Equipment ID	<u>90FLT - WAB</u>	Condition on return:
Equipment Serial No.		

"We do more than give you great equipment... We give you great solutions!"

Phone: (Free Call) 1300 735 295		Fax: (Free Call) 1800 675 123		Email: RentalsAU@Thermofisher.com	
Melbourne Branch 5 Caribbean Drive, Scoresby 3179	Sydney Branch Level 1, 4 Talavera Road, North Ryde 2113	Adelaide Branch 27 Beulah Road, Norwood, South Australia 5067	Brisbane Branch Unit 2/5 Ross St Newstead 4006	Perth Branch 121 Beringarra Ave Malaga WA 6090	

Appendix I – Field Works Photographs



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2217	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW1 – Soil Log 0.5 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2218	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW1 – Soil Log 1.0 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2219	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW1 – Soil Log 1.5 mbgl		



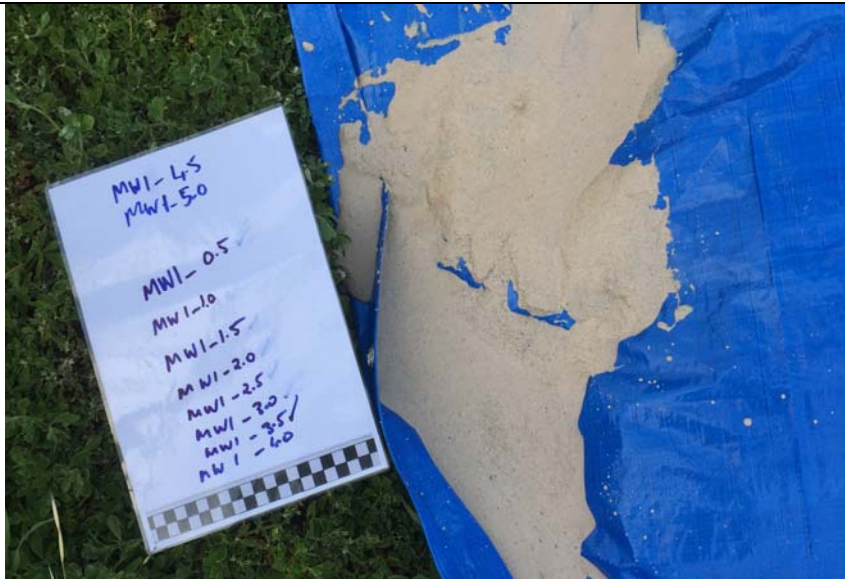
Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2220	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW1 – Soil Log 2.0 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2221	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW1 – Soil Log 2.5 mbgl		

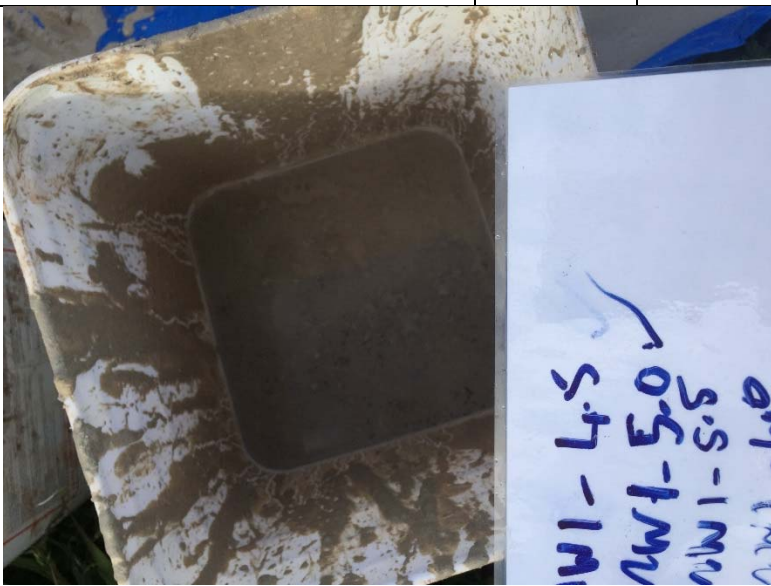


Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2222	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW1 – Soil Log 3.0 mbgl		

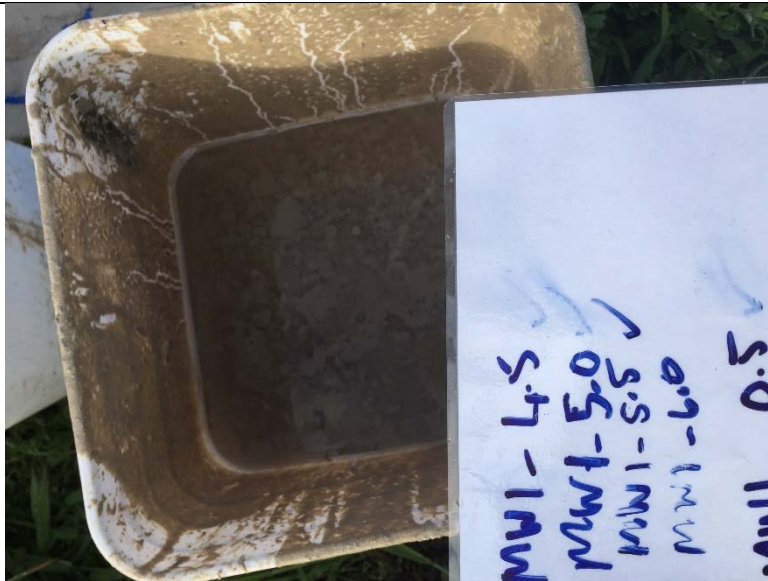


Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2223	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW1 – Soil Log 3.5 mbgl		
		
Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2224	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW1 – Soil Log 4.0 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2225	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW1 – Soil Log 4.5 mbgl		
		

Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2226	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW1 – Soil Log 5.0 mbgl		



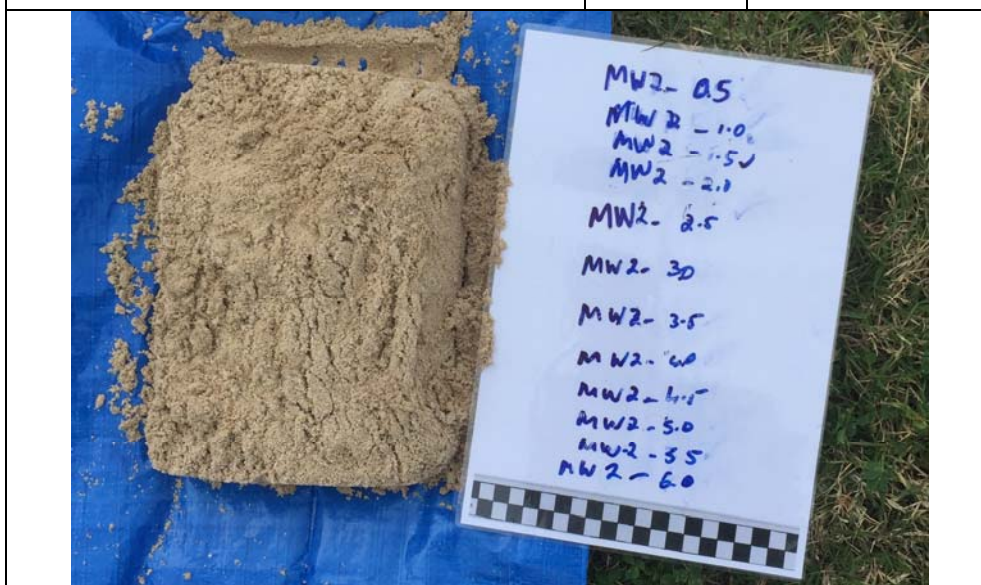
Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2227	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW1 – Soil Log 5.5 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2229	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW2 – Soil Log 0.5 mbgl		



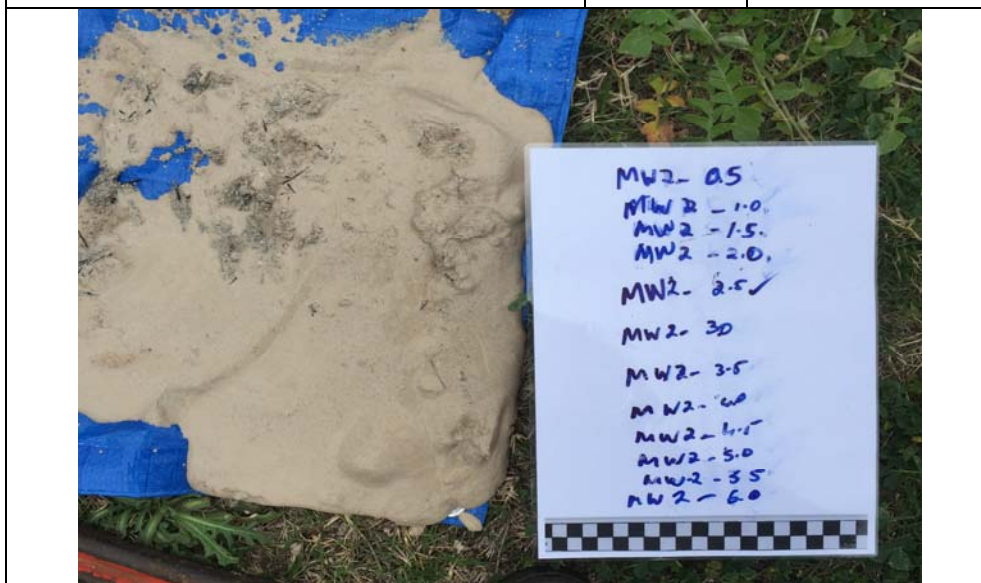
Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2230	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW2 – Soil Log 1 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2231	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW2 – Soil Log 1.5 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2232	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW2 – Soil Log 2.0 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2233	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW1 – Soil Log 2.5 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2234	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW2 – Soil Log 3.0 mbgl		



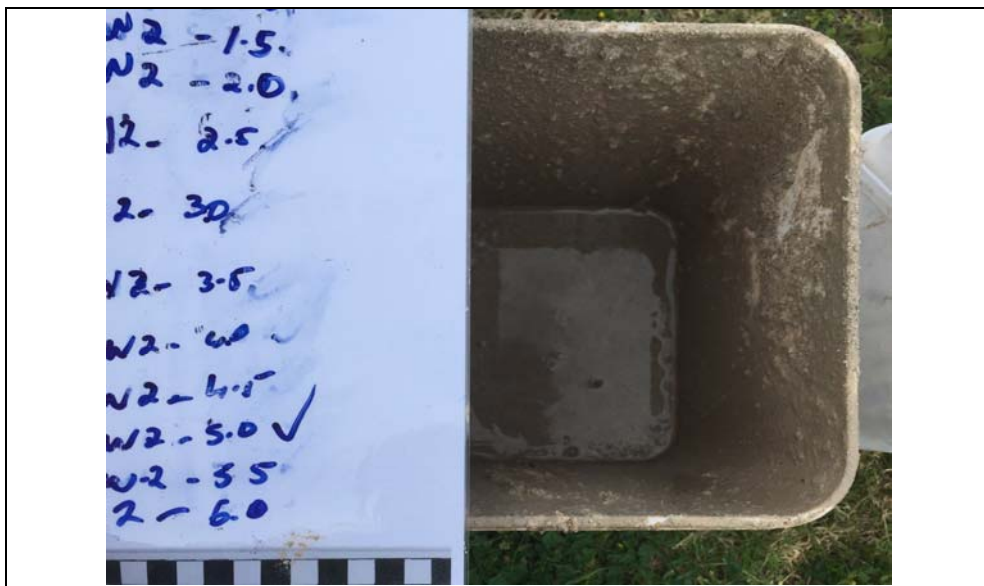
Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2235	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW2 – Soil Log 3.5 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2236	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW2 – Soil Log 4.0 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2237	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW2 – Soil Log 4.5 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2238	2016	
File: G:\61\34772\Technical\Photos\		
Description: MW2 – Soil Log 5.0 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2239	2016	
File: G:\61\34772\Technical\Photos\		
Description: MW2 – Soil Log 5.5 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2240	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW2 – Soil Log 6.0 mbgl		
		

Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2241	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW3 – Soil Log 0.5 mbgl		

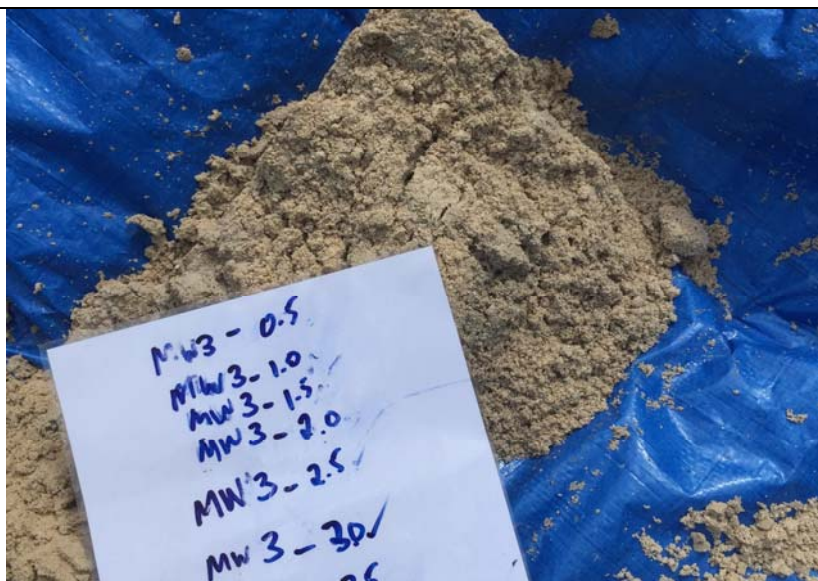
		
Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2242	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW3 – Soil Log 1.0 mbgl		
		
Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2243	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW3 – Soil Log 1.5 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2244	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW3 – Soil Log 2.0 mbgl		



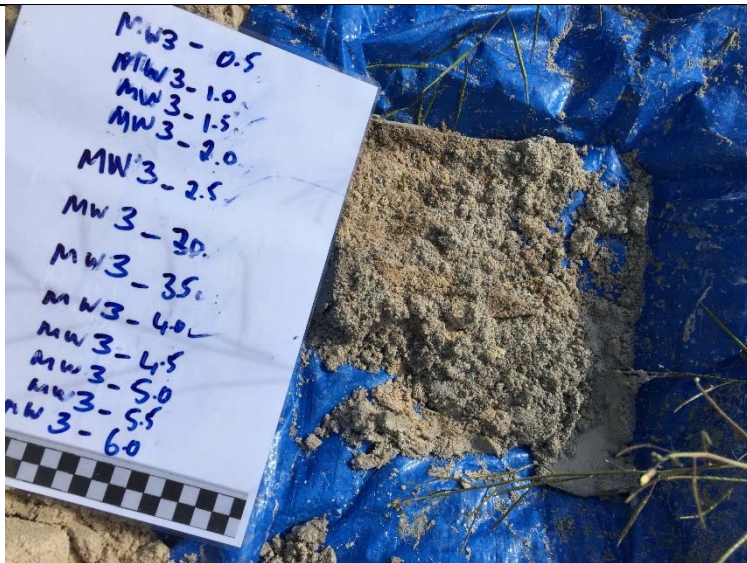
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Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2245	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW3 – Soil Log 2.5 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2246	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW3 – Soil Log 3.0 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2247	2016	
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Description: MW3 – Soil Log 3.5 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2248	2016	
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Description: MW3 – Soil Log 4.0 mbgl		
		

Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2249	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW3 – Soil Log 4.5 mbgl		



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Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2250	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW3 – Soil Log 5.0 mbgl		



Created by: S Petts	Date	Point Moore Groundwater Assessment
Source: GHD (15/08/2016)	16/09/2016	
Reference: IMG_2251	2016	
File:G:\61\34772\Technical\Photos\		
Description: MW3 – Soil Log 5.5 mbgl		



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Source: GHD (15/08/2016)	16/09/2016	Groundwater
Reference: IMG_2252	2016	Assessment
File:G:\61\34772\Technical\Photos\		
Description: MW3 – Soil Log 6.0 mbgl		

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Document Status

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		Name	Signature	Name	Signature	Date
0	S. Petts	D. Edgar	DME	D. Edgar	DME	10/11/2016
1	S. Petts	A. Nagle D. Edgar	<i>DME for AN DME</i>	D. Edgar	<i>DME Edgar</i>	25/11/2016

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