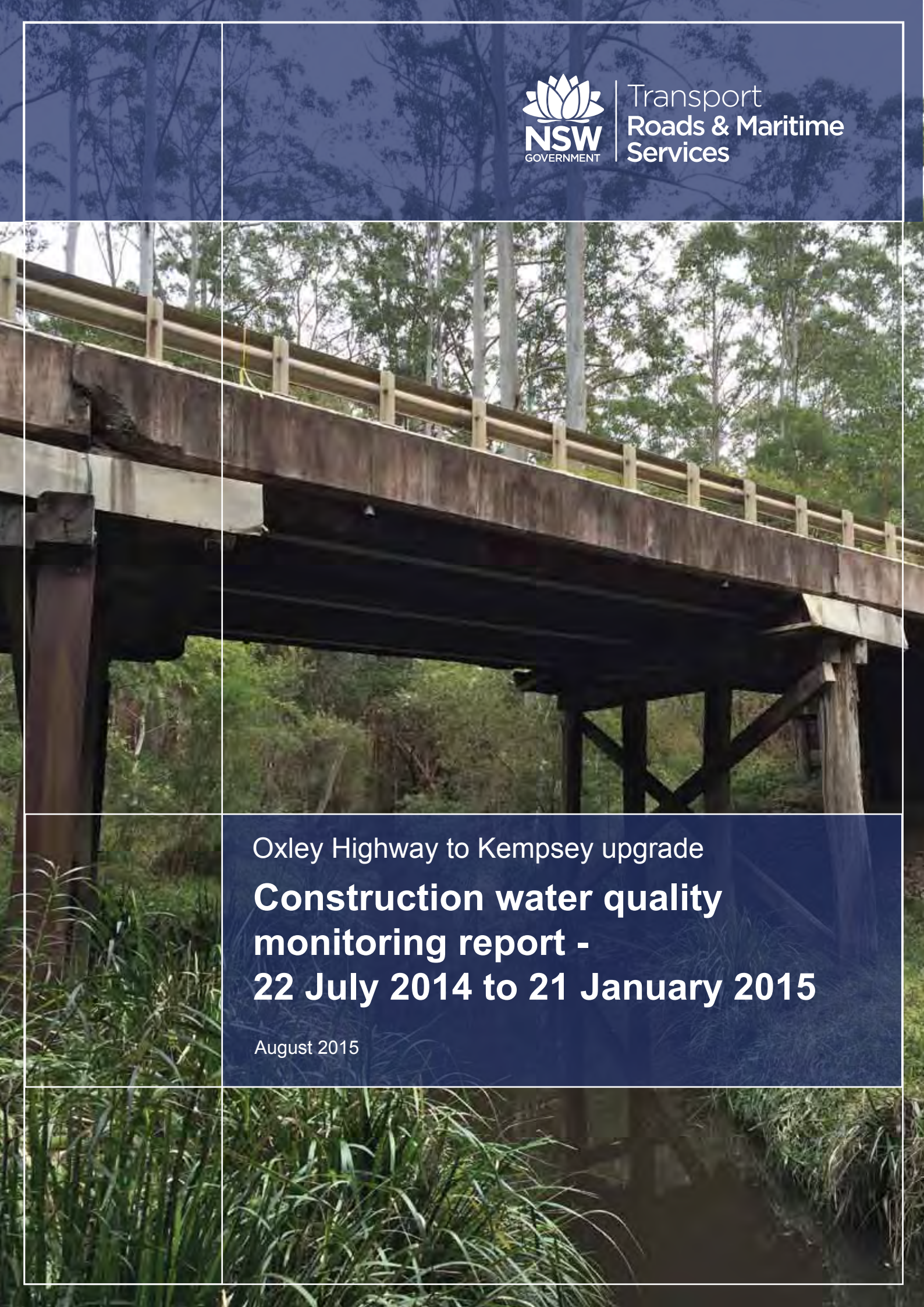

Transport Roads & Maritime Services

NSW GOVERNMENT

Oxley Highway to Kempsey upgrade

Construction water quality monitoring report - 22 July 2014 to 21 January 2015

August 2015

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1 Introduction

1.1 The project

On behalf of the Australian and NSW governments, Roads and Maritime Services (Roads and Maritime) is currently constructing the Oxley Highway to Kempsey Pacific Highway Upgrade (the project). The project is 37 kilometres in length, commencing approximately 700 metres north of the Oxley Highway interchange and continuing northwards to tie in with the dual carriageways of the Kempsey to Eungai Pacific Highway Upgrade. The project involves the duplication of the existing highway, except for sections in the vicinity of the Hastings River and Wilson River that deviate from the existing highway, and a bypass of Telegraph Point. The existing highway will be retained wherever possible for use as a service road or local road connection. Figure 1-1 shows the location of the project.

Roads and Maritime will construct and open the project in stages. The stages of the project are:

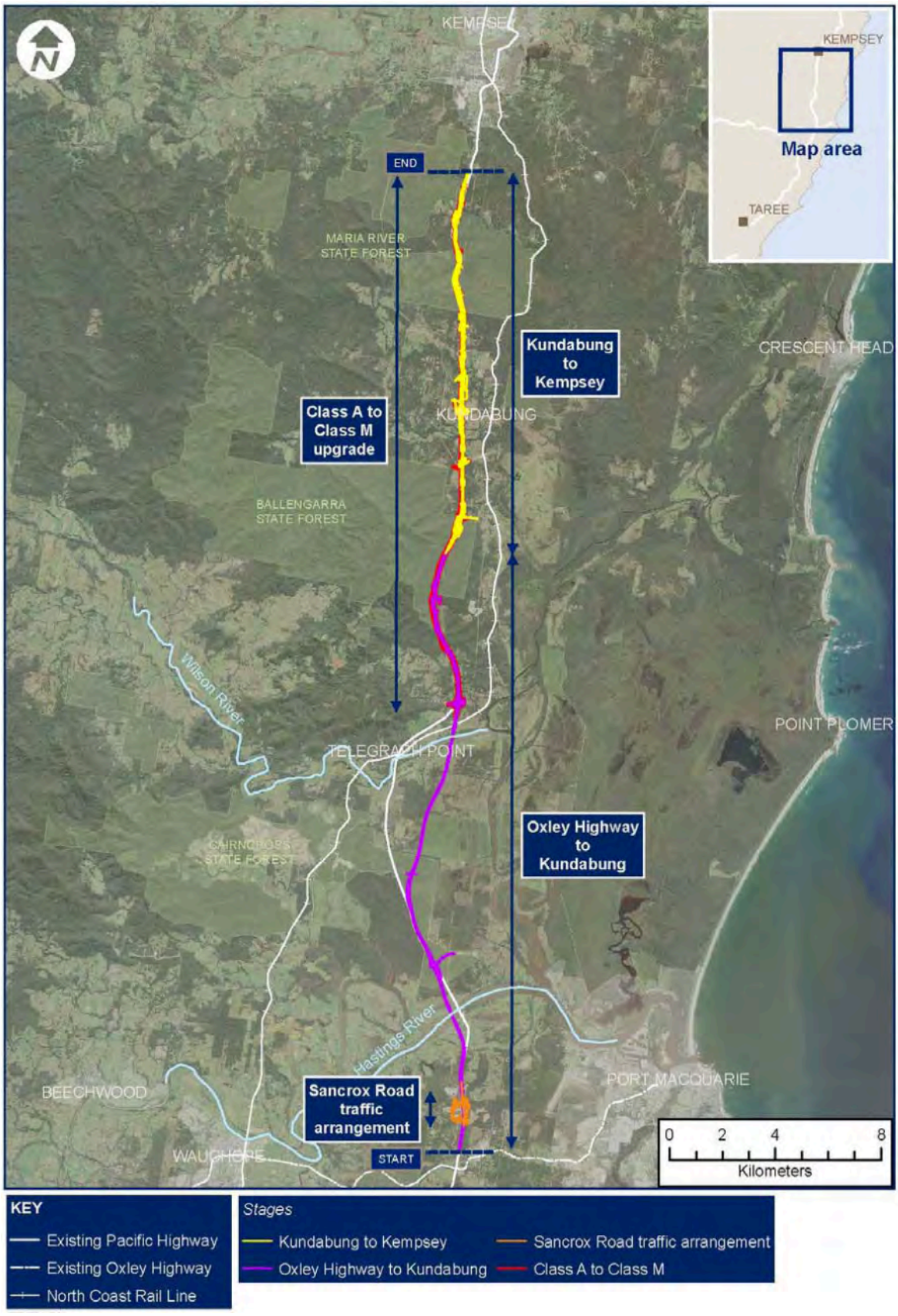
- Stage 1 - The Sancrox Traffic Arrangement works located about two kilometres north of the Oxley Highway / Pacific Highway intersection.
- Stage 2 - Kundabung to Kempsey Stage consisting of about 14 kilometres of dual carriageway, commencing north of Barrys Creek near Kundabung (chainage 24,000) and connecting to the Kempsey Bypass at Stumpy Creek (Chainage 37,800).
- Stage 3 - Oxley Highway to Kundabung Stage consisting of about 24 kilometres of dual carriageway, commencing just north of the Oxley Highway / Pacific Highway intersection (chainage 700) and connecting with the Kundabung to Kempsey stage just north of Barrys Creek (chainage 24,000).

1.2 Project approval

On 8 December 2006, the project was declared by the then Minister for Planning to be a project to which Part 3A of the *Environmental Planning and Assessment Act 1979* applies. An environmental assessment was prepared and placed on public exhibition for 30 days between September and October 2010. Following consideration of submissions made during the exhibition period, the submissions report, including changes to the proposal following consideration of submissions, was submitted to the Minister for Planning and Infrastructure seeking approval. Approval of the project was granted on 8 February 2012, subject to a number of Conditions of Approval (MCoA). At the request of Roads and Maritime, the Minister has since modified the approval on two occasions.

Under MCoA B17, Roads and Maritime must prepare and implement a Water Quality Monitoring Program (WQMP) to monitor the impacts of the project on surface and groundwater quality and resources and wetlands, during construction and operation. The WQMP was prepared in consultation with the EPA, DPI (Fishing and Aquaculture) and NoW, and was submitted to Department of Planning and Infrastructure for approval on 11 February 2014. The plan was subsequently approved on 5 March 2014.

Figure 1-1 Location of Oxley Highway to Kempsey project



1.3 Purpose of this report

The WQMP developed in response to MCoA B17 outlines various pre-construction, construction and post-construction surface and groundwater quality monitoring and assessment requirements. This report addresses the first construction period between 22 July 2014 and 21 January 2015 of surface and groundwater quality monitoring requirements outlined in Chapter 4 and Chapter 5 of the WQMP, which include, but are not limited to:

- Undertaking surface and groundwater quality sampling monthly and at other intervals throughout construction.
- Collecting and analysing representative surface water samples for chemical, physical and nutrient properties during dry and wet-weather conditions.
- Collecting and analysing representative groundwater samples for chemical, physical and nutrient properties, and major cations and anions at nominated intervals.
- Comparing upstream and downstream surface water sampling results to evaluate and determine whether any changes and/or impacts on water quality might be attributable to construction.
- Evaluate trends in groundwater conditions through an analysis of measured results gathered during pre-construction and construction, and determine any changes and/or impacts that might be attributable to construction.
- Providing results of sampling to relevant stakeholders including the DP&E, DPI (Fisheries and Aquaculture) and NOW.
- Accumulating further data to provide a basis for construction and post-construction monitoring result comparison.

A review of surface water and groundwater quality results to evaluate potential surface and groundwater interactions has not been undertaken for this monitoring period due to the absence of activities that might effect these interactions. This type of evaluation will be the subject of subsequent construction water quality monitoring reports.

2 Methodology

The approved method for surface and groundwater quality monitoring is outlined in detail in the WQMP. The following sections are a summary of key elements of that program.

2.1 Monitoring sites

The project traverses either through or near a number of water dependent ecosystems including major rivers, creeks, tributaries, SEPP 14 wetlands and endangered ecological communities. Surface and groundwater quality monitoring sites were selected to ensure potential impacts on these systems from the project could be identified early and where necessary measures to remedy any impacts implemented.

2.1.1 Surface water monitoring sites

Table 2-1 lists the 27 surface water quality monitoring locations and the reason for site selection. Appendix A includes a series of maps that show the location of each monitoring site relative to the project alignment. The WQMP identified 30 locations for sampling of which SW4a, SW4b and SW5a are no longer subject to the program. These sites were removed from the regular sample regime as they rarely hold or carry water, generally only limited to the immediate affect of surface flows during a rain event. The remaining 27 site are considered sufficiently diverse in terms of location, condition, type and suitability for the protection of nearby sensitive water depended ecosystems / land uses.

Table 2-1 Surface water quality monitoring locations

Site no.	Chainage	Waterway name	Position relative to project	Reason for site selection
SW1a	2500	Unnamed tributary of Fernbank Creek	Upstream / West	Industrial land use upstream
SW1b	2600	Unnamed tributary of Fernbank Creek	Upstream / West	Industrial land use upstream
SW1c	2650	Unnamed tributary of Fernbank Creek	Downstream / East	Industrial land use upstream
SW2a	4620	Fernbank Creek	Downstream / East	EEC / ASS
SW2b	4800	Fernbank Creek	Upstream / West	EEC / ASS
SW3a	6040	Northern bank of Hastings River	Upstream / West	Major river with oyster leases downstream
SW3b	6080	Northern bank of Hastings River	Downstream / East	Major river with oyster leases downstream
SW5b	15820	Unnamed tributary of Wilson River	Downstream / West	EEC / ASS
SW6a	16460	South bank of Wilson River	Upstream / West	Major river / SEPP 14 / Floodplain / ASS

Site no.	Chainage	Waterway name	Position relative to project	Reason for site selection
SW6b	16600	South bank of Wilson River	Downstream / East	Major river / SEPP 14 / Floodplain / ASS
SW6c	16830	North bank of Wilson River	Upstream / West	Major river / SEPP 14 / Floodplain / ASS
SW6d	16840	North bank of Wilson River	Downstream / East	Major river / SEPP 14 / Floodplain / ASS
SW7a	19660	Cooperabung Creek	Upstream / West	EEC / Giant Barred Frog habitat
SW7b	19660	Cooperabung Creek	Downstream / East	EEC / Giant Barred Frog habitat
SW8a	23775	Barrys Creek	Upstream / West	EEC / Giant Barred Frog habitat
SW8b	24000	Barrys Creek	Downstream / East	EEC / Giant Barred Frog habitat
SW8c	25325	Barrys Creek	Downstream / East	EEC / Giant Barred Frog habitat
SW9a	28300	Smiths Creek	Downstream / East	EEC / Giant Barred Frog habitat
SW9b	28300	Smiths Creek	Upstream / West	EEC / Giant Barred Frog habitat
SW10a	30700	Pipers Creek	Downstream / East	EEC / Giant Barred Frog habitat
SW10b	30700	Pipers Creek	Upstream / West	EEC / Giant Barred Frog habitat
SW11a	34650	Unnamed drainage line	Downstream / East	Downhill of significant cut site / potential ASR
SW11b	34700	Unnamed drainage line	Upstream / West	Downhill of significant cut site / potential ASR
SW12a	36850	Maria River	Upstream / West	Major river / EEC / Giant Barred Frog habitat
SW12b	36850	Maria River	Downstream / East	Major river / EEC / Giant Barred Frog habitat
SW13a	37700	Stumpy Creek	Downstream / East	Major creek / EEC
SW13b	37750	Stumpy Creek	Upstream / West	Major creek / EEC

Surface water quality monitoring of a spring fed dam on private property (known as tipping dam) that had the potential to be affected during construction was also proposed in the WQMP. As noted in the pre-construction surface water quality monitoring report (June 2015) Roads and Maritime's construction partner for Stage 2 (K2K) and the property owner

reached an agreement to use the resource during construction. The dam was enlarged and water is being used for construction purposes. The dam and surrounding land will be restored inline with the agreement established between the two parties. Ongoing monitoring of water levels during construction as outlined in section 4.2 to the WQMP is therefore no longer proposed.

2.1.2 Groundwater monitoring sites

Table 2-2 lists the 30 groundwater quality monitoring locations and the reason for site selection. Appendix A includes a series of maps that show the location of each monitoring site relative to the project alignment.

Table 2-2 Groundwater quality monitoring locations

Site no.	Chainage	Reason for site selection
GW01	3020	Category A Cut
GW02	5000	Floodplain / ASS / significant embankment
GW03	5500	Floodplain / ASS / significant embankment
GW04	6140	Floodplain / ASS / significant embankment
GW05	6350	Floodplain / ASS / significant embankment
GW06	7620	Category A Cut
GW07	8640	Category A Cut / significant earthworks for intersection / no existing groundwater information in this location
GW08	10360	Category A Cut / no existing groundwater information in this location
GW09	10440	Category A Cut
GW10	11460	Confirm Cut Category B / near EEC & GDE
GW11	13100	Floodplain / near existing groundwater users / near EEC & GDE
GW12	15830	Floodplain / ASS / near EEC & GDE
GW13	16400	Floodplain / ASS / near EEC & GDE / significant embankment
GW14	17080	SEPP 14 / floodplain / significant embankment / ASS / EEC / GDE
GW15	17920	Category A Cut / nearby existing groundwater users
GW16	18390	Category A Cut / near existing groundwater users / near ASS
GW17	20680	Category A Cut
GW18	21050	Category A Cut
GW19	22000	Confirm Cut Category B / near EEC
GW20	22620	Category A Cut
GW21	22620	Category A Cut (and will assist with modelling)
GW22	24800	Significant cut / acid sulfate rock expected in this location / capture impacts from the rest areas
GW23	24800	Significant cut / acid sulfate rock expected in this location / capture impacts from the rest areas
GW24	25900	Cluster of private bores to the east of the highway / next to a cut
GW25	33800	Category A Cut
GW26	34300	Category B Cut

Site no.	Chainage	Reason for site selection
GW27	35150	Category A Cut
GW28	35280	Category A Cut
GW29	35900	Category A Cut
GW30	37160	Category A Cut/ near existing groundwater user

2.2 Monitoring parameters

Surface water quality monitoring parameters have been selected with reference to:

- Roads and Maritime Guideline for Construction Water Quality Monitoring (RTA undated).
- The Australian guidelines for water quality monitoring and reporting (ANZECC Monitoring Guidelines) (ANZECC/ARMCANZ 2000b).
- The parameters included in earlier monitoring programs within the region (eg by the Port Macquarie Hastings Council and by the Kempsey Bypass Alliance).
- For groundwater, the standard water quality parameters were selected from Appelo & Postma (1993), Driscoll (1989) and Sterrett (2007).

Table 2-3 lists the monitoring parameters that form the basis of the surface water monitoring program and identifies whether measurement is taken in the field or by a NATA accredited laboratory off site.

Table 2-3 Water quality monitoring parameters

Parameter type	Surface (SW) or groundwater (GW)	Parameter	Unit of measurement	Analysis method
Chemical properties	SW and GW	pH	Scale 0 to 14	Field measurement
	SW	Dissolved oxygen (DO)	%	Field measurement
	SW and GW	Total petroleum hydrocarbons	ug/L	Field visual assessment / laboratory measurement
	SW and GW	Trace metals: Aluminum (Al) Arsenic (As) Cadmium (Cd) Chromium (Cr) Copper (Cu) Iron (Fe) Lead (Pb) Manganese (Mn) Mercury (Hg) Nickel (Ni) Silver (Ag) Zinc (Zn)	mg/L	Laboratory measurement
Physical properties	SW	Electrical conductivity (EC)	uS/cm	Field measurement

	GW	Electrical conductivity (EC)	uS/cm	Field measurement / laboratory analysis
	SW and GW	Temperature	^{0}C	Field measurement
	SW	Turbidity	NTU	Field measurement
	SW	Total suspended solids	mg/L	Laboratory measurement
Nutrients	SW and GW	Total nitrogen (TN)	mg/L	Laboratory measurement
	SW and GW	Total phosphorous (TP)	mg/L	Laboratory measurement
Nutrients	GW	Ammonia (NH_4) Phosphate (PO_4)	mg/L	Laboratory measurement
Major anions	GW	Bicarbonate (HCO-) Chloride (Cl-) Nitrate (NO3-) Sulfate ($SO4^{2-}$)	mg/L	Laboratory measurement
Major cations	GW	Calcium (Ca^{2+}) Magnesium (Mg^{2+}) Potassium (K+) Sodium (Na+)	mg/L	Laboratory measurement
Groundwater levels	GW	Groundwater levels	Metres below top of casing (mTOC)	Field measurement

2.3 Water quality analysis

Section 2.2 noted that the analysis of water quality depending on the parameter subject to investigation is undertaken in one of two ways. Some physical and chemical properties due to their rapid degradation with time are analysed in the field. This analysis has been performed with the use of a Yeo-Kal Model 615 Water Quality Analyser on surface waters. The instrument is factory calibrated annually, with in-field calibration checked / undertaken at regular intervals, typically monthly and/or prior to each sampling event.

ALS NATA accredited Sydney laboratory operations undertake all off-site surface water quality analysis. Samples are collected on-site in ALS supplied sample bottles, refrigerated and transported to the ALS Warabrook depot for dispatch to Sydney. Chain of custody documentation is produced and updated during the collection, transport and analysis stages of the process.

Similarly, analysis of groundwater is undertaken both in the field and off-site by an accredited NATA laboratory as the parameter dictates (refer to Section 2.2). Automated data loggers (Hobo) have been installed at 26 groundwater monitoring sites to recorded groundwater levels below ground at 30 minute intervals. One barometric air pressure data logger has also been installed, enabling the correction of water levels across the monitoring site to local atmospheric conditions. In-field dip level monitoring is also undertaken on a two monthly basis.

In-field parameters are analysed using a DKK-TOA Model WQC-24 multi parameter water quality meter. The presence of hydrocarbons for both surface and groundwater are undertaken on a visual basis in the first instance. Where found to be present a sample is collected and sent for laboratory analysis.

Port Macquarie-Hastings Council performs off-site groundwater sample analysis with support by Sydney Water. Chain of custody documentation is produced and updated during the collection, transport and analysis stages of the process.

2.4 Monitoring frequency and duration

2.4.1 Surface water

During the construction surface water quality monitoring phase, sampling of all parameters except trace metals, are required for one dry event and as required two wet-weather events per month. Further monitoring of trace metals are required for one dry weather event and as required one wet weather event per month. A wet-weather event has been defined as 10 millimetres of rainfall within a 24-hour period. Sampling for a wet-weather event commences within 24 hours of the cessation of that event.

2.4.2 Groundwater

During the construction groundwater quality monitoring phase, sampling of in-field parameters are required on a monthly basis, or every two months where a groundwater level logger is in place. Monitoring of anions, cations, ammonia and phosphate are to be monitored on one occasion in the first quarter and then on an annual basis thereafter. All other laboratory analysed parameters shall be monitored on a monthly basis for the first three months and then on a three monthly basis if no impact is detected. If an impacts is detected (ie levels outside of trigger values), this monitoring would be reinstated to a monthly basis.

The requirements for ongoing construction and post-construction monitoring are detailed in the WQMP and will be outlined in subsequent construction and post-construction surface water quality monitoring reports.

2.5 Rainfall records

During the first construction monitoring period rainfall records were obtained through three Bureau of Meteorology weather stations including:

- Kempsey Airport (Station number – 59007).
- Telegraph Point – Farrawells Road (Station number – 60031).
- Port Macquarie Airport (Station number – 60139).

Rainfall records for these stations are attached at Appendix B and include the period between July 2014 and January 2015.

Site based weather stations have also been established for the project at three locations including:

- Kundabung – Port Macquarie.
- Telegraph Point – Port Macquarie.
- Sancrox – Port Macquarie.

These stations have been established at various times during pre-construction and construction. These stations have been used during the construction phase of the project to determine the need for wet-weather monitoring and ongoing water quality reporting. Records from these sites for the monitoring period are also attached and Appendix B.

3 Results

3.1 Prevailing climatic conditions

Rainfall during the reporting period 22 July 2014 to 21 January 2015 was mixed with about 50 per cent of records at each Bureau of Meteorology monitoring station characterised as well below average to average. The remaining months in particular August 2014, December 2014 and January 2015 recorded rainfall well above average and in some cases up to four times the historical mean for the month. A summary of daily / monthly rainfall for three weather stations in the Port Macquarie / Kempsey area referred to in Section 2.5 are provided courtesy of the Australian Bureau of Meteorology at Appendix B.

3.2 Summary of construction activities

Construction activity across the project with the potential to impact on surface water quality was limited during the monitoring period. Due to the superficial nature of works during in monitoring period, direct impacts on groundwater quality and/or level across the project was generally not anticipated. Works on each of the stages included:

- Stage 1 – Vegetation clearing, extensive earthworks across the entire site and culvert work at the new quarry entrance. Works on Stage 1 with the potential to influence surface water quality were in progress near waterway with reference number SW1.
- Stage 2 – Selective vegetation clearing and topsoil removal, installation of some temporary and permanent water quality basins, minor earthworks and culvert works. Works on Stage 2 with the potential to influence surface water quality were in progress near waterways with reference numbers SW8 and SW11. There were no works in progress in the vicinity of the remaining waterways on Stage 2. Due to the limited nature of earthworks (ie surface/shallow only) it is considered that the potential to intercept groundwater during the reporting period was negligible.
- Stage 3 – Selective vegetation clearing and topsoil removal, installation of some temporary and permanent water quality basins and minor earthworks. Works on Stage 3 with the potential to influence surface water quality were in progress near waterways with reference numbers SW7 and SW8. There were no works in progress in the vicinity of the remaining waterways on Stage 3. Due to the limited nature of earthworks (ie surface/shallow only) it is considered that the potential to intercept groundwater during the reporting period was negligible.

Further detail on all construction activities undertaken during the reporting period is provided in the Oxley Highway to Kempsey – Construction Compliance Tracking Report 1.

3.3 Limitations of surface water results

A number of factors have influenced the continuity and completeness of water quality results obtained during the monitoring period and the extent to which they are suitable for upstream and downstream comparison. Relevant considerations include:

- Waterway conditions were such that where sampling was undertaken following wet weather events (ie an event greater than 10 millimetres in 24 hours), particularly where only a marginal event occurred, no visible response within many of the waterways was observed ie no subsequent flow and/or connection between upstream and downstream sampling locations.

- Due to the absence of water at both SW2 and SW5 only a limited number of samples were taken ie less than 50 per cent of all sampling events across the project during the monitoring period.
- A number of the freshwater streams remained isolated ponds for all or a large proportion of both dry and wet-weather sampling events. On one occasion during the monitoring period did SW8 (Barrys Creek) prevail as a continuous waterway ie 20 January 2015. SW8a, SW8b and SW8c remained isolated ponds for all other sampling events during the entire monitoring period.
- SW8a was sampled on only one occasion during the monitoring period due to the absence of water within the waterway. Comparison between 80th and 20th percentiles at SW8a and downstream locations (ie SW8b, SW8c) do not adequately represent any potential impacts associated with construction.
- At times, due to very shallow water depth at sampling points ie <75mm, measurement of in-field parameters was not possible. Where collection of a bottled sampled was still possible, these were collected and sent for laboratory analysis for the standard suite of parameters.
- 80th and 20th percentile trigger values have generally been established from 24 sampling events up to and including the month subject to analysis (consistent with ANZECC requirements). However, due to the frequency of metal analysis during the pre-construction period, the trigger values have been derived from fewer samples for all waterways. This anomaly will be resolved progressively during subsequent reporting periods as the number of samples analysed for metals reaches and exceeds 24 events.

3.4 Summary of surface water results

Table 3-1 to Table 3-17 represent an aggregate summary of water quality results by waterway for upstream and downstream sampling locations. In accordance with the WQMP, 80th and 20th percentiles for upstream sample locations form the trigger values for median downstream results. Appendix C includes all monitoring results for this construction period. Full laboratory reports for all sampling events are available on request

Table 3-1 Construction surface water quality results by waterway

Parameter	Unit	LOR / probe limit	ANZECC default trigger value	Results									
				July 2014					August 2014				
				SW1a derived trigger values*			SW1b	SW1c	SW1a derived trigger values*			SW1b	SW1c
				Std dev	80th %	20th %	Median	Median	Std dev	80th %	20th %	Median	Median
Temperature	^{0}C		NA	4.9	23.6	14.4	12.3	11.2	5.2	23.4	12.5	12.7	13.1
Electrical conductivity (EC)	uS/cm		125-2200	788	1179	221	768	737	755	1048	233	480	441
Dissolved oxygen (DO)	%		85-110	35	95	38	24	22	35	93	36	34	32
pH			6.5-8	0.4	7.0	6.6	7.5	7.4	0.4	7.3	6.6	7.1	6.9
Turbidity	NTU		6-50	202	97	21	131	201	192	94	19	75	84
Total suspended solids (TSS)	mg/L	5	-	139	46	8	51	68	132	42	6	35	17
Aluminium (Al)	mg/L	0.01	0.055”	0.29	0.52	0.04	0.02	0.01	0.28	0.47	0.04	0.08	0.08
Arsenic (As)	mg/L	0.001	0.024	0.000	0.002	0.001	0.002	0.001	0.000	0.001	0.001	0.003	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0005	0.0010	0.0001	0.0001	0.0001	0.0004	0.0010	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.003	0.008	0.002	0.001	0.001	0.003	0.005	0.002	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	1.51	2.28	0.11	0.25	0.10	1.41	1.91	0.05	1.60	0.23
Lead (Pb)	mg/L	0.001	0.0034	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.147	0.345	0.033	0.107	0.148	0.137	0.282	0.029	0.236	0.138
Mercury (Hg)	mg/L	0.0001	0.0006	0.00009	0.00010	0.00001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.001	0.002	0.001	0.002	0.002	0.001	0.002	0.001	0.003	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.033	0.078	0.022	0.020	0.011	0.033	0.058	0.013	0.025	0.018
Total Nitrogen (TN)	mg/L	0.1	0.5	1.2	0.9	0.2	1.8	2.5	1.1	0.8	0.2	0.8	0.8
Total Phosphorous (TP)	mg/L	0.01	0.05	0.23	0.18	0.02	0.39	0.66	0.22	0.17	0.02	0.10	0.14

* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

“ for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

Table 3-2 Construction surface water quality results by waterway (cont.)

Parameter				Results									
	Unit	LOR / probe limit	ANZECC default trigger value	September 2014					October 2014				
				SW1a derived trigger values*			SW1b	SW1c	SW1a derived trigger values*			SW1b	SW1c
				Std dev	80th %	20th %	Median	Median	Std dev	80th %	20th %	Median	Median
Temperature	^{0}C	-2-50	NA	5.1	23.4	12.7	14.2	14.1	5.1	23.0	12.5	16.0	15.9
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	728	874	238	639	698	762	915	268	773	786
Dissolved oxygen (DO)	%	0-200	85-110	34	92	33	41	38	35	88	20	27	19
pH		0-14	6.5-8	0.4	7.2	6.6	7.3	6.8	0.4	7.1	6.6	7.2	6.9
Turbidity	NTU	0-600	6-50	189	91	20	36	34	207	70	16	172	215
Total suspended solids (TSS)	mg/L	5	-	130	41	5	5	7	138	41	5	58	98
Aluminium (Al)	mg/L	0.01	0.055”	0.26	0.44	0.04	0.07	0.05	0.25	0.44	0.04	0.02	0.02
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.001	0.0003	0.001	0.001	0.002	0.002
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0004	0.0010	0.0001	0.0001	0.0001	0.0004	0.0010	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.0003	0.001	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.003	0.004	0.001	0.002	0.002	0.003	0.003	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	1.30	1.59	0.08	0.33	0.48	2.92	2.10	0.15	1.36	1.21
Lead (Pb)	mg/L	0.001	0.0034	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.135	0.219	0.021	0.068	0.088	0.135	0.272	0.023	0.234	0.258
Mercury (Hg)	mg/L	0.0001	0.0006	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.001	0.002	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.032	0.045	0.011	0.015	0.017	0.031	0.040	0.010	0.029	0.009
Total Nitrogen (TN)	mg/L	0.1	0.5	1.0	0.7	0.2	0.5	0.6	1.0	0.7	0.2	2.0	1.2
Total Phosphorous (TP)	mg/L	0.01	0.05	0.21	0.14	0.02	0.04	0.06	0.16	0.13	0.02	1.02	0.63

* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

“ for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

Table 3-3 Construction surface water quality results by waterway (cont.)

Parameter				Results									
	Unit	LOR / probe limit	ANZECC default trigger value	November 2014					December 2014				
				SW1a derived trigger values*			SW1b	SW1c	SW1a derived trigger values*			SW1b	SW1c
				Std dev	80th %	20th %	Median	Median	Std dev	80th %	20th %	Median	Median
Temperature	^{0}C	-2-50	NA	4.9	22.8	13.1	20.9	20.6	4.8	22.3	13.3	21.3	21.6
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	778	1094	285	601	578	787	1279	285	376	393
Dissolved oxygen (DO)	%	0-200	85-110	35	85	11	12	5	35	80	8	5	2
pH		0-14	6.5-8	0.4	7.1	6.6	7.0	6.5	0.4	7.0	6.5	6.7	6.5
Turbidity	NTU	0-600	6-50	199	71	16	122	149	199	72	17	98	119
Total suspended solids (TSS)	mg/L	5	-	116	44	5	52	39	116	36	5	80	63
Aluminium (Al)	mg/L	0.01	0.055”	0.24	0.44	0.04	0.03	0.01	0.24	0.43	0.04	0.03	0.02
Arsenic (As)	mg/L	0.001	0.024	0.0003	0.001	0.001	0.002	0.003	0.0003	0.001	0.001	0.002	0.002
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0004	0.0010	0.0001	0.0001	0.0001	0.0004	0.0006	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.0002	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.003	0.004	0.001	0.007	0.001	0.003	0.004	0.001	0.002	0.002
Iron (Fe)	mg/L	0.05	ID	2.75	1.73	0.21	1.89	0.80	2.63	2.28	0.28	1.97	0.49
Lead (Pb)	mg/L	0.001	0.0034	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.129	0.263	0.026	0.332	0.338	0.131	0.296	0.028	0.258	0.236
Mercury (Hg)	mg/L	0.0001	0.0006	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.001	0.002	0.001	0.004	0.003	0.001	0.002	0.001	0.002	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.030	0.034	0.008	0.034	0.022	0.029	0.032	0.008	0.023	0.014
Total Nitrogen (TN)	mg/L	0.1	0.5	1.0	0.6	0.2	3.6	2.0	0.9	0.6	0.3	1.9	1.5
Total Phosphorous (TP)	mg/L	0.01	0.05	0.16	0.06	0.02	2.18	1.8	0.15	0.06	0.02	2.00	1.06

* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

“ for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

Table 3-4 Construction surface water quality results by waterway (cont.)

Parameter				Results									
	Unit	LOR / probe limit	ANZECC default trigger value	January 2015									
				SW1a derived trigger values*			SW1b	SW1c	SW1a derived trigger values*			SW1b	SW1c
				Std dev	80th %	20th %	Median	Median	Std dev	80th %	20th %	Median	Median
Temperature	^{0}C	-2-50	NA	4.7	22.2	13.3	23.3	23.3					
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	762	1258	285	328	252					
Dissolved oxygen (DO)	%	0-200	85-110	33	51	6	12	60					
pH		0-14	6.5-8	0.5	7.1	6.5	6.8	6.8					
Turbidity	NTU	0-600	6-50	46	72	18	37	30					
Total suspended solids (TSS)	mg/L	5	-	19	34	5	30	22					
Aluminium (Al)	mg/L	0.01	0.055”	0.23	0.40	0.03	0.04	0.02					
Arsenic (As)	mg/L	0.001	0.024	0.0003	0.001	0.001	0.004	0.002					
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0004	0.0003	0.0001	0.0001	0.0001					
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.001					
Copper (Cu)	mg/L	0.001	0.0014	0.003	0.003	0.001	0.001	0.001					
Iron (Fe)	mg/L	0.05	ID	2.92	3.60	0.35	2.77	0.77					
Lead (Pb)	mg/L	0.001	0.0034	0.001	0.001	0.001	0.002	0.001					
Manganese (Mn)	mg/L	0.001	1.9	0.160	0.344	0.029	0.464	0.206					
Mercury (Hg)	mg/L	0.0001	0.0006	0.0001	0.0001	0.0001	0.0001	0.0001					
Nickel (Ni)	mg/L	0.001	0.011	0.001	0.002	0.001	0.002	0.001					
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.001					
Zinc (Zn)	mg/L	0.005	0.008	0.028	0.031	0.007	0.037	0.017					
Total Nitrogen (TN)	mg/L	0.1	0.5	0.9	0.7	0.3	1.0	1.0					
Total Phosphorous (TP)	mg/L	0.01	0.05	0.15	0.07	0.02	0.20	0.16					

* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

“ for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

Table 3-5 Construction surface water quality results by waterway (cont.)

Parameter				Results					
	Unit	LOR / probe limit	ANZECC default trigger value	SW2b pre construction trigger values*			SW2a median values		
				Std dev	80th %	20th %	November 2014^	December 2014	January 2015
Temperature	^{0}C	-2-50	NA	4.1	24.0	18.3		DNS	23.6
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	286	893	405			840
Dissolved oxygen (DO)	%	0-200	85-110	27	90	57			53
pH		0-14	6.5-8	0.9	6.1	4.1			4.3
Turbidity (NTU)	NTU	0-600	6-50	180	97	14			34
Total suspended solids (TSS)	mg/L	5	-	786	235	12	13		20
Aluminium (Al)	mg/L	0.01	0.055”	12.22	1.11	0.10			0.14
Arsenic (As)	mg/L	0.001	0.024	0.012	0.004	0.001			0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0004	0.0010	0.0001			0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.021	0.002	0.001			0.001
Copper (Cu)	mg/L	0.001	0.0014	0.024	0.005	0.001			0.001
Iron (Fe)	mg/L	0.05	ID	75.07	23.34	0.50			0.95
Lead (Pb)	mg/L	0.001	0.0034	0.011	0.001	0.001			0.001
Manganese (Mn)	mg/L	0.001	1.9	1.761	2.416	0.204			0.512
Mercury (Hg)	mg/L	0.0001	0.0006	0.0001	0.0002	0.0001			0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.266	0.013	0.003			0.007
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001			0.001
Zinc (Zn)	mg/L	0.005	0.008	0.105	0.048	0.013			0.02
Total Nitrogen (TN)	mg/L	0.1	0.5	10.3	5.4	0.7	1.9		0.8
Total Phosphorous (TP)	mg/L	0.01	0.05	2.00	0.71	0.03	0.06		0.06

* Trigger values are typically derived from 24 sampling events up to and including the month indicated. However, this is not the case for SW2b due to the general absence of water during the pre-construction and first construction monitoring periods.

DNS – “Did not sample” during the month due to insufficient or no water.

^ - Water body too shallow to take in-field measurement.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

“ for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

Table 3-6 Construction surface water quality results by waterway (cont.)

Parameter				Results											
	Unit	LOR / probe limit	ANZECC default trigger value	November 2014				December 2014				January 2015			
				SW3a*			SW3b	SW3a*			SW3b	SW3a*			SW3b
				Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median
Temperature	^{0}C	-2-50	NA	3.9	25.1	16.7	25.3	4.1	25.1	16.7	24.7	4.4	26.2	16.8	27.7
Electrical conductivity (EC)	uS/cm	0-8000	-	16196	38280	8000	8000	13867	17260	8000	8000	9378	8000	8000	8000
Dissolved oxygen (DO)	%	0-200	80-110	18	96	65	97	18	95	65	90	15	95	66	89
pH		0-14	7.0-8.5	0.4	7.8	7.2	7.6	0.4	7.7	7.2	7.5	0.4	7.6	7.1	7.4
Turbidity (NTU)	NTU	0-600	0.5-10	29	38	4	17	25	32	5	8	26	38	6	23
Total suspended solids (TSS)	mg/L	5		40	29	5	21	16	29	5	10	15	25	5	13
Aluminium (Al)	mg/L	0.01	ID	0.48	0.10	0.09	0.10	0.44	0.10	0.09	0.10	0.41	0.10	0.08	0.06
Arsenic (As)	mg/L	0.001	ID	0.004	0.010	0.002	0.010	0.004	0.010	0.002	0.010	0.004	0.010	0.002	0.006
Cadmium (Cd)	mg/L	0.0001	0.0055	0.0003	0.0010	0.0010	0.0010	0.0003	0.0010	0.0010	0.0010	0.0004	0.0010	0.0008	0.0006
Chromium (Cr)	mg/L	0.001	0.0274	0.004	0.010	0.001	0.010	0.004	0.010	0.001	0.010	0.004	0.010	0.001	0.006
Copper (Cu)	mg/L	0.001	0.0013	0.004	0.010	0.001	0.010	0.004	0.010	0.001	0.010	0.004	0.010	0.001	0.006
Iron (Fe)	mg/L	0.05	ID	0.52	0.50	0.10	0.30	0.48	0.50	0.12	0.50	0.46	0.50	0.09	0.28
Lead (Pb)	mg/L	0.001	0.0044	0.004	0.010	0.001	0.010	0.004	0.010	0.001	0.010	0.004	0.010	0.001	0.006
Manganese (Mn)	mg/L	0.001	ID	0.016	0.042	0.019	0.027	0.017	0.041	0.018	0.015	0.017	0.040	0.017	0.014
Mercury (Hg)	mg/L	0.0001	0.0004	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.07	0.004	0.010	0.001	0.010	0.004	0.010	0.001	0.010	0.004	0.010	0.001	0.006
Silver (Ag)	mg/L	0.001	0.0014	0.004	0.010	0.001	0.010	0.004	0.010	0.001	0.010	0.004	0.010	0.001	0.007
Zinc (Zn)	mg/L	0.005	0.015	0.022	0.050	0.005	0.050	0.022	0.050	0.005	0.050	0.022	0.050	0.005	0.028
Total Nitrogen (TN)	mg/L	0.1	0.3	1.6	0.5	0.2	0.5	2.0	0.5	0.2	0.5	1.6	0.5	0.2	0.2
Total Phosphorous (TP)	mg/L	0.01	0.03	0.05	0.07	0.02	0.05	0.06	0.07	0.02	0.05	0.04	0.08	0.02	0.05

* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Note – Since April 2014 the upper limit of Electrical Conductivity (EC) is 8000 uS/cm due to in-field equipment range limitations.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

ID – Insufficient representative data (ANZECC).

Table 3-7 Construction surface water quality results by waterway (cont.)

Parameter				Results					
	Unit	LOR / probe limit	ANZECC default trigger value	SW5b pre construction trigger values*			SW5b median values		
				Std dev	80th %	20th %	November 2014	December 2014	January 2015
Temperature	^{0}C	-2-50	No data	5.1	26.8	17.7	DNS	DNS	27.8
Electrical conductivity (EC)	uS/cm	0-8000	No data	481	1083	452			762
Dissolved oxygen (DO)	%	0-200	No data	28	106	62			115
pH		0-14	No data	0.9	5.6	4.4			4.4
Turbidity (NTU)	NTU	0-600	No data	184	83	4			8
Total suspended solids (TSS)	mg/L	5	-	340	361	14			7
Aluminium (Al)	mg/L	0.01	0.055”	1.16	2.26	0.91			0.43
Arsenic (As)	mg/L	0.001	0.024	0.004	0.005	0.001			0.002
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0004	0.0010	0.0002			0.0002
Chromium (Cr)	mg/L	0.001	0.001	0.001	0.001	0.001			0.001
Copper (Cu)	mg/L	0.001	0.0014	0.002	0.004	0.002			0.003
Iron (Fe)	mg/L	0.05	ID	6.09	6.59	0.26			0.41
Lead (Pb)	mg/L	0.001	0.0034	0.001	0.001	0.001			0.001
Manganese (Mn)	mg/L	0.001	1.9	1.190	3.170	1.750			1.660
Mercury (Hg)	mg/L	0.0001	0.0006	0.0001	0.0001	0.0001			0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.009	0.017	0.004			0.012
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001			0.001
Zinc (Zn)	mg/L	0.005	0.008	0.047	0.107	0.042			0.355
Total Nitrogen (TN)	mg/L	0.1	No data	4.6	7.2	0.4			0.4
Total Phosphorous (TP)	mg/L	0.01	No data	0.64	0.36	0.02			0.02

* Trigger values are typically derived from 24 sampling events up to and including the month indicated. However, this is not the case for SW5b due to the general absence of water during the pre-construction monitoring period.

DNS – “Did not sample” during the month due to insufficient or no water.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

ID – Insufficient representative data (ANZECC).

Table 3-8 Construction surface water quality results by waterway (cont)

Parameter				Results											
	Unit	LOR / probe limit	ANZECC default trigger value	November 2014				December 2014				January 2015			
				SW6a*			SW6b	SW6a*			SW6b	SW6a*			SW6b
				Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median
Temperature	^{0}C	-2-50	NA	4.5	25.1	15.7	25.3	4.6	25.3	15.8	25.1	5.1	26.7	15.8	28.6
Electrical conductivity (EC)	uS/cm	0-8000	-	6820	13700	6160	8000	6099	11260	6160	8000	5276	8000	3310	3421
Dissolved oxygen (DO)	%	0-200	80-110	18	94	62	79	17	89	62	84	14	86	62	74
pH		0-14	7.0-8.5	0.5	7.3	6.7	7.4	0.5	7.4	6.7	7.3	0.5	7.4	6.6	6.8
Turbidity (NTU)	NTU	0-600	0.5-10	10	14	3	6	10	11	3	7	12	15	3	14
Total suspended solids (TSS)	mg/L	5		9	16	5	5	9	13	5	5	12	10	5	8
Aluminium (Al)	mg/L	0.01	ID	0.20	0.27	0.01	0.07	0.19	0.22	0.01	0.01	0.18	0.17	0.01	0.06
Arsenic (As)	mg/L	0.001	ID	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.002
Cadmium (Cd)	mg/L	0.0001	0.0055	0.0004	0.0010	0.0001	0.0001	0.0004	0.0006	0.0001	0.0001	0.0004	0.0003	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.0274	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0013	0.000	0.001	0.001	0.008	0.000	0.001	0.001	0.002	0.000	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	0.46	0.38	0.05	0.06	0.44	0.36	0.05	0.05	0.41	0.35	0.05	0.26
Lead (Pb)	mg/L	0.001	0.0044	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	ID	0.063	0.095	0.034	0.085	0.058	0.094	0.034	0.087	0.055	0.093	0.034	0.049
Mercury (Hg)	mg/L	0.0001	0.0004	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.07	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001	0.0014	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.015	0.006	0.012	0.005	0.008	0.005	0.011	0.005	0.005	0.005	0.010	0.005	0.005
Total Nitrogen (TN)	mg/L	0.1	0.3	0.18	0.4	0.2	0.4	0.2	0.5	0.2	0.5	0.2	0.5	0.2	0.4
Total Phosphorous (TP)	mg/L	0.01	0.03	0.021	0.020	0.010	0.02	0.03	0.05	0.01	0.05	0.03	0.05	0.01	0.02

* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Note – Since April 2014 the upper limit of Electrical Conductivity (EC) is 8000 uS/cm due to in-field equipment range limitations.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

ID – Insufficient representative data (ANZECC).

Table 3-9 Construction surface water quality results by waterway (cont.)

Parameter				Results											
	Unit	LOR / probe limit	ANZECC default trigger value	November 2014				December 2014				January 2015			
				SW6c*			SW6d	SW6c*			SW6d	SW6c*			SW6d
				Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median
Temperature	^{0}C	-2-50	NA	4.5	24.4	15.6	25.7	4.7	25.5	15.7	25.2	5.2	26.9	15.7	28.6
Electrical conductivity (EC)	uS/cm	0-8000	-	6933	13240	5287	8000	6174	11540	5287	8000	5305	8000	3176	2886
Dissolved oxygen (DO)	%	0-200	80-110	15	87	58	80	16	88	58	84	13	83	58	74
pH		0-14	7.0-8.5	0.3	7.3	6.9	7.0	0.3	7.3	6.8	7.1	0.3	7.3	6.6	6.8
Turbidity (NTU)	NTU	0-600	0.5-10	23	8	3	7	23	9	3	7	23	12	3	14
Total suspended solids (TSS)	mg/L	5		16	8	5	5	16	8	5	5	16	9	5	11
Aluminium (Al)	mg/L	0.01	ID	0.11	0.15	0.01	0.03	0.10	0.13	0.01	0.01	0.10	0.11	0.01	0.07
Arsenic (As)	mg/L	0.001	ID	0.000	0.002	0.001	0.001	0.000	0.002	0.001	0.002	0.001	0.002	0.001	0.002
Cadmium (Cd)	mg/L	0.0001	0.0055	0.0004	0.0010	0.0001	0.0001	0.0004	0.0007	0.0001	0.0001	0.0004	0.0004	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.0274	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0013	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	0.25	0.32	0.05	0.05	0.24	0.31	0.05	0.05	0.22	0.30	0.05	0.26
Lead (Pb)	mg/L	0.001	0.0044	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	ID	0.057	0.097	0.034	0.093	0.053	0.098	0.034	0.089	0.051	0.097	0.033	0.043
Mercury (Hg)	mg/L	0.0001	0.0004	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.07	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001	0.0014	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.015	0.003	0.007	0.005	0.005	0.003	0.007	0.005	0.005	0.003	0.006	0.005	0.005
Total Nitrogen (TN)	mg/L	0.1	0.3	0.2	0.4	0.2	0.2	0.2	0.5	0.2	0.5	0.2	0.5	0.2	0.3
Total Phosphorous (TP)	mg/L	0.01	0.03	0.08	0.02	0.01	0.02	0.08	0.03	0.01	0.05	0.08	0.04	0.01	0.02

* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Note – Since April 2014 the upper limit of Electrical Conductivity (EC) is 8000 uS/cm due to in-field equipment range limitations.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

ID – Insufficient representative data (ANZECC).

Table 3-10 Construction surface water quality results by waterway (cont.)

Parameter				Results											
	Unit	LOR / probe limit	ANZECC default trigger value	November 2014				December 2014				January 2015			
				SW7a*			SW7b	SW7a*			SW7b	SW7a*			SW7b
				Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median
Temperature	^{0}C	-2-50	NA	3.7	20.6	13.8	19.7	3.8	21.0	13.9	19.5	4.2	22.4	13.9	24.0
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	31	221	178	245	35	228	178	115	34	219	174	207
Dissolved oxygen (DO)	%	0-200	85-110	24	76	43	13	27	74	32	14	24	70	29	38
pH		0-14	6.5-8	0.6	7.4	6.5	7.0	0.5	7.5	6.6	6.7	0.6	7.5	6.6	6.5
Turbidity (NTU)	NTU	0-600	6-50	4	11	4	19	6	14	4	124	10	14	4	12
Total suspended solids (TSS)	mg/L	5	-	5	9	5	9	7	14	5	18	7	13	5	8
Aluminium (Al)	mg/L	0.01	0.055”	0.07	0.19	0.04	0.06	0.07	0.16	0.03	0.28	0.07	0.17	0.03	0.10
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.002	0.001	0.002	0.001	0.003	0.001	0.001	0.001	0.002
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0004	0.0010	0.0001	0.0001	0.0004	0.0006	0.0001	0.0001	0.0004	0.0003	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.002	0.001	0.001	0.008	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	1.58	0.79	0.31	1.04	3.22	1.31	0.35	2.22	3.02	1.14	0.33	0.75
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	1.540	0.305	0.043	2.305	1.756	1.827	0.050	1.705	1.664	0.834	0.052	0.122
Mercury (Hg)	mg/L	0.0001	0.0006	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.002	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.002	0.009	0.005	0.008	0.002	0.009	0.005	0.005	0.002	0.008	0.005	0.006
Total Nitrogen (TN)	mg/L	0.1	0.5	0.1	0.4	0.1	0.5	0.2	0.4	0.1	0.8	0.2	0.4	0.1	0.3
Total Phosphorous (TP)	mg/L	0.01	0.05	0.01	0.03	0.01	0.04	0.01	0.03	0.01	0.10	0.01	0.03	0.01	0.02

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

“ for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

Table 3-11 Construction surface water quality results by waterway (cont.)

Parameter	Unit	LOR / probe limit	ANZECC default trigger value	Results									
				November 2014					December 2014				
				SW8a derived trigger values*^			SW8b	SW8c	SW8a derived trigger values*^			SW8b	SW8c
				Std dev	80th %	20th %	Median	Median	Std dev	80th %	20th %	Median	Median
Temperature	^{0}C	-2-50	NA	2.4	18.9	16.1	21.2	21.9	2.4	18.9	16.1	19.3	22.4
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	26	181	141	257	176	26	181	141	285	158
Dissolved oxygen (DO)	%	0-200	85-110	13	26	10	34	37	13	26	10	12	20
pH		0-14	6.5-8	0.3	6.5	6.1	7.0	6.3	0.3	6.5	6.1	7.3	6.8
Turbidity	NTU	0-600	6-50	10	25	12	7	9	10	25	12	12	14
Total suspended solids (TSS)	mg/L	5	-	1	5	3	5	9	1	5	3	12	7
Aluminium (Al)	mg/L	0.01	0.055”	0.00	0.91	0.91	0.05	0.06	0.00	0.91	0.91	0.12	0.11
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.000	0.001	0.001	0.003	0.002	0.000	0.001	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	0.00	0.38	0.38	1.35	0.57	0.00	0.38	0.38	3.23	1.01
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.000	0.078	0.078	0.109	0.529	0.000	0.078	0.078	0.200	0.633
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.000	0.006	0.006	0.008	0.006	0.000	0.006	0.006	0.005	0.005
Total Nitrogen (TN)	mg/L	0.1	0.5	0.1	0.4	0.3	0.6	0.3	0.1	0.4	0.3	0.6	0.3
Total Phosphorous (TP)	mg/L	0.01	0.05	0.01	0.03	0.02	0.03	0.02	0.01	0.03	0.02	0.05	0.01

* Trigger values typically derived from 24 sampling events up to and including the month indicated. However, due to the absence of water at SW8a a total of only five monitoring events have taken place to 20 January 2015, with only one analysed for metals.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

^ - Due to the absence of water, only one sample from SW8a was collected during the monitoring period. SW8b and SW8c persisted as isolated ponds for the entire monitoring period with the exception of the 20 January 2015 monitoring event.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

“ for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

Table 3-12 Construction surface water quality results by waterway (cont.)

Parameter				Results									
	Unit	LOR / probe limit	ANZECC default trigger value	January 2015									
				SW8a derived trigger values*^			SW1b	SW1c	SW8a derived trigger values			SW1b	SW1c
				Std dev	80th %	20th %	Median	Median	Std dev	80th %	20th %	Median	Median
Temperature	^{0}C	-2-50	NA	2.5	20.5	17.0	19.4	21.5					
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	33	177	118	166	151					
Dissolved oxygen (DO)	%	0-200	85-110	36	67	16	28	36					
pH		0-14	6.5-8	0.3	6.4	5.8	5.8	5.8					
Turbidity	NTU	0-600	6-50	10	31	12	15	12					
Total suspended solids (TSS)	mg/L	5	-	2	6	3	8	8					
Aluminium (Al)	mg/L	0.01	0.055”	0.00	0.91	0.91	0.49	0.26					
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.001					
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0000	0.0001	0.0001	0.0001	0.0001					
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.001					
Copper (Cu)	mg/L	0.001	0.0014	0.000	0.001	0.001	0.001	0.001					
Iron (Fe)	mg/L	0.05	ID	0.00	0.38	0.38	0.20	0.35					
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.001					
Manganese (Mn)	mg/L	0.001	1.9	0.000	0.078	0.078	0.015	0.135					
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0001					
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.001					
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.001					
Zinc (Zn)	mg/L	0.005	0.008	0.000	0.006	0.006	0.005	0.006					
Total Nitrogen (TN)	mg/L	0.1	0.5	0.1	0.5	0.3	0.1	0.3					
Total Phosphorous (TP)	mg/L	0.01	0.05	0.01	0.02	0.02	0.02	0.02					

* Trigger values typically derived from 24 sampling events up to and including the month indicated. However, due to the absence of water at SW8a a total of only five monitoring events have taken place to 20 January 2015, with only one analysed for metals.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

^ - Due to the absence of water, only one sample from SW8a was collected during the monitoring period. SW8b and SW8c persisted as isolated ponds for the entire monitoring period with the exception of the 20 January 2015 monitoring event.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

“ for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

Table 3-13 Construction surface water quality results by waterway (cont.)

Parameter				Results											
	Unit	LOR / probe limit	ANZECC default trigger value	November 2014				December 2014				January 2015			
				SW9b*			SW9a	SW9b*			SW9a	SW9b*			SW9a
				Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median
Temperature	^{0}C	-2-50	NA	4.3	20.2	12.2	21.4	4.6	22.0	12.5	21.6	4.9	22.3	12.5	22.6
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	347	454	267	352	346	454	274	355	357	396	230	224
Dissolved oxygen (DO)	%	0-200	85-110	27	49	16	10	22	45	12	8	17	41	12	19
pH		0-14	6.5-8	0.2	6.9	6.6	6.6	0.2	6.9	6.6	6.8	0.3	6.9	6.6	6.2
Turbidity (NTU)	NTU	0-600	6-50	7	15	6	18	9	20	7	25	10	24	8	9
Total suspended solids (TSS)	mg/L	5	-	34	13	5	16	9	10	5	12	3	10	5	8
Aluminium (Al)	mg/L	0.01	0.055”	0.14	0.10	0.02	0.04	0.13	0.06	0.02	0.03	0.12	0.06	0.02	0.08
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.002	0.000	0.002	0.001	0.004	0.000	0.002	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0004	0.0005	0.0001	0.0001	0.0004	0.0005	0.0001	0.0001	0.0004	0.0005	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	1.21	1.43	0.50	5.61	1.47	3.31	0.55	5.60	1.38	2.97	0.58	1.07
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.606	0.857	0.118	1.140	0.615	1.170	0.148	0.729	0.592	1.069	0.162	0.208
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.005	0.010	0.005	0.007	0.005	0.010	0.005	0.005	0.005	0.010	0.005	0.015
Total Nitrogen (TN)	mg/L	0.1	0.5	0.3	0.7	0.2	0.8	0.3	0.9	0.2	0.7	0.3	0.8	0.2	0.5
Total Phosphorous (TP)	mg/L	0.01	0.05	0.02	0.06	0.01	0.07	0.03	0.08	0.01	0.07	0.03	0.07	0.01	0.03

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

“ for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

Table 3-14 Construction surface water quality results by waterway (cont.)

Parameter				Results											
	Unit	LOR / probe limit	ANZECC default trigger value	November 2014				December 2014				January 2015			
				SW10b*			SW10a	SW10b*			SW10a	SW10b*			SW10a
				Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median
Temperature	^{0}C	-2-50	NA	4.4	20.1	12.4	22.4	5.0	22.5	12.6	23.6	5.3	23.1	12.6	23.3
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	67	308	235	278	53	285	228	238	46	277	205	221
Dissolved oxygen (DO)	%	0-200	85-110	29	54	15	7	27	49	14	15	24	47	11	16
pH		0-14	6.5-8	0.2	6.9	6.5	6.6	0.2	6.9	6.5	6.9	0.3	6.9	6.4	6.2
Turbidity (NTU)	NTU	0-600	6-50	11	26	7	17	10	26	9	19	11	26	10	14
Total suspended solids (TSS)	mg/L	5	-	6	11	5	7	6	11	5	8	4	15	5	16
Aluminium (Al)	mg/L	0.01	0.055”	0.23	0.16	0.02	0.04	0.21	0.18	0.02	0.16	0.19	0.15	0.03	0.14
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.002	0.000	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0004	0.0003	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.002	0.000	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	1.05	1.17	0.67	1.10	0.96	1.35	0.70	1.55	0.90	1.29	0.75	1.15
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.180	0.278	0.057	0.255	0.173	0.304	0.060	0.295	0.162	0.309	0.065	0.286
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.002	0.006	0.005	0.006	0.002	0.006	0.005	0.005	0.002	0.007	0.005	0.015
Total Nitrogen (TN)	mg/L	0.1	0.5	0.2	0.8	0.4	0.8	0.2	0.8	0.4	0.8	0.2	0.9	0.4	0.9
Total Phosphorous (TP)	mg/L	0.01	0.05	0.01	0.04	0.02	0.04	0.01	0.05	0.02	0.03	0.02	0.05	0.02	0.06

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

“ for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

Table 3-15 Construction surface water quality results by waterway (cont.)

Parameter				Results											
	Unit	LOR / probe limit	ANZECC default trigger value	November 2014				December 2014				January 2015			
				SW11b*			SW11a	SW11b*			SW11a	SW11b*			SW11a
				Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median
Temperature	^{0}C	-2-50	NA	3.8	19.8	13.0	20.6	4.4	21.0	13.1	21.0	5.1	22.2	13.1	23.2
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	62	232	119	188	63	231	102	192	67	235	101	278
Dissolved oxygen (DO)	%	0-200	85-110	24	46	18	45	24	46	17	9	23	46	17	47
pH		0-14	6.5-8	0.5	6.8	5.9	7.0	0.5	6.8	6.0	6.6	0.5	6.8	5.9	5.3
Turbidity (NTU)	NTU	0-600	6-50	15	36	8	17	24	43	8	20	25	45	8	73
Total suspended solids (TSS)	mg/L	5	-	22	12	5	7	21	15	5	8	4	13	5	26
Aluminium (Al)	mg/L	0.01	0.055”	0.34	0.11	0.03	0.13	0.37	0.26	0.04	0.13	0.34	0.26	0.04	0.18
Arsenic (As)	mg/L	0.001	0.024	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.003	0.001	0.002	0.001	0.002
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	1.96	2.69	0.47	1.98	1.80	2.48	0.60	4.09	1.67	2.30	0.62	1.14
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.132	0.315	0.068	0.074	0.123	0.266	0.076	0.135	0.116	0.227	0.076	0.284
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.002
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.006	0.013	0.005	0.008	0.006	0.014	0.005	0.005	0.006	0.014	0.006	0.008
Total Nitrogen (TN)	mg/L	0.1	0.5	0.5	1.3	0.4	0.9	0.7	1.4	0.4	0.9	0.6	1.3	0.4	0.7
Total Phosphorous (TP)	mg/L	0.01	0.05	0.06	0.08	0.01	0.06	0.06	0.09	0.01	0.04	0.05	0.08	0.01	0.03

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

“ for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

Table 3-16 Construction surface water quality results by waterway (cont.)

Parameter				Results											
	Unit	LOR / probe limit	ANZECC default trigger value	November 2014				December 2014				January 2015			
				SW12a*			SW12b	SW12a*			SW12b	SW12a*			SW12b
				Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median
Temperature	^{0}C	-2-50	NA	4.1	20.0	11.7	23.0	4.7	21.4	11.7	25.6	4.9	21.7	11.7	22.8
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	108	318	164	256	92	224	164	248	38	210	162	199
Dissolved oxygen (DO)	%	0-200	85-110	38	46	20	36	37	48	20	24	28	48	16	4
pH		0-14	6.5-8	0.4	6.8	6.2	6.5	0.4	6.9	6.4	6.7	0.5	6.9	6.2	5.6
Turbidity (NTU)	NTU	0-600	6-50	15	45	20	21	15	43	19	21	15	42	19	18
Total suspended solids (TSS)	mg/L	5	-	8	20	6	14	7	15	5	8	7	14	6	10
Aluminium (Al)	mg/L	0.01	0.055”	0.26	0.24	0.07	0.05	0.24	0.22	0.06	0.04	0.25	0.31	0.07	0.42
Arsenic (As)	mg/L	0.001	0.024	0.000	0.002	0.001	0.002	0.000	0.002	0.001	0.002	0.000	0.002	0.001	0.002
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.002	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.002	0.001	0.003
Iron (Fe)	mg/L	0.05	ID	1.12	1.53	0.70	1.05	1.10	1.52	0.52	1.06	1.03	1.58	0.63	1.46
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.004	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.144	0.236	0.123	0.293	0.144	0.216	0.089	0.385	0.137	0.269	0.096	0.253
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.002	0.001	0.001	0.000	0.002	0.001	0.001	0.001	0.002	0.001	0.002
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.004	0.015	0.008	0.012	0.004	0.016	0.008	0.005	0.004	0.015	0.008	0.011
Total Nitrogen (TN)	mg/L	0.1	0.5	0.2	1.1	0.6	0.9	0.3	1.1	0.5	0.5	0.3	1.1	0.5	0.8
Total Phosphorous (TP)	mg/L	0.01	0.05	0.02	0.06	0.03	0.05	0.02	0.06	0.03	0.02	0.02	0.07	0.03	0.03

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

“ for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

Table 3-17 Construction surface water quality results by waterway (cont.)

Parameter				Results											
	Unit	LOR / probe limit	ANZECC default trigger value	November 2014				December 2014				January 2015			
				SW13b*			SW13a	SW13b*			SW13a	SW13b*			SW13a
				Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median	Std dev	80th %	20th %	Median
Temperature	^{0}C	-2-50	NA	3.9	19.9	13.7	21.6	4.1	21.0	13.8	21.0	4.4	21.4	13.8	21.2
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	148	503	245	204	141	479	245	357	140	388	203	337
Dissolved oxygen (DO)	%	0-200	85-110	25	57	35	63	25	57	30	50	19	56	29	55
pH		0-14	6.5-8	0.6	6.9	6.2	6.5	0.6	7.1	6.3	6.9	0.6	7.1	6.3	6.1
Turbidity (NTU)	NTU	0-600	6-50	76	59	19	207	75	60	23	45	74	60	24	30
Total suspended solids (TSS)	mg/L	5	-	40	22	5	90	40	20	5	9	40	20	5	10
Aluminium (Al)	mg/L	0.01	0.055”	0.76	0.65	0.08	0.09	0.72	0.49	0.06	0.10	0.68	0.32	0.07	0.08
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0004	0.0010	0.0001	0.0001	0.0004	0.0006	0.0001	0.0001	0.0004	0.0003	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.003	0.001	0.001	0.001	0.003	0.001	0.002	0.001	0.002	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	1.42	1.90	0.46	0.58	1.34	1.70	0.46	0.55	1.26	1.50	0.47	0.73
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.086	0.192	0.074	0.077	0.080	0.180	0.076	0.143	0.076	0.180	0.079	0.113
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.00001	0.0001	0.0000	0.0001	0.00005	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.002	0.001	0.001	0.000	0.002	0.001	0.001	0.000	0.002	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.014	0.021	0.009	0.014	0.013	0.018	0.008	0.011	0.013	0.015	0.008	0.007
Total Nitrogen (TN)	mg/L	0.1	0.5	1.8	0.9	0.5	1.0	1.8	0.9	0.5	0.4	1.8	0.9	0.6	0.4
Total Phosphorous (TP)	mg/L	0.01	0.05	0.04	0.05	0.01	0.11	0.04	0.05	0.01	0.01	0.04	0.05	0.02	0.02

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note - Level of reporting raised for some sampling events due to matrix interference eg salinity. Samples diluted 10 times. Refer to individual results at Appendix C.

Colour red - Represents the calculated median result being either above the 80th percentile or below the 20th percentile at the downstream sampling location.

“ for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

3.5 Discussion of surface water results

Nearly all waterways had at least one parameter for one or more monthly results that fell either above or below calculated upstream 80th and 20th percentile values. However, as indicated in section 3.2, most waterways were some distance from active work areas and were considered unlikely to be influenced in anyway by construction activities in progress during the monitoring period. Therefore, the following observations have been limited to waterways where construction activities would have had the potential for impact. General and specific observations include:

- The monitoring period can be characterised by a mixture of below average and well above average rainfall across the entire project and broader region. All waterways, with the exception of the Hastings and Wilson Rivers, were predominantly isolated pondages with infrequent connection between upstream and downstream sampling points.
- Electrical conductivity – Calculated median values were generally within the calculated upstream 80th and 20th percentile trigger values for all waterways. There were individual exceptions at SW7b for November 2014, SW8b for November and December 2014, and SW11a for January 2015 where levels were slightly above the calculated 80th percentile values. In all instances the calculated median values were well within the default trigger values for low land rivers presented in the ANZECC guidelines. Impacts attributable to construction are considered unlikely.
- Dissolved oxygen – Calculated median values were generally within the calculated upstream 80th and 20th percentile trigger values for all waterways with the exception of SW1. Calculated median values at SW1b and in particular SW1c were below the 20th percentile upstream values and well below the default trigger values for low land rivers presented in the ANZECC guidelines. It is considered that these exceptions were largely attributable to the low or no flow conditions that prevailed during the monitoring period. This is also demonstrated by the calculated median value at SW1c for January 2015 that was above the calculated 80th percentile value for the month. It should be noted that the January 2015 calculated median value at SW1c remained below the lower limit default trigger values for low land rivers presented in the ANZECC guidelines. Impacts attributable to construction are considered unlikely.
- pH – Calculated median values were generally within the calculated upstream 80th and 20th percentile trigger values for all waterways. There were minor exceptions (in most instances equal to pH 0.1) at SW1b, SW1c, SW8b and SW8c. In all instances, pH levels were well within the default trigger values for low land rivers presented in the ANZECC guidelines. At SW11a, the calculated pH median value for January 2015 was 5.3, which equates to pH 0.6 below the calculated 20th percentile. It should be noted that the lower recorded pH values recorded during January 2015 coincided with substantial wet weather events where upstream and downstream measurements were similar. The corridor in this area is not known to contain underlying soils that present an acid sulfate risk. It is considered that pH variability within SW11 was unrelated to construction during the monitoring period.
- Turbidity – Calculated median values for SW1b, SW1c, SW7b and SW11a exceeded calculated 80th percentile values on a number of occasions during the monitoring period, particularly at SW1. Exceedances at SW1 occurred during July, October, November and December 2014. During individual sampling events turbidity levels at SW1b and SW1c were substantially elevated when compared to the upstream reference point. The catchment for SW1 includes a number of industrial activities (ie quarry operations and a heavy machinery sales and servicing business) in addition to the project and it is considered likely that all are contributing to the elevated downstream turbidity levels. Roads and Maritime has been proactive in its response to minimising any impacts

attributable to the project. This is discussed further in section 3.6.

Elevated turbidity levels for calculated downstream median values were also experienced at waterways SW7 and SW11 for December 2014 and January 2015, respectively. At SW7b, the elevated levels can be attributed to runoff on two occasions from a private unsealed access road downstream of the project. Since these results, the preferred sampling location has been relocated upstream of the access track on the boundary of the project corridor. Future influences on downstream water quality other than that attributable to the project are considered unlikely. At SW11, culvert works including the installation of a temporary waterway diversion was underway in December 2014. The subsequent high turbidity levels during January 2015 can be attributed to substantial storm events that overwhelmed site controls. During these events sediment was observed to have been deposited in downstream pools. This was found to be re-mobilised during subsequent basin discharges and minor rainfall events, influencing water quality downstream of the project.

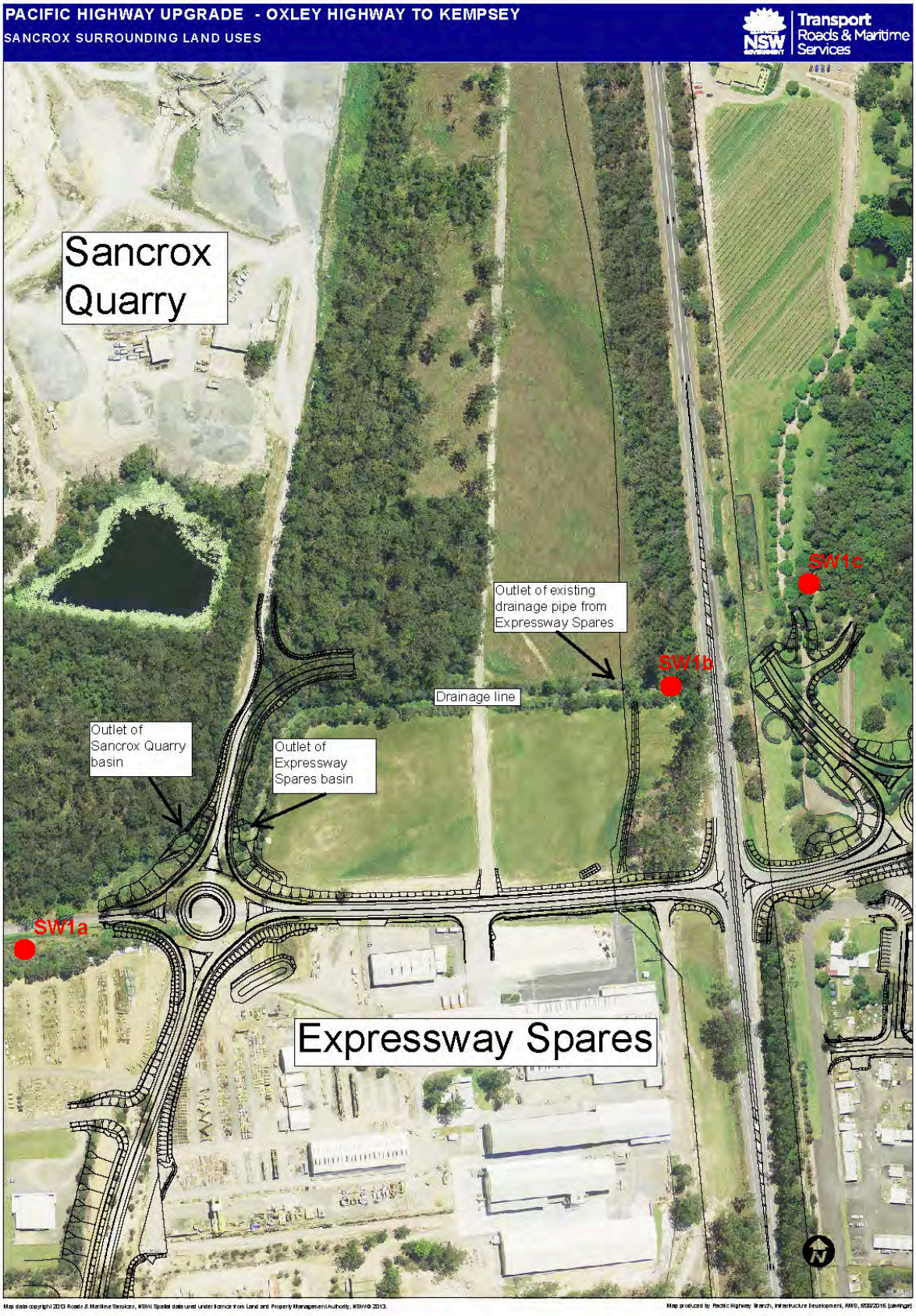
- Nitrogen and phosphorus – Calculated median values for nitrogen and phosphorus exceeded the calculated 80th percentile values at SW1 on a number of occasions during the reporting period. Exceedances occurred during July, October, November and December 2014, and January 2015 and were typically well above the default upper limited trigger values presented in the ANZECC guidelines. While it appears clear that catchment activities are influencing levels within the waterway, this level of exceedance is not inconsistent with results obtained during the pre-construction period. Irrespective, Roads and Maritime has been proactive in its response to minimising any impacts attributable to the project. This is discussed further in section 3.6.
- Total petroleum hydrocarbons (TPH) – Sampling for TPH following the observed presence of oil and grease was undertaken at SW1b on one occasion. The catchment for SW1 includes a heavy machinery sales and servicing business, quarry operations and the project. There were no incidents during the reporting period on Stage 1 that included the release of fuel or hydraulic oil from machinery working on site. It should also be noted that during pre-construction monitoring that the presence of TPH in SW1b and/or SW1c was found on three occasions. Roads and Maritime is of the view that the presence of TPH is unrelated to the project, but nonetheless adopts a proactive approach to minimising potential impacts on adjacent waterways. This is discussed further in section 3.6.
- Metals – Analysis of metals showed limited variation in levels for nearly all sampling locations and analytes. Exceptions included iron and magnesium at some waterways, that showed substantial variability throughout the first construction monitoring period. Elevated levels were experienced both upstream and downstream at different times. This was consistent with the variability and levels experienced during the pre-construction monitoring period. None of the elevated or low metal parameters are considered likely to be attributable to construction related activities (eg exposure of acid sulfate material).

3.6 Project response to surface water quality results

Impacts on water quality attributable to the project were generally considered to be negligible during the monitoring period. However, elevated turbidity levels at SW1 and SW11 downstream monitoring sites might be considered in part or largely attributable to project activities. In response, Roads and Maritime and its construction partners have adopted a number of responses to minimise the likelihood of future reoccurrences. These include, but are not limited to:

- SW1 – as discussed above, the monitoring points at SW1 are considered to be influenced by a number of surrounding industrial activities, unsealed access tracks and the construction of the Sancrox Interchange (Figure 3-1). Two of the industrial land uses in the area have sediment basins and all have exposed surfaces, hardstand areas, unsealed carparks and unsealed access roads that discharge to the drainage line (between the up and downstream monitoring points) where the monitoring is conducted. Relocation of the monitoring points was not found to be feasible due to the varying discharge points of the surrounding land uses. Despite this, Ferrovial Agroman identified areas where their sediment controls could be improved to minimise sediment laden water runoff. This included the splitting of the catchment into smaller areas through the use of diversion drains and rollover bunds. Ferrovial also increased the capacity of the downslope controls, geotextile fabric wrapped rock bunds and mulch sediment traps, and conducted maintenance on the existing sediment fence. Progressive Erosion and Sediment Control Plans continue to be prepared by the soil conservation specialist prior to implementation and updated as required, based on the staging of works.
- SW11 – whilst sediment basin discharges in this area are being conducted in accordance with the project Environment Protection Licence (EPL), an investigation into the high NTU results at this location found that large pumps were being used for discharge. Whilst this ensured that the project was meeting the five-day discharge criteria stipulated in the EPL, it was resulting in high velocity flows that were disturbing previously deposited sediment (from large rain events) within the drainage line. In response, the project has opted for smaller pumps, or larger pumps not being used at full capacity, to minimise water velocity, whilst still meeting the EPL discharge timeframe. This site was visited during an Environmental Review Group meeting on 11 March 2015, and all present were satisfied with the mitigation measures that had been implemented.

Figure 3-1 Location of Stage 1 works and surrounding land uses



3.7 Limitations of groundwater results

A number of factors have influenced the continuity and completeness of groundwater quality results obtained during the monitoring period and the extent to which they can be analysed for trends. Relevant considerations include:

- There is insufficient historical (pre-construction) data to allow for the development of 80th and 20th percentile trigger values in accordance with ANZECC guidelines. The minimum number of samples to develop site specific trigger values is 24 (eg generally a period of two years). With the exception of groundwater levels and temperature, most analytes were sampled on three or less occasions.
- GW06 was dry when monitored in December 2014 and believed destroyed prior to subsequent sampling event in February 2015.
- GW08 has no pre-construction data to facilitate the development of trends between pre, during and post construction.
- GW09 was dry through the first period of construction monitoring.
- GW16, GW17 and GW20 were not sampled during the pre-construction period and remained dry during the first construction monitoring period.
- In-field and laboratory groundwater monitoring was not conducted from July 2014 – November 2014, although the loggers did run during this period. The Roads and Maritime resource conducting the monitoring became ill, and then left the organisation during this time. The project team did not become aware of this until November 2014. Since this time, the project team has arranged for a team from the Roads and Maritime geotechnical division to conduct this monitoring, to ensure it continues if someone is unwell or away. Despite this, the K2K and OH2Ku stages of the project were not under construction during this period, and whilst the Sancrox stage had commenced, there is no groundwater monitoring point within the vicinity of this stage of the project. As such, missing this period did not result in the loss of any construction related monitoring.

  From November 2014, monitoring was conducted once every two months for the first six-months, rather than once a month for the first three months, due to a misinterpretation of the Water Quality Monitoring Program. However, this error resulted in an extended initial monitoring period within which to determine whether there were any construction impacts, before reducing this monitoring to quarterly as allowed for in the WQMP. No construction related impacts were detected during this six-month period.

3.8 Summary of groundwater results

Table 3-18 to Table 3-30 present data collected manually during the construction period 22 July 2014 to 21 January 2015 with reference to the pre-construction data reported in the Oxley Highway to Kempsey Groundwater Pre-construction Report, April 2014. Groundwater levels captured automatically (as noted in section 2.3) have been graphed with corresponding rainfall data from the Bureau of Meteorology and presented in Appendix D.

Table 3-18 Construction groundwater monitoring results by borehole

Parameter	Unit	LOR	GW01		Results		GW02		Results		GW03		Results	
			20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15
Dissolved Aluminium	mg/L	0.01	4.24	4.6	2.51	0.1	<0.01*	<0.01*	<0.01	0.03	0.03	0.03	<0.01	0.02
Dissolved Arsenic	mg/L	0.001	0.007	0.008	0.008	0.002	0.0034	0.0046	0.003	<0.001	0.003	0.003	<0.001	<0.001
Dissolved Cadmium	mg/L	0.0001	0.001	0.001	<0.001	<0.001	<0.01*	<0.01*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001
Dissolved Chromium	mg/L	0.001	0.001	0.001	<0.001	<0.001	<0.01*	<0.01*	<0.001	<0.001	0.012	0.012	<0.001	<0.001
Dissolved Copper	mg/L	0.001	0.043	0.063	0.037	0.009	<0.01*	<0.01*	0.001	0.004	0.007	0.007	0.005	0.005
Total Iron	mg/L	0.05	7.01	10.84	2.27	1.8	42.54	59.28	15.9	8.65	53.7	149.8	35.7	11.3
Dissolved Lead	mg/L	0.001	0.021	0.03	0.026	0.002	<0.01*	<0.01*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001
Total Manganese	mg/L	0.001	0.472	0.487	0.247	0.052	0.458	0.482	0.477	0.088	0.252	0.483	1.13	0.947
Mercury	mg/L	0.0001			<0.00001	0.00001			<0.00001	<0.00001			<0.00001	<0.00001
Dissolved Nickel	mg/L	0.001	0.033	0.035	0.025	0.005	0.0032	0.0038	0.003	0.004	0.0048	0.0132	0.012	0.013
Dissolved Silver	mg/L	0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001
Dissolved Zinc	mg/L	0.005	0.522	0.553	0.347	0.118	0.0074	0.0086	0.007	0.026	0.013	0.013	0.01	0.019
EC laboratory	uS/cm		5166	5982	4400	2170	383.6	468.8	345	178	967	1292	1290	939
Total Nitrogen	mg/L		0.35	1.00	0.38	0.5	1.08	2.04	2.7	1.0	1.2	1.9	0.7	0.6
Total Phosphorus	mg/L		0.04	0.12	0.05	0.07	0.196	0.424	0.37	0.23	0.30	0.62	0.37	0.11
Ammonia	mg/L		0.03	0.03	0.02	<0.02	0.272	0.506	1.54	0.12	0.07	0.17	0.17	0.10
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg $CaCO_3/L^{-1}$				7	13			123	34			147	118
Chloride	mg/L		1427	1919	1307	489	27	37.2	27	24	194	325	254	163
Nitrate					0.08	0.25			0.11	0.04			0.02	0.02
Sulphate	mg/L		105	258	159	274	14.4	29.4	7.7	8.4	99	149	102	80
Calcium	mg/L		7.86	10.23	4.41	1.28	14.28	18.66	14.8	6.07	33.1	58.0	30.8	27.4
Magnesium	mg/L		109.3	136.2	87.4	21.7	12.18	16.92	9.62	4.01	37	76	39.9	24.5
Potassium	mg/L		6.17	7.23	5.78	3.2	4.85	6.044	4.09	1.89	6.17	13.84	3.49	2.93
Sodium	mg/L		741	874	692	370	38.48	54.38	36.5	21.5	97	337	164	105

* No variation established between sampling events

^ Based on one record only.

Based on pre-construction records

Table 3-19 Construction groundwater monitoring results by borehole (cont.)

Parameter	Unit	LOR	GW04		Results		GW05		Results		GW07^		Results	
			20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15
Dissolved Aluminium	mg/L	0.01	<0.01*	<0.01*	<0.01	0.01	<0.01*	<0.01*	0.01	0.02				0.2
Dissolved Arsenic	mg/L	0.001	0.0034	0.0046	<0.001	<0.001	0.006	0.010	<0.001	<0.001				<0.001
Dissolved Cadmium	mg/L	0.0001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001				<0.001
Dissolved Chromium	mg/L	0.001	0.002	0.002	0.001	0.002	<0.001*	<0.001*	<0.001	0.001				0.002
Dissolved Copper	mg/L	0.001	<0.001*	<0.001*	0.005	0.002	<0.001*	<0.001*	0.01	0.003				0.001
Total Iron	mg/L	0.05	66.3	93.3	106	28.6	158	510	111	66.2	38.3	38.3		26.7
Dissolved Lead	mg/L	0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001				<0.001
Total Manganese	mg/L	0.001	0.410	0.540	0.632	0.409	0.799	0.980	0.944	1.15				0.124
Mercury	mg/L	0.0001			<0.00001	<0.00001			<0.00001	<0.00001				<0.00001
Dissolved Nickel	mg/L	0.001	0.0018	0.0042	0.002	0.004	0.004	0.01	0.004	0.012				0.002
Dissolved Silver	mg/L	0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001				<0.001
Dissolved Zinc	mg/L	0.005	0.010	0.014	<0.005	0.017	0.019	0.019	0.015	0.020				0.005
EC laboratory	uS/cm		3212	4922	4190	3050	6598	7294	7260	6910	168	168		212
Total Nitrogen	mg/L		1.4	2.7	1.5	0.9	2.6	5.5	3.1	1.8	1.4	1.4		0.7
Total Phosphorus	mg/L		0.38	1.40	0.52	0.11	1.60	3.18	9.43	1.03	0.2	0.2		0.16
Ammonia	mg/L		0.18	0.98	0.34	0.16	0.80	0.89	0.82		0.07	0.07		<0.02
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg $CaCO_3/L^{-1}$				319	176			558	397				36
Chloride	mg/L		1089	1309	1148	858	1468	1564	2494	1654	38	38		35
Nitrate					0.01	0.01			0.10	0.07				<0.01
Sulphate	mg/L		40	65	44	29	1055	1171	2032	1305	4.7	4.7		9.5
Calcium	mg/L		34.7	54.9	44.2	25.2	170	232	96.6	148	37.6	37.6		22.6
Magnesium	mg/L		68	107	83.7	48.7	273	367	281	228	16.9	16.9		9.09
Potassium	mg/L		14.2	24.7	21.8	11.2	35.4	56.34	21.9	31	5.25	5.25		2.92
Sodium	mg/L		511	701	627	456	973	1045	999	914	26.2	26.2		30.8

* No variation established between sampling events

^ Based on one record only.

Based on pre-construction records

Table 3-20 Construction groundwater monitoring results by borehole (cont.)

Parameter	Unit	LOR	GW08		Results		GW09		Results		GW010		Results	
			20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15
Dissolved Aluminium	mg/L	0.01			0.02	0.12	0.23^	0.23^			1^	1^	0.17	0.54
Dissolved Arsenic	mg/L	0.001			0.001	<0.001	<0.001^	<0.001^			0.001^	0.001^	0.002	0.004
Dissolved Cadmium	mg/L	0.0001			<0.001	<0.001	0.002^	0.002^			<0.001^	<0.001^	<0.001	<0.001
Dissolved Chromium	mg/L	0.001			<0.001	0.001	0.001^	0.001^			0.003^	0.003^	0.002	0.004
Dissolved Copper	mg/L	0.001			<0.001	0.004	0.218^	0.218^			0.02^	0.02^	0.087	0.014
Total Iron	mg/L	0.05			139	52.1	8.47	9.49			115.1	194.5	74.1	23.8
Dissolved Lead	mg/L	0.001			<0.001	<0.001	<0.001^	<0.001^			0.001^	0.001^	<0.001	0.001
Total Manganese	mg/L	0.001			0.452	0.125	0.85^	0.85^			0.013^	0.013^	0.22	0.15
Mercury	mg/L	0.0001			<0.00001	<0.00001							<0.00001	<0.00001
Dissolved Nickel	mg/L	0.001			0.002	0.005	0.061^	0.061^			0.002^	0.002^	0.003	0.003
Dissolved Silver	mg/L	0.001			<0.001	<0.001	<0.001^	<0.001^			<0.001^	<0.001^	<0.001	<0.001
Dissolved Zinc	mg/L	0.005			<0.005	0.063	0.063^	0.063^			0.007^	0.007^	0.007	0.018
EC laboratory	uS/cm					1530					270^	270^		419
Total Nitrogen	mg/L					1.6					1.1^	1.1^		0.8
Total Phosphorus	mg/L					0.27					0.11^	0.11^		0.09
Ammonia	mg/L					0.05					<0.02^	<0.02^		<0.02
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg $CaCO_3/L^{-1}$					37							71	15
Chloride	mg/L				264	400					52^	52^	70	106
Nitrate						0.02								<0.01
Sulphate	mg/L				11	24					9.4^	9.4^	5.5	7
Calcium	mg/L				108	23.2	20.45	59.86			46.1	127.0	28.6	9.38
Magnesium	mg/L				50	22.8	54.8	108.9			22.1	48.6	10.9	7.11
Potassium	mg/L				17.2	9.61	5.57	11.59			9.42	16.01	5.64	3.9
Sodium	mg/L				229	264	478	698			69.0	120.8	66.1	63.4

* No variation established between sampling events

^ Based on one record only.

Based on pre-construction records

Table 3-21 Construction groundwater monitoring results by borehole (cont.)

Parameter	Unit	LOR	GW11		Results		GW12		Results		GW013		Results	
			20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15
Dissolved Aluminium	mg/L	0.01	0.26	0.56	0.96	0.01	0.02	0.02	0.01	0.01	0.02	0.03	0.02	0.01
Dissolved Arsenic	mg/L	0.001	<0.001*	<0.001*	0.003	<0.001	0.029	0.030	0.004	0.003	0.002	0.004	<0.001	<0.001
Dissolved Cadmium	mg/L	0.0001	0.0022	0.0028	0.002	<0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001
Dissolved Chromium	mg/L	0.001	0.001	0.001	<0.001	0.001	<0.001*	<0.001*	<0.001	<0.001	0.001	0.001	<0.001	0.001
Dissolved Copper	mg/L	0.001	0.1818	0.2292	0.126	0.039	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	0.004	0.003
Total Iron	mg/L	0.05	46.8	219.3	14	14.5	185	283	344	191	41.5	60.4	76.9	13.7
Dissolved Lead	mg/L	0.001	<0.001*	<0.001*	0.003	<0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001
Total Manganese	mg/L	0.001	0.791	1.623	1.80	0.735	5.07	7.14	8.61	4.85	0.217	0.249	0.358	0.114
Mercury	mg/L	0.0001			<0.00001	<0.00001			<0.00001	<0.00001			<0.00001	<0.00001
Dissolved Nickel	mg/L	0.001	0.0626	0.0884	0.157	0.043	0.003	0.003	0.004	0.009	0.003	0.003	<0.001	0.001
Dissolved Silver	mg/L	0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001
Dissolved Zinc	mg/L	0.005	0.0788	0.0992	0.136	0.045	0.028	0.034	0.02	0.018	0.014	0.023	0.007	0.014
EC laboratory	uS/cm		2904	7650	8510	4370	3314	6962	4020	2860	207	305	300	247
Total Nitrogen	mg/L		0.56	1	0.7	--	1.3	1.7	3.8	2.0	1.6	1.7	1.4	0.7
Total Phosphorus	mg/L		0.08	0.70	0.10	0.03	0.08	0.19	0.70	0.20	0.41	0.59	4.21	0.33
Ammonia	mg/L		0.03	0.13	0.19	0.07	0.82	0.93	1.58	1.48	0.32	0.50	0.38	0.23
Phosphate	mg/L													
Bicaronate / Alkalinity	mg $CaCO_3/L^{-1}$				7	118			74	83			62	40
Chloride	mg/L		581	1422	2076	966	394	781	354	281	25	36	39	24
Nitrate					0.02	0.01			<0.01	<0.10*			0.01	<0.01
Sulphate	mg/L		448	1263	1889	928	1284	3267	1865	1342	14	26	22	34
Calcium	mg/L		30.8	120.4	94.7	62.6	85.9	148.8	64.2	68.3	3.70	4.36	4.48	10.1
Magnesium	mg/L		58.1	189.4	272	103	137	233	217	103	8.23	9.23	7	2.54
Potassium	mg/L		14.4	20.8	14.1	12.6	14.2	21.0	10.6	11.6	6.19	8.58	3.89	2.8
Sodium	mg/L		427	1013	1240	669	313	481	488	281	28.8	41.2	40.6	32.3

* No variation established between sampling events

^ Based on one record only.

Based on pre-construction records

Table 3-22 Construction groundwater monitoring results by borehole (cont.)

Parameter	Unit	LOR	GW14		Results		GW15		Results		GW018		Results	
			20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15
Dissolved Aluminium	mg/L	0.01	4.07	4.29	0.05	0.03	0.01	0.01	0.02	0.02	<0.01*	<0.01*	0.02	0.03
Dissolved Arsenic	mg/L	0.001	0.001	0.001	<0.001	<0.001	0.020	0.021	0.01	0.008	0.007	0.008	0.006	0.005
Dissolved Cadmium	mg/L	0.0001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001
Dissolved Chromium	mg/L	0.001	<0.001*	<0.001*	<0.001	0.001	<0.001*	<0.001*	<0.001	0.001	0.001	0.001	<0.001	<0.001
Dissolved Copper	mg/L	0.001	0.114	0.200	0.024	0.008	<0.001*	<0.001*	0.008	0.002	<0.001*	<0.001*	0.008	0.004
Total Iron	mg/L	0.05	2.05	3.40	0.79	0.37	8.13	10.30	7.28	6.61	5.76	9.92	5.26	5.57
Dissolved Lead	mg/L	0.001	0.001	0.001	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001
Total Manganese	mg/L	0.001	0.757	0.759	0.279	0.171	2.85	2.99	2.55	2.21	1.64	1.83	2.00	1.80
Mercury	mg/L	0.0001			<0.00001	0.00001			<0.00001	<0.00001			<0.00001	<0.00001
Dissolved Nickel	mg/L	0.001	0.028	0.029	0.003	0.002	0.003	0.003	0.003	0.003	0.003	0.005	0.002	0.002
Dissolved Silver	mg/L	0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001
Dissolved Zinc	mg/L	0.005	0.130	0.146	0.018	0.019	0.007	0.007	0.021	0.016	0.011	0.015	0.022	0.014
EC laboratory	uS/cm		7480	8074	3690	3230	3768	3798	3760	3740	1652	1658	1690	1690
Total Nitrogen	mg/L		0.7	0.9	0.7	1.1	0.43	0.96	0.26	--	0.6	0.7	0.46	--
Total Phosphorus	mg/L		0.02	0.03	0.03	0.06	0.07	0.09	0.09	0.05	0.15	0.15	0.09	0.06
Ammonia	mg/L		0.08	0.10	0.03	0.04	0.07	0.10	0.05	--	0.20	0.22	0.14	0.18
Phosphate	mg/L													
Bicaronate / Alkalinity	mg $CaCO_3/L^{-1}$				506	461			260	239			676	645
Chloride	mg/L		2386	3480	833	700	990	1559	981	1086	101	109	96	95
Nitrate					0.22	0.38			<0.01	<0.01			0.02	<0.01
Sulphate	mg/L		166	215	284	286	136	206	149	164	150	154	168	157
Calcium	mg/L		106	127	141	138	62.3	71.5	30.2	47.7	166	185	115	186
Magnesium	mg/L		165	195	32.9	23.9	115	123	105	99.3	61.9	62.1	56.6	49.2
Potassium	mg/L		2.67	3.12	2.76	3.32	8.80	9.14	5.30	8.87	7.65	8.02	4.48	6.15
Sodium	mg/L		1048	1216	610	509	532	557	507	527	100.0	108.3	97.7	98.9

* No variation established between sampling events

^ Based on one record only.

Based on pre-construction records

Table 3-23 Construction groundwater monitoring results by borehole (cont.)

Parameter	Unit	LOR	GW19		Results		GW21^		Results		GW022		Results	
			20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15
Dissolved Aluminium	mg/L	0.01	<0.01^	<0.01^	0.02	0.14	0.05	0.05	0.36	0.03	0.05^	0.05^	0.07	0.18
Dissolved Arsenic	mg/L	0.001	0.001^	0.001^	0.002	<0.001	0.002	0.002	0.008	0.002	<0.01^	<0.01^	<0.001	<0.001
Dissolved Cadmium	mg/L	0.0001	<0.001^	<0.001^	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001^	<0.001^	<0.001	<0.001
Dissolved Chromium	mg/L	0.001	<0.001^	<0.001^	<0.001	0.001	<0.001	<0.001	0.004	<0.001	<0.001^	<0.001^	0.001	<0.001
Dissolved Copper	mg/L	0.001	0.013^	0.013^	0.043	0.01	0.048	0.048	0.021	<0.001	0.01^	0.01^	0.021	0.003
Total Iron	mg/L	0.05	18.1	48.4	24.7	83.6	43.2	43.2	159	86.6	199	217	77.2	55.5
Dissolved Lead	mg/L	0.001	<0.001^	<0.001^	<0.001	<0.001	<0.001	<0.001	0.01	<0.001	<0.001^	<0.001^	<0.001	<0.001
Total Manganese	mg/L	0.001	0.636^	0.636^	0.865	0.319	0.358	0.358	1.00	0.979	0.011^	0.011^	1.75	0.863
Mercury	mg/L	0.0001			<0.00001	0.00002			<0.00001	<0.00001			<0.00001	<0.00001
Dissolved Nickel	mg/L	0.001	0.015^	0.015^	0.016	0.006	0.144	0.144	0.009	0.003	<0.001^	<0.001^	0.007	0.001
Dissolved Silver	mg/L	0.001	<0.001^	<0.001^	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001^	<0.001^	<0.001	<0.001
Dissolved Zinc	mg/L	0.005	0.057^	0.057^	0.056	0.016	0.122	0.122	0.022	0.009	0.084^	0.084^	0.123	0.037
EC laboratory	uS/cm		746	1371	634	435	1750	1750	1050	714	872	2056	542	205
Total Nitrogen	mg/L		1.6	1.7	0.5	1.1	2.6	2.6	3.1	2.2	2.4	2.6	0.6	1.1
Total Phosphorus	mg/L		0.24	0.38	0.14	0.64	0.39	0.39	0.55	0.42	0.56	0.89	0.45	0.49
Ammonia	mg/L		0.1	0.28	0.03	<0.02			<0.02	<0.02	0.08	0.08	<0.02	<0.02
Phosphate	mg/L													
Bicaronate / Alkalinity	mg $CaCO_3/L^{-1}$				96	40			376	292			32	11
Chloride	mg/L		90	98	126	64	178	178	101	54	201	475	62	45
Nitrate					<0.01	<0.01			0.01	<0.01			<0.01	0.01
Sulphate	mg/L		46	143	22	57	326	326	54	1.8	52	154	137	12
Calcium	mg/L		34.8	124.9	3.36	3.37	29.3	29.3	39.9	38.8	22.5	27.5	88.1	41.5
Magnesium	mg/L		22.7	55.8	10.2	9.21	28.2	28.2	50.3	26.9	42.3	56.5	35	18.9
Potassium	mg/L		7.74	8.23	6.15	10.6	10.3	10.3	39.1	18.6	17.5	18.3	9.65	8.94
Sodium	mg/L		91.1	100.8	114	79.3	310	310	220	147	154.8	331.9	77.6	35.9

* No variation established between sampling events

^ Based on one record only.

Based on pre-construction records

Table 3-24 Construction groundwater monitoring results by borehole (cont.)

Parameter	Unit	LOR	GW23		Results		GW24		Results		GW025		Results	
			20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15
Dissolved Aluminium	mg/L	0.01	0.05	0.19	0.16	0.62	0.19^	0.19	0.07	0.27	0.05^	0.05^	0.20	0.14
Dissolved Arsenic	mg/L	0.001	0.001	0.001	0.001	0.001	0.002^	0.002	0.003	<0.001	0.001^	0.001^	<0.001	<0.001
Dissolved Cadmium	mg/L	0.0001	<0.001*	<0.001*	<0.001	<0.001	<0.001^	<0.001	<0.001	<0.001	0.001^	0.001^	0.001	0.001
Dissolved Chromium	mg/L	0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001^	<0.001	<0.001	<0.001	<0.001^	<0.001^	<0.001	<0.001
Dissolved Copper	mg/L	0.001	0.009	0.009	0.018	0.014	0.428^	0.428	0.087	1.52	0.066^	0.066^	0.156	0.351
Total Iron	mg/L	0.05	21.9	35.8	96.9	101	34.2	98.5	92.5	23.8	89.0	103.3	30.5	17.6
Dissolved Lead	mg/L	0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001^	<0.001	<0.001	<0.001	0.001^	0.001^	0.006	0.005
Total Manganese	mg/L	0.001	0.458	0.642	0.232	0.252	0.172^	0.172	0.366	0.132	0.902^	0.902^	2.23	0.929
Mercury	mg/L	0.0001			<0.00001	<0.00001			<0.00001	<0.00001			<0.00001	<0.00001
Dissolved Nickel	mg/L	0.001	0.003	0.006	<0.001	<0.001	0.028^	0.028	0.007	0.011	0.016^	0.016^	0.035	0.018
Dissolved Silver	mg/L	0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001^	<0.001	<0.001	<0.001	<0.001^	<0.001^	<0.001	<0.001
Dissolved Zinc	mg/L	0.005	0.069	0.239	0.048	0.022	0.13^	0.13	0.06	0.074	0.15^	0.15^	0.388	0.306
EC laboratory	uS/cm		417	624	501	325	5530^	5530^		595	805^	805^		967
Total Nitrogen	mg/L		0.5	0.8	2.3	2.5	1.2^	1.2^		1.3	0.9^	0.9^		0.8
Total Phosphorus	mg/L		0.43	1.096	0.37	0.39	4.6^	4.6^		0.3	0.12^	0.12^		0.05
Ammonia	mg/L		0.03	0.04	<0.02	<0.02	0.04^	0.04^		0.09	0.14^	0.14^		0.18
Phosphate	mg/L													
Bicaronate / Alkalinity	mg $CaCO_3/L^{-1}$				18	19			32	<5			<5	<5
Chloride	mg/L		55.4	86	128	72	1686^	1686^	136	154	235^	235^	523	269
Nitrate	mg/L				0.01	<0.01				<0.01				0.12
Sulphate	mg/L		51	87	24	21	151^	151^	37	26	18^	18^	20	25
Calcium	mg/L		28.8	45.6	12.7	9.04	42.5	160.6	7.57	1.69	2.55^	2.55^	2.98	1.67
Magnesium	mg/L		17	23	16.1	15.4	29.35	96.59	12.6	6.71	14.8^	14.8^	25.7	12.2
Potassium	mg/L		5.56	5.93	11.6	12.5	7.2	12.5	10.1	5.48	17^	17^	10.0	9.9
Sodium	mg/L		54.0	87.6	104	65.2	206.7	593.9	100	94.4	130^	130^	250	150

* No variation established between sampling events

^ Based on one record only.

Based on pre-construction records

Table 3-25 Construction groundwater monitoring results by borehole (cont.)

Parameter	Unit	LOR	GW26		Results		GW27		Results		GW028		Results	
			20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15
Dissolved Aluminium	mg/L	0.01			<0.01	0.04	<0.01^	<0.01^	<0.01	0.02			0.11	
Dissolved Arsenic	mg/L	0.001			0.002	<0.001	0.001^	0.001^	0.003	<0.001			0.002	
Dissolved Cadmium	mg/L	0.0001			<0.001	<0.001	<0.001^	<0.001^	<0.001	<0.001			<0.001	
Dissolved Chromium	mg/L	0.001			<0.001	<0.001	<0.001^	<0.001^	<0.001	<0.001			0.001	
Dissolved Copper	mg/L	0.001				0.23	0.002^	0.002^	0.012	0.053				
Total Iron	mg/L	0.05	41.3	41.3	26.2	43.6	6.61	10.20	21.2	20.5	65.3	65.3	22.6	
Dissolved Lead	mg/L	0.001			<0.001	<0.001	<0.001^	<0.001^	<0.001	<0.001			<0.001	
Total Manganese	mg/L	0.001			0.928	0.972	0.492^	0.492^	2.66	1.33			0.226	
Mercury	mg/L	0.0001			<0.00001	<0.00001			<0.00001	<0.00001			0.00001	
Dissolved Nickel	mg/L	0.001			0.021	0.016	0.006^	0.006^	0.008	0.011			0.015	
Dissolved Silver	mg/L	0.001			<0.001	<0.001	<0.001^	<0.001^	<0.001	<0.001			<0.001	
Dissolved Zinc	mg/L	0.005			0.165	0.178	0.026^	0.026^	0.020	0.066			0.052	
EC laboratory	uS/cm		494	494		896	567	746		514	2140	2140		
Total Nitrogen	mg/L		1.4	1.4		1	0.3	0.7		0.8	2.6	2.6		
Total Phosphorus	mg/L		0.18	0.18		0.23	0.14	0.22		0.31	0.92	0.92		
Ammonia	mg/L		0.1	0.1		0.03	0.04	0.06		0.05	0.06	0.06		
Phosphate	mg/L													
Bicaronate / Alkalinity	mg $CaCO_3/L^{-1}$					26			231	51			31	
Chloride	mg/L		136	136	281	250	80	81	139	76	34	34	40	
Nitrate						0.01				0.09				
Sulphate	mg/L		18	18	32	11	41	64	55	73	5.9	5.9	51	
Calcium	mg/L		2.09	2.09	38.2	18.4	18.3	25.6	71.1	25.4	5.75	5.75	4.56	
Magnesium	mg/L		7.07	7.07	46.5	57.4	8.3	9.6	18.5	8.8	6.83	6.83	11.1	
Potassium	mg/L		12.8	12.8	12.6	14.6	4.34	6.24	7.35	7.48	10.5	10.5	6.63	
Sodium	mg/L		78.9	78.9	229	153	60.2	60.3	90.5	52.6	33.1	33.1	50.2	

* No variation established between sampling events

^ Based on one record only.

Based on pre-construction records

Table 3-26 Construction groundwater monitoring results by borehole (cont.)

Parameter	Unit	LOR	GW29		Results		GW30		Results		GW0		Results	
			20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15	20th per#	80th per#	Dec 14	Feb 15
Dissolved Aluminium	mg/L	0.01	3.21^	3.21^	0.16	0.72	2.34	2.60	1.36	0.06				
Dissolved Arsenic	mg/L	0.001	0.014^	0.014^	0.004	0.002	0.002	0.003	0.001	0.002				
Dissolved Cadmium	mg/L	0.0001	0.001^	0.001^	<0.001	<0.001	0.001	0.001	<0.001	<0.001				
Dissolved Chromium	mg/L	0.001	0.006^	0.006^	<0.001	0.002	<0.001*	<0.001*	<0.001	<0.001				
Dissolved Copper	mg/L	0.001	0.017^	0.017^	0.014	0.022	2.09	2.23	0.175	0.009				
Total Iron	mg/L	0.05	109	110	187	5.29	36.9	115.6	16.8	6.37				
Dissolved Lead	mg/L	0.001	0.009^	0.009^	<0.001	0.001	<0.001*	<0.001*	<0.001	<0.001				
Total Manganese	mg/L	0.001	0.571^	0.571^	3.29	0.089	3.21	3.58	1.10	0.162				
Mercury	mg/L	0.0001			<0.00001	<0.00001			<0.00001	<0.00001				
Dissolved Nickel	mg/L	0.001	0.031^	0.031^	0.007	0.007	0.161	0.172	0.067	0.004				
Dissolved Silver	mg/L	0.001	<0.001^	<0.001^	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001				
Dissolved Zinc	mg/L	0.005	5.25^	5.25^	0.069	0.103	0.813	0.859	0.310	0.018				
EC laboratory	uS/cm		291	539	274	145	4436	4934	2820	435				
Total Nitrogen	mg/L		2.6	4.8	5.5%	0.7	1.8	2.0	0.6	0.6				
Total Phosphorus	mg/L		0.63	1.07	1.23%	0.1	0.52	0.55	0.11	0.06				
Ammonia	mg/L		0.05	0.06	0.03	<0.02	0.04	0.05	0.03	<0.02				
Phosphate	mg/L													
Bicaronate / Alkalinity	mg $CaCO_3/L^{-1}$				46	17			<5	120				
Chloride	mg/L		45	63	46	27	1219	1390	798	39				
Nitrate					0.01	0.01			0.24	<0.01				
Sulphate	mg/L		35.9	123.7	28	6.4	158	167	232	32				
Calcium	mg/L		7.2	13.9	36.3	0.74	11.5	12.3	3.37	15.6				
Magnesium	mg/L		23.1	34.0	85.1	1.77	79.9	90.3	31.9	3.58				
Potassium	mg/L		13.9	20.3	39.9	2.08	13.2	14.2	6.59	1.96				
Sodium	mg/L		133	231	67.4	24.3	687	760		78.2				

* No variation established between sampling events

^ Based on one record only.

Based on pre-construction records

Table 3-27 Construction groundwater level – manual record

Borehole reference	Top of casting RL (mAHD)	Depth of water level			
		Pre-construction		Construction	
		20th per	80th per	Dec 14	Feb 15
GW01 (mTOC)	20.11	4.41	4.93	5.65	5.02
GW01 (mAHD)		15.18	15.70		
GW02 (mTOC)	3.57	1.95	2.96	3.17	1.77
GW02 (mAHD)		0.61	1.62		
GW03 (mTOC)	2.64	0.81	2.08	2.29	0.64
GW03 (mAHD)		0.58	1.81		
GW04 (mTOC)	1.69	1.11	2.21	2.37	0.96
GW04 (mAHD)		-0.52	0.58		
GW05 (mTOC)	1.24	0.81	1.55	1.79	0.55
GW05 (mAHD)		-0.31	0.43		
GW06 (mTOC)	20.1	5.36	5.85	Dry	Destroyed
GW06 (mAHD)		14.25	14.74		
GW07 (mTOC)	15.98	2.86	5.19	6.79 (dry)	1.81
GW07 (mAHD)		10.79	13.12		
GW08 (mTOC)	19.09	6.94	6.94	8.58	7.97
GW08 (mAHD)		12.15	12.15		
GW09 (mTOC)	17.57	8.05	8.66	Dry	Dry
GW09 (mAHD)		8.91	9.52		
GW10 (mTOC)	15.38	3.34	7.27	7.31	2.74
GW10 (mAHD)		8.11	12.04		
GW11 (mTOC)	1.591	1.49	2.45	2.99	Not taken
GW11 (mAHD)		-0.86	0.10		
GW12 (mTOC)	1.573	0.74	1.68	1.60	0.38
GW12 (mAHD)		-0.20	0.83		
GW13 (mTOC)	2.04	1.44	2.05	2.08	0.98
GW13 (mAHD)		-0.01	0.60		
GW14 (mTOC)	5.656	2.60	3.43	3.92	2.60
GW14 (mAHD)		2.23	3.06		
GW15 (mTOC)	13.79	10.01	10.32	10.45	10.63
GW15 (mAHD)		3.47	3.78		
GW16 (mTOC)	14.14	8.13	8.13	Dry	Dry
GW16 (mAHD)		6.01	6.01		
GW17 (mTOC)	59.47	Dry	Dry	Dry	Dry
GW17 (mAHD)		Dry	Dry		
GW18 (mTOC)	96.71	33.98	34.04	34.09	33.70
GW18 (mAHD)		62.67	62.73		
GW19 (mTOC)	51.81	7.53	9.46	9.45	6.28
GW19 (mAHD)		42.35	44.28		
GW20 (mTOC)	87.18	Dry	Dry	Dry	32.80 (dry)
GW20 (mAHD)		Dry	Dry		
GW21 (mTOC)	51.29	4.65	5.79	4.19	3.34
GW21 (mAHD)		45.50	46.64		
GW22 (mTOC)	17.27	4.64	5.28	3.37	2.34
GW22 (mAHD)		11.99	12.63		
GW23 (mTOC)	39.22	15.93	15.99	16.29	15.98

Borehole reference	Top of casting RL (mAHD)	Depth of water level			
		Pre-construction		Construction	
		20th per	80th per	Dec 14	Feb 15
GW23 (mAHD)		23.23	23.29		
GW24 (mTOC)	26.09	6.25	7.78	8.05	3.51
GW24 (mAHD)		18.31	19.84		
GW25 (mTOC)	61.72	11.53	12.35	13.04	12.30
GW25 (mAHD)		49.37	50.19		
GW26 (mTOC)	54.56	14.17	14.98	15.00	13.58
GW26 (mAHD)		39.58	40.39		
GW27 (mTOC)	74.33	27.45	27.66	28.41	27.47
GW27 (mAHD)		46.67	46.88		
GW28 (mTOC)	54.65	8.45	9.40	9.37	9.02
GW28 (mAHD)		45.25	46.20		
GW29 (mTOC)	45.11	2.97	8.82	8.49	3.39
GW29 (mAHD)		36.29	42.14		
GW30 (mTOC)	41.49	3.16	4.59	5.14	2.61
GW30 (mAHD)		36.90	38.33		

Table 3-28 Construction groundwater monitoring (EC) – manual record

Borehole reference	Electrical conductivity (uS/cm)			
	Pre-construction		Construction	
	20th per	80th per	Dec 14	Feb 15
GW01	5062	5502	446	202
GW02	293	656	31600	16400
GW03	1009	1283	118	85000
GW04	3027	5520	450	294
GW05	5970	6728	737	666
GW06	1359	8204	Dry	Destroyed
GW07	172	230	Dry	20300
GW08	No record	No record	47700	140
GW09	1981	2536	Dry	Dry
GW10	443	780	46300	39000
GW11	1296	5880	845	416
GW12	2467	4460	399	271
GW13	186	295	39100	22400
GW14	6312	7068	340	308
GW15	3600	3740	371	359
GW16	No record	No record	Dry	Dry
GW17	No record	No record	Dry	Dry
GW18	1588	1648	162	155
GW19	554	602	60000	40900
GW20	No record	No record	Dry	Dry
GW21	1861	2426	100400	67100
GW22	842	5484	54100	14300
GW23	415	726	50200	31300
GW24	509	974	54000	55500
GW25	476	965	158	90100

	Electrical conductivity (uS/cm)			
	Pre-construction		Construction	
Borehole reference	20th per	80th per	Dec 14	Feb 15
GW26	1083	1337	87800	84500
GW27	535	737	87200	47200
GW28	181	225	28400	Dry
GW29	222	299	26800	14100
GW30	1750	3800	257	39400

Table 3-29 Construction groundwater monitoring (pH) – manual record

	pH			
	Pre-construction		Construction	
Borehole reference	20th per	80th per	Dec 14	Feb 15
GW01	4.1	4.5	4.4	5.4
GW02	6.2	6.5	Not recorded	5.71
GW03	6.0	6.5	6.5	6.2
GW04	6.0	6.3	6.5	6.2
GW05	6.2	6.6	6.8	6.5
GW06	3.6	5.0	Dry	Destroyed
GW07	5.6	5.9	Dry	5.9
GW08	No record	No record	6.3	5.7
GW09	4.1	5.6	Dry	Dry
GW10	5.7	6.3	6.7	5.5
GW11	4.9	5.2	5.3	6.1
GW12	5.8	6.0	6.4	6.0
GW13	5.3	5.8	6.3	6.0
GW14	4.4	6.1	7.6	6.9
GW15	6.2	6.4	6.5	6.3
GW16	No record	No record	Dry	Dry
GW17	No record	No record	Dry	Dry
GW18	6.5	6.7	6.7	6.9
GW19	6.1	6.4	6.1	5.6
GW20	No record	No record	Dry	Dry
GW21	6.2	6.3	6.8	6.9
GW22	6.0	6.3	5.7	5.0
GW23	5.8	6.2	5.7	5.7
GW24	4.5	5.3	5.9	4.8
GW25	4.7	5.0	6.0	4.6
GW26	5.5	5.9	6.3	5.5
GW27	6.0	6.2	7.1	6.2
GW28	5.3	5.7	6.2	Dry
GW29	5.4	5.9	6.0	5.5
GW30	4.3	5.0	4.6	6.1

Table 3-30 Construction groundwater monitoring (temperature) – manual record

	Temperature			
	Pre-construction		Construction	
Borehole reference	20th per	80th per	Dec 14	Feb 15
GW01	20.1	20.9	18.9	21.1
GW02	19.0	21.2	18.5	21.9
GW03	18.5	21.3	19.0	22.7
GW04	18.6	20.3	18.7	22.3
GW05	17.4	18.9	17.3	20.1
GW06	18.5	19.8	Dry	Destroyed
GW07	18.5	19.5	Dry	21.7
GW08	No record	No record	20.2	21.6
GW09	18.3	18.5	Dry	Dry
GW10	18.2	19.5	19.0	20.6
GW11	18.2	19.6	18.3	20.4
GW12	18.0	20.5	18.1	21.5
GW13	19.1	20.0	18.2	21.4
GW14	19.2	20.0	18.2	20.6
GW15	19.4	20.2	18.8	20.5
GW16	No record	No record	Dry	Dry
GW17	No record	No record	Dry	Dry
GW18	19.9	20.5	18.5	20.2
GW19	19.5	20.2	18.8	19.6
GW20	No record	No record	Dry	Dry
GW21	18.8	20.3	18.9	19.8
GW22	17.6	20.2	19.1	19.2
GW23	19.0	19.6	18.3	20.3
GW24	18.3	19.0	21.8	19.7
GW25	19.9	20.5	21.0	21.1
GW26	19.1	20.6	22.7	20.3
GW27	19.3	20.5	19.6	20.4
GW28	19.5	22.6	21.6	Dry
GW29	18.4	19.9	18.3	19.6
GW30	19.4	20.0	18.4	20.2

3.9 Discussion of groundwater results

Construction activity during the monitoring period was limited. Activity across the majority of the project was largely limited to vegetation clearing, topsoil removal and minor earthworks (eg water quality basins), and is considered unlikely to have directly or indirectly affect groundwater resources. Considering these factors, the following general observations can be made:

- Logged data shows that groundwater level for the majority of boreholes responds to rainfall across the site. Of the 26 logging sites, 17 record a steep rise in level following significant rain events. The remaining sites tend to show smaller fluctuations (see Appendix D).

- Laboratory analysed parameters show considerable variability for a number of analytes between sampling events.
- Manually recorded pH and temperature records are generally consistent with levels recorded during the pre-construction period.
- Table 3-28 shows considerable variability in electrical conductivity between pre-construction and construction levels. This anomaly was highlighted in Roads and Maritime's pre-construction groundwater report (April 2014) that noted the differences between laboratory results and those collected in the field. It remains unclear why the differences have occurred, but is most likely attributable to infield monitor calibration. It should be noted that the two infield monitoring results during this period we generally consistent. Variability, as indicated earlier, is not considered attributable to construction.

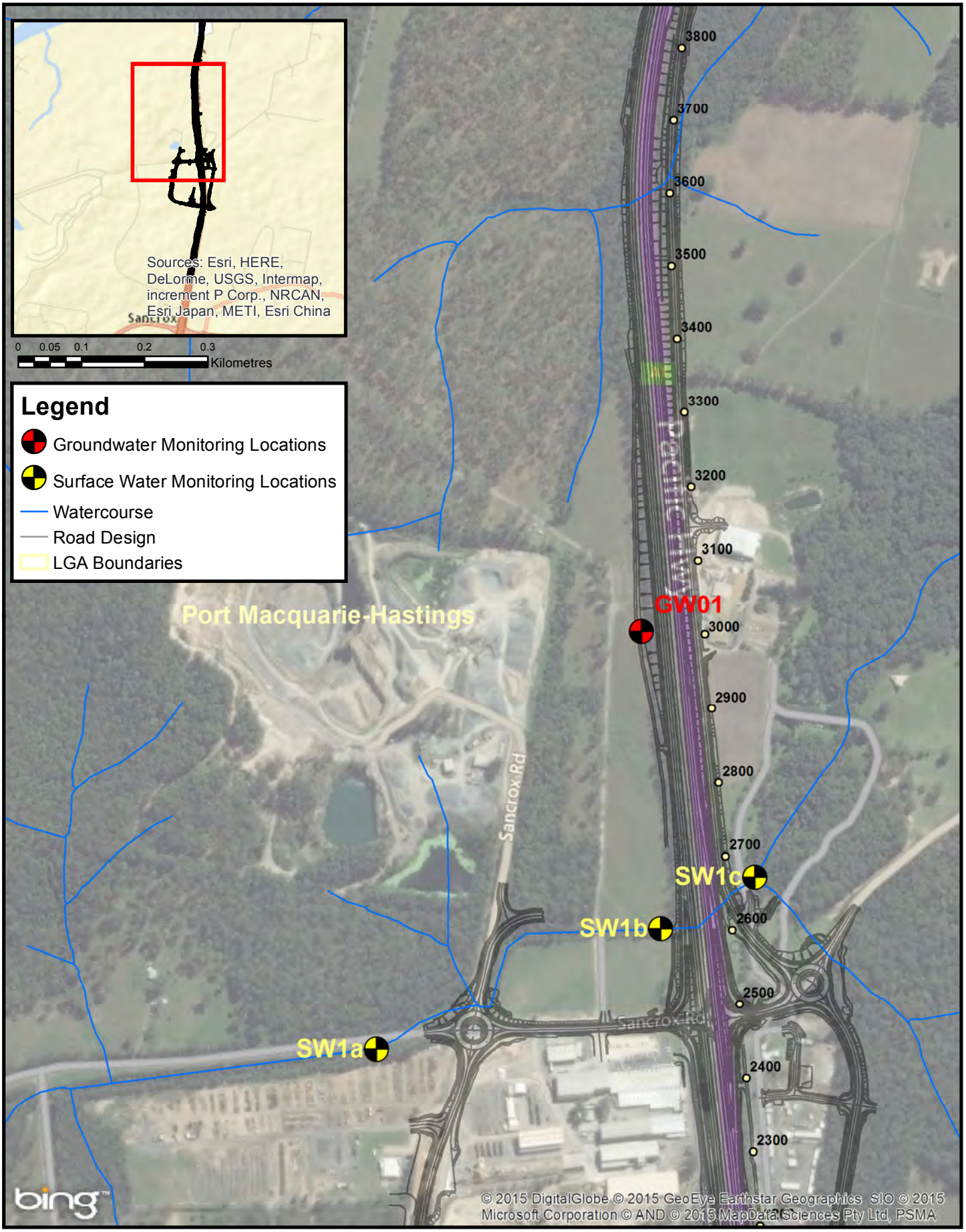
3.10 Project response to groundwater quality results

It is considered that construction works in progress during the monitoring period, given their superficial and limited nature, were unlikely to impact on groundwater resources ie quality or level. No specific action in response to groundwater quality results is therefore proposed at this time.

Terms and acronyms

Term	Meaning
CEMP	Construction environmental management plan
Director General	Director General of the NSW Department of Planning and Environment (or delegate)
DPI (Fishing and Aquaculture)	The Department of Primary Industry (Fishing and Aquaculture)
EA	Environmental Assessment
EMS	Environmental management system
EPA	Environmental Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
ER	Environmental Representative
K2K	Kundabung to Kempsey stage of the Oxley Highway to Kempsey project
MCoA	The Department of Planning and Infrastructure Ministers Condition of Approval
Minister, the	Minister for Planning and Environment (formerly "Minister for Planning and Infrastructure")
NOW	The NSW Office of Water
OH2K	Oxley Highway to Kempsey, also referred to as the project
OH2Ku	Oxley Highway to Kundabung stage of the Oxley Highway to Kempsey project
OEH	Office of Environment and Heritage
P&E	The Department of Planning and the Environment (formerly P&I)
P&I	The Department of Planning and Infrastructure
Project, the	Oxley Highway to Kempsey Pacific Highway Upgrade
Roads and Maritime	Roads and Maritime Services
SoC	Revised statement of commitments (March 2011)

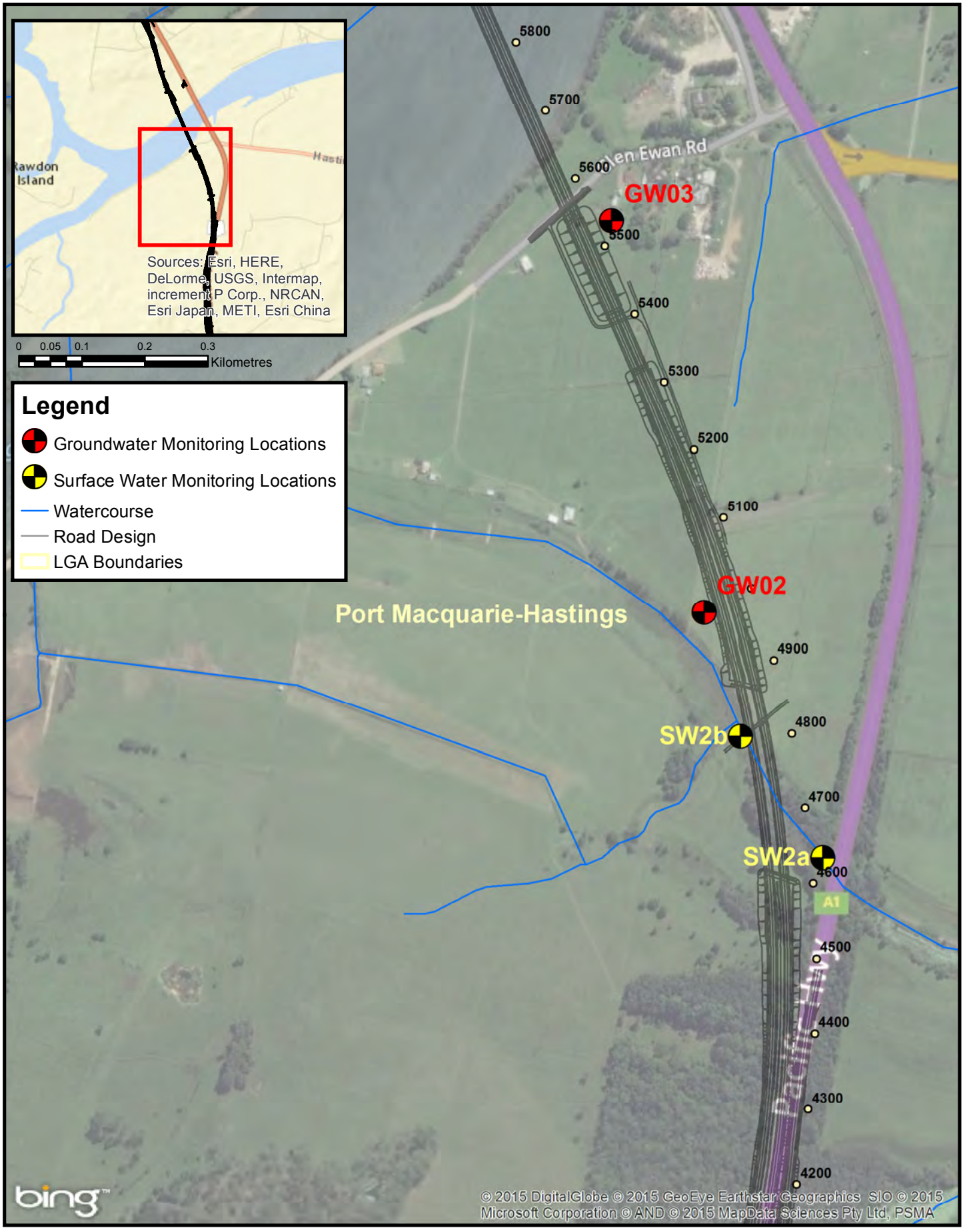
Appendix A – Site locality maps



Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT Transport Roads & Maritime Services

	Surface & groundwater monitoring locations
	Drawn By: Stuart Hill
Sheet 1 of 17	Prepared for: Roads and Maritime Services (Hunter)
	Date: 22/04/2015



Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT Transport Roads & Maritime Services

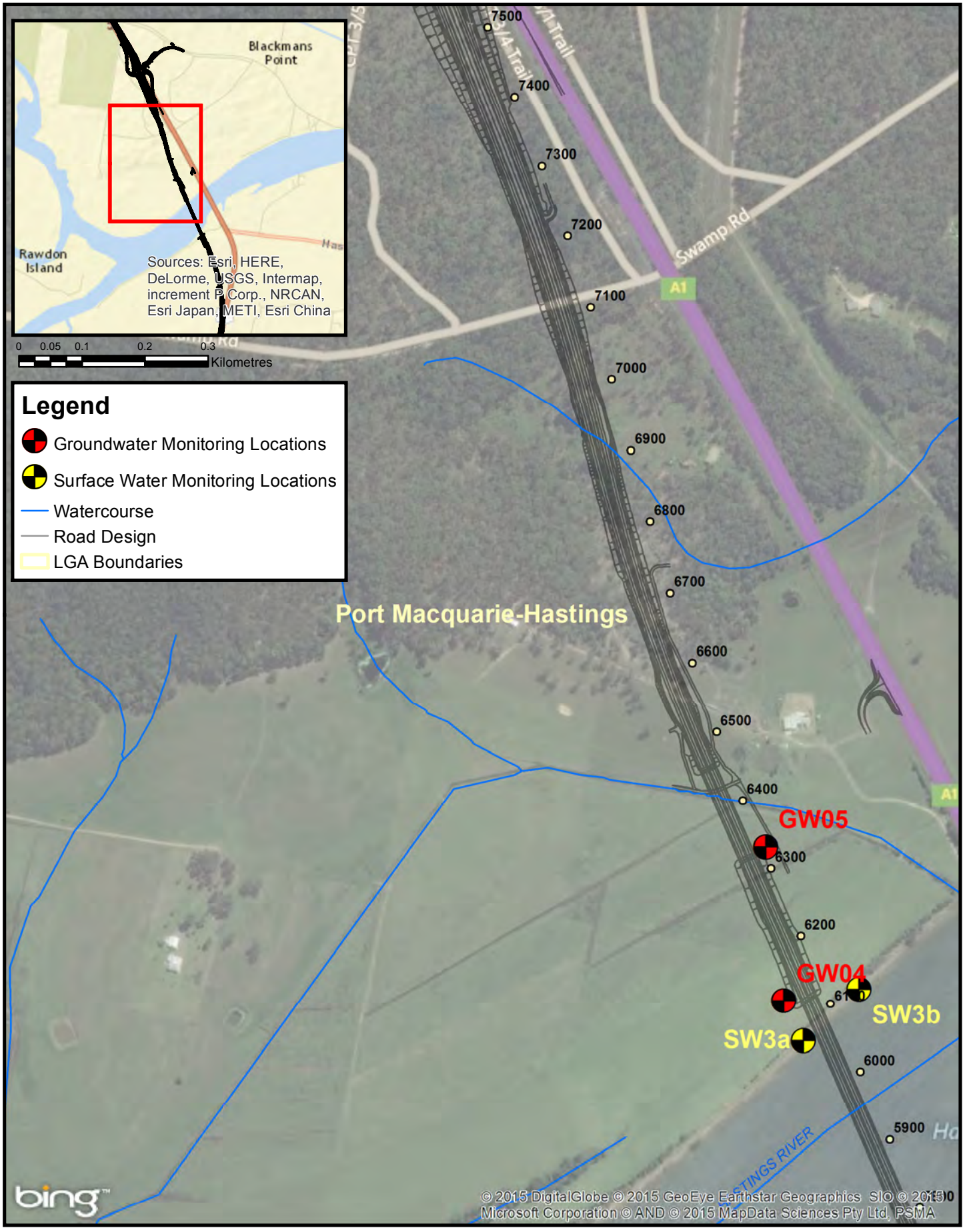
Surface & groundwater monitoring locations

Drawn By: Stuart Hill

Sheet 2 of 17

Prepared for: Roads and Maritime Services (Hunter)

Date: 22/04/2015



Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT Transport Roads & Maritime Services

Surface & groundwater monitoring locations

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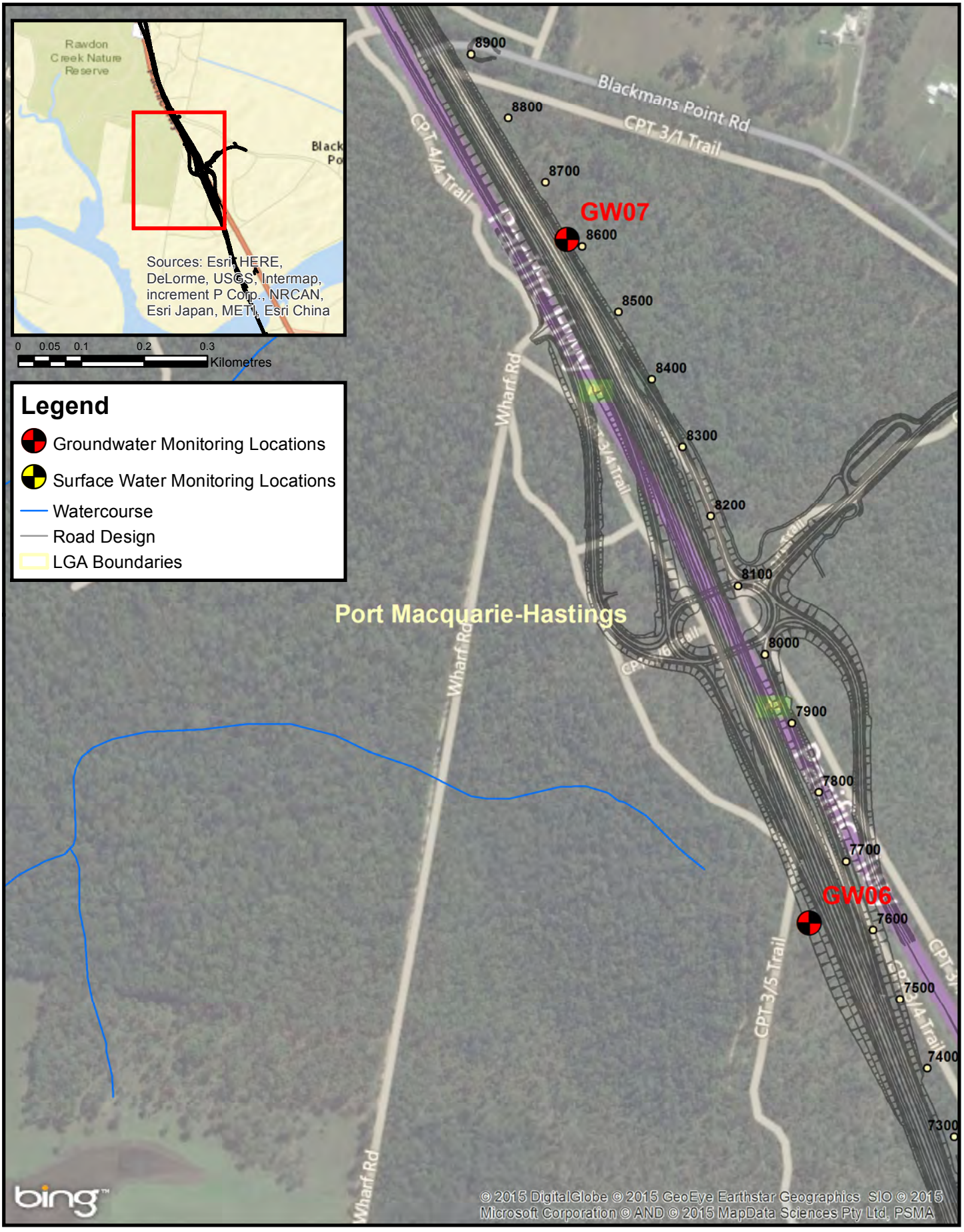
Sheet 3 of 17

Prepared for: Roads and Maritime Services (Hunter)

Date: 22/04/2015



Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT Transport Roads & Maritime Services

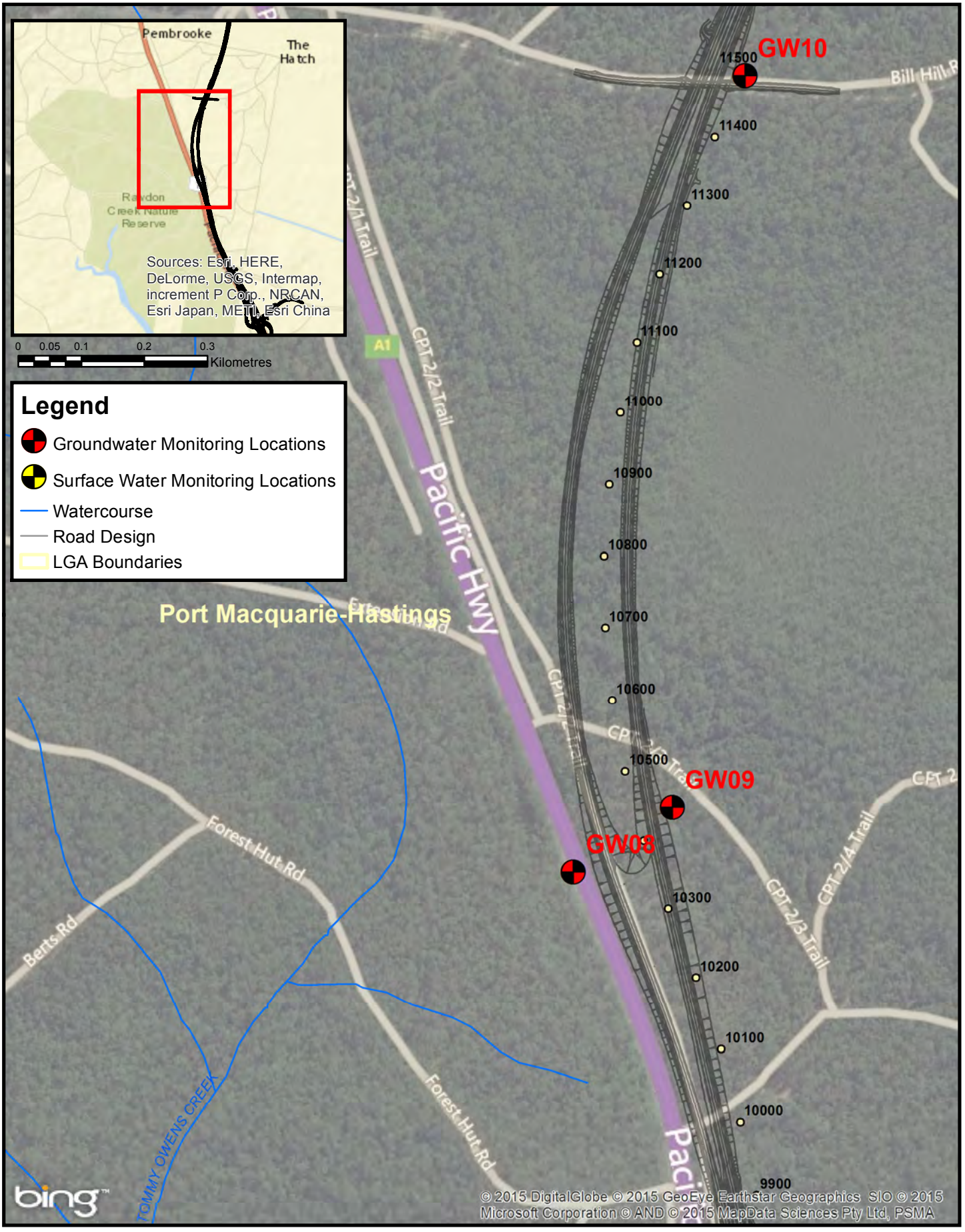
Surface & groundwater monitoring locations

Drawn By: Stuart Hill

Sheet 4 of 17

Prepared for: Roads and Maritime Services (Hunter)

Date: 22/04/2015



Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT | Transport Roads & Maritime Services

Surface & groundwater monitoring locations

Drawn By: Stuart Hill

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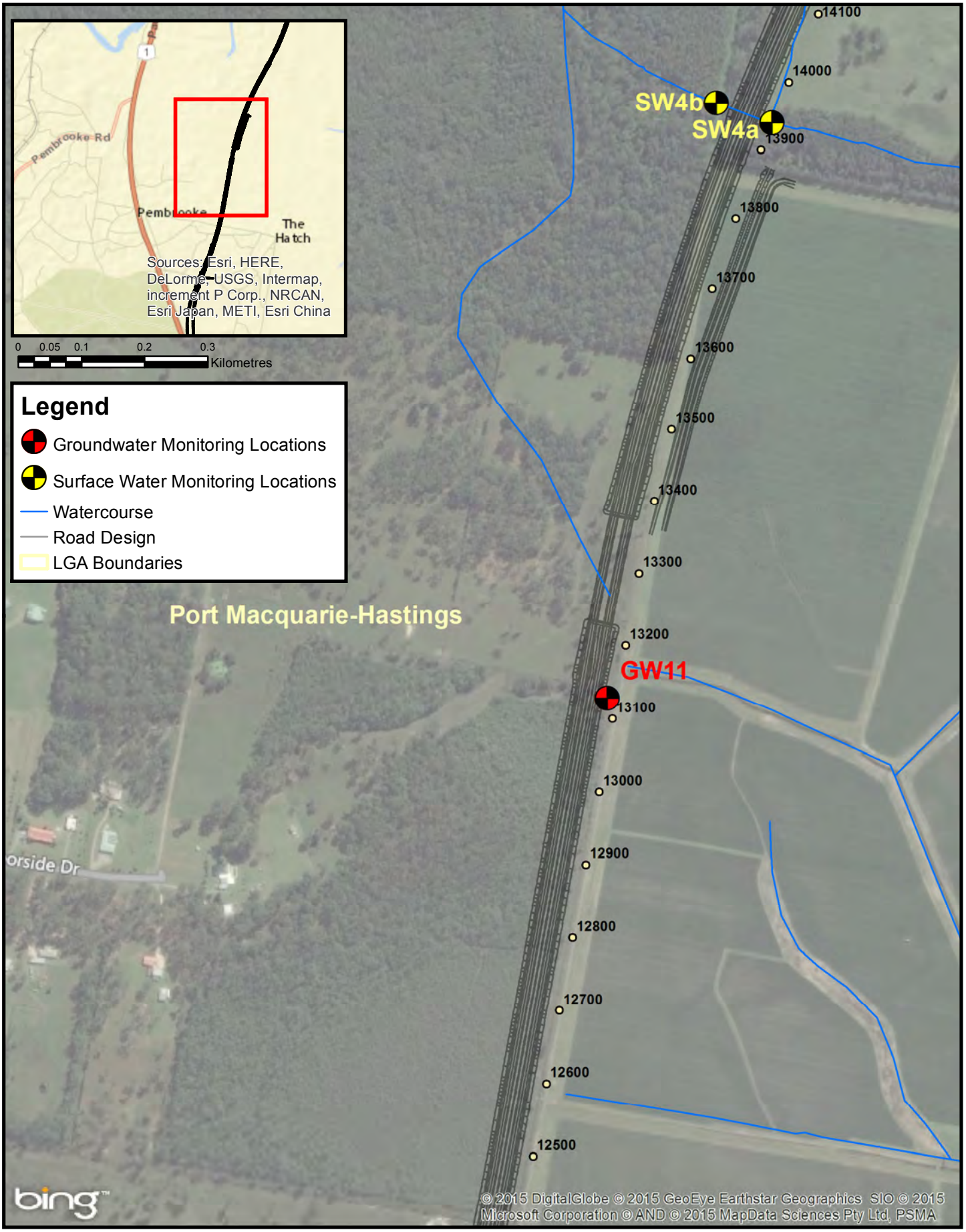
Prepared for: Roads and Maritime Services (Hunter)

Date: 22/04/2015



Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT | Transport Roads & Maritime Services

Surface & groundwater monitoring locations

Drawn By: Stuart Hill

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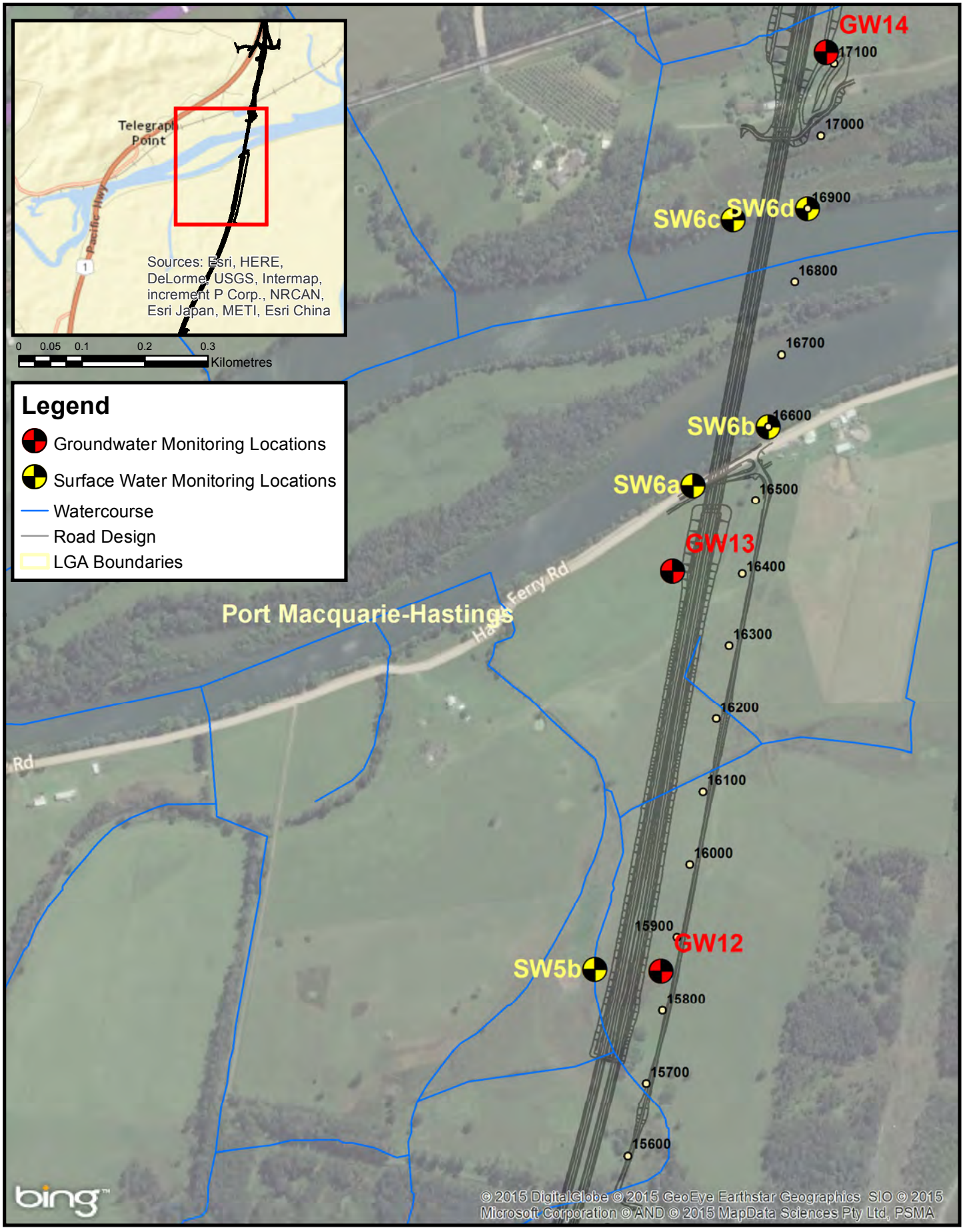
Prepared for: Roads and Maritime Services (Hunter)

Date: 22/04/2015



Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT | Transport Roads & Maritime Services

Surface & groundwater monitoring locations

Drawn By: Stuart Hill

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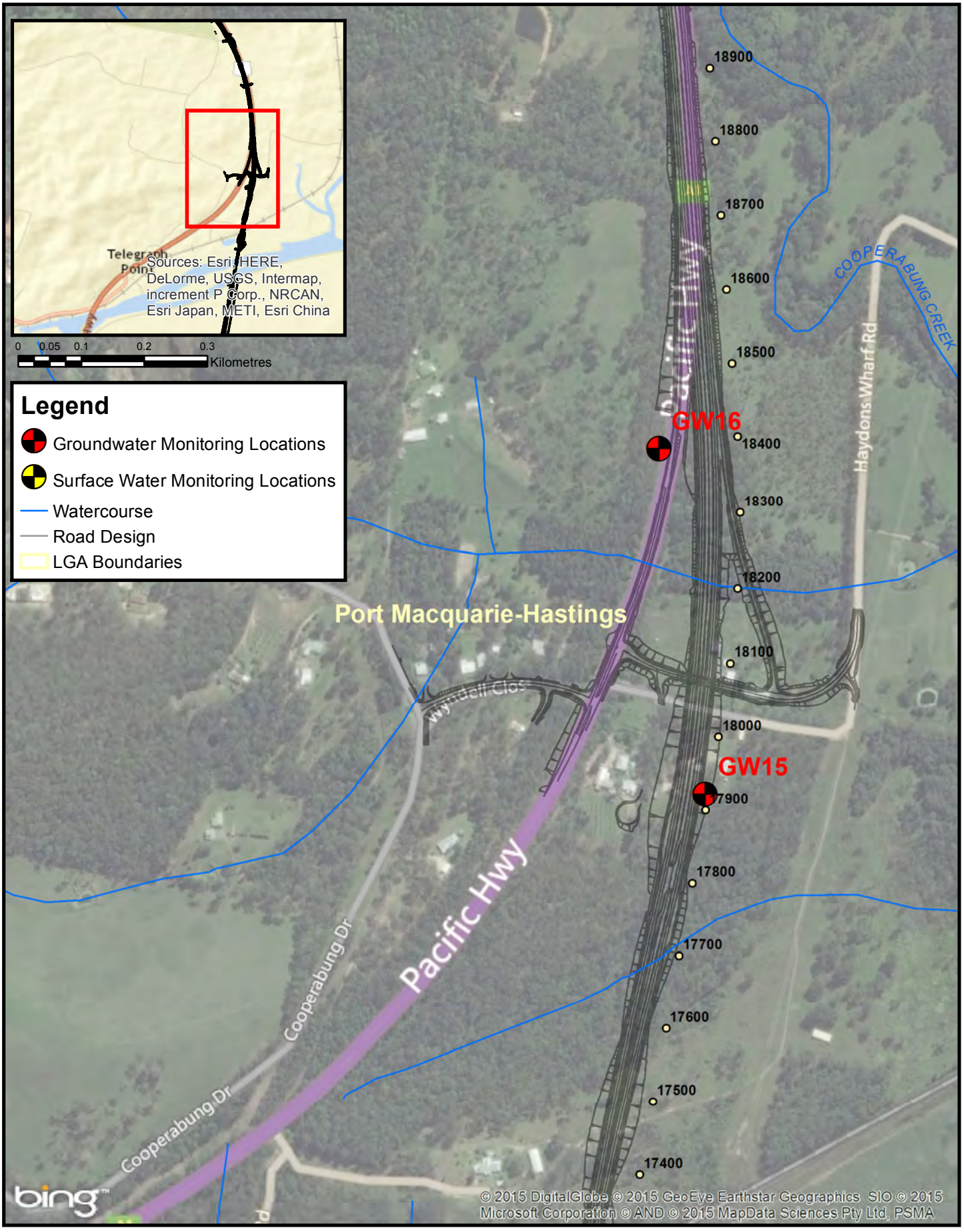
Prepared for: Roads and Maritime Services (Hunter)

Date: 22/04/2015



Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT Transport Roads & Maritime Services

Surface & groundwater monitoring locations

Drawn By: Stuart Hill

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Prepared for: Roads and Maritime Services (Hunter)

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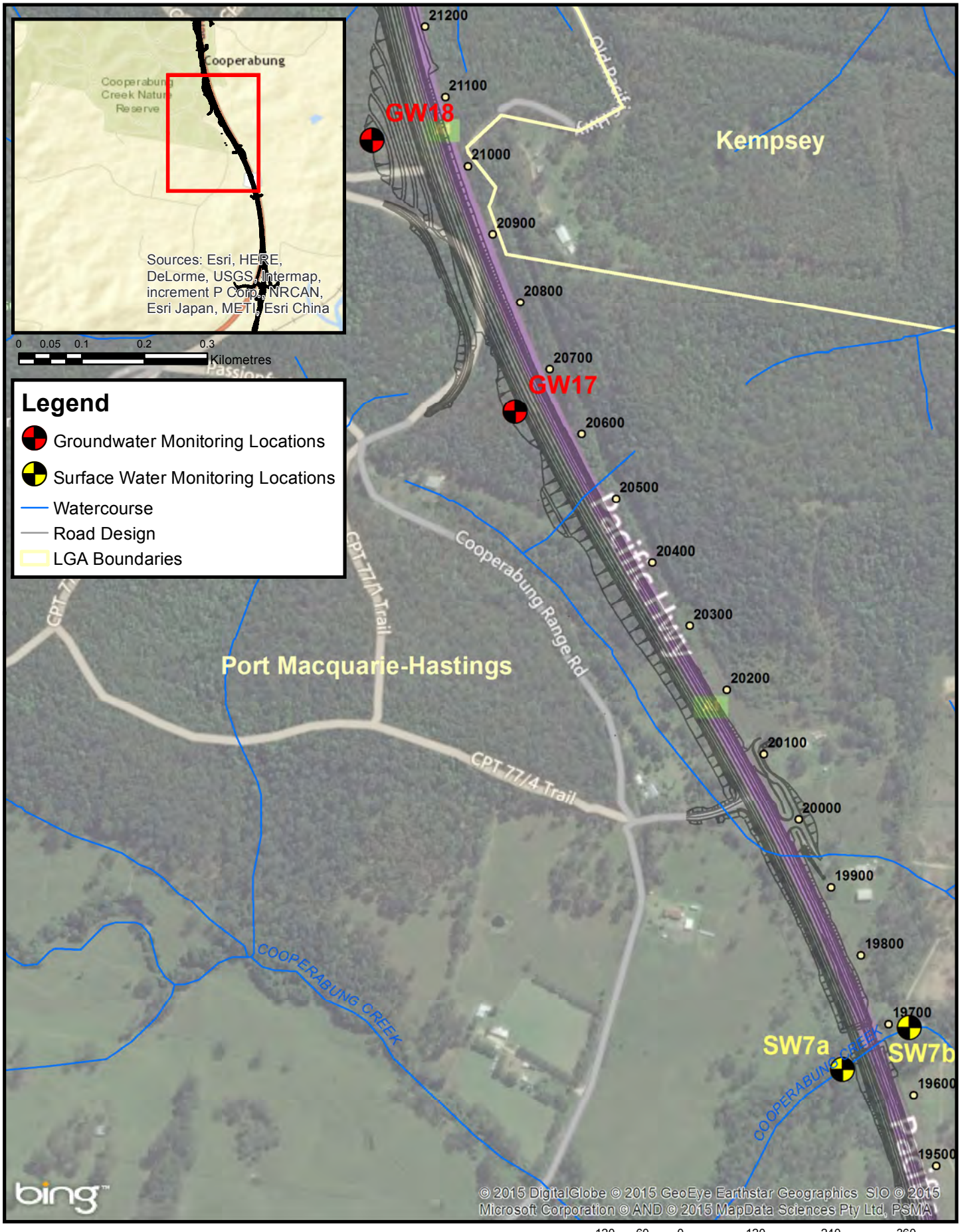

Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT Transport Roads & Maritime Services

Surface & groundwater monitoring locations

Drawn By: Stuart Hill

Prepared for: Roads and Maritime Services (Hunter)

Date: 22/04/2015

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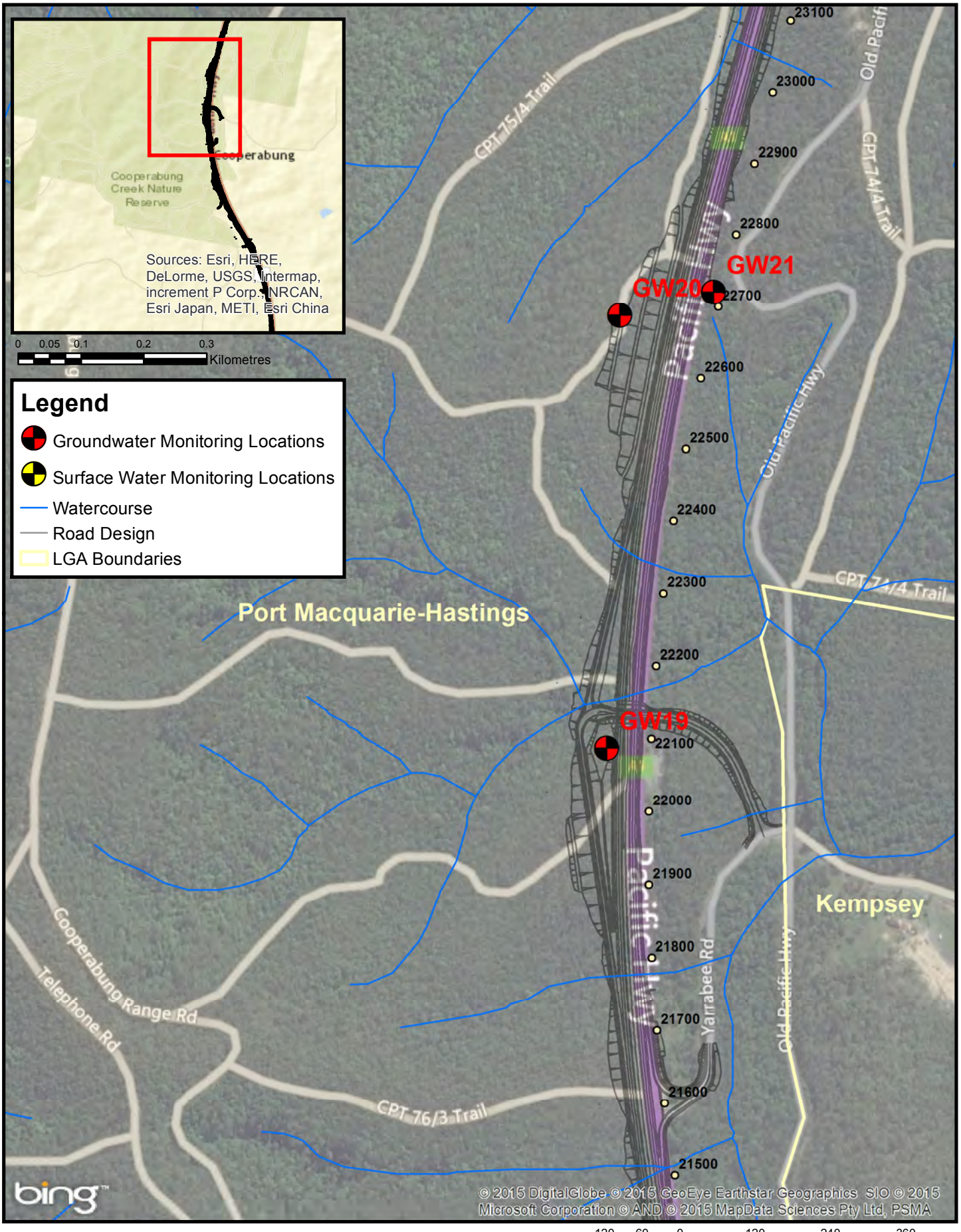

Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT | Transport Roads & Maritime Services

Surface & groundwater monitoring locations

Drawn By: Stuart Hill

Prepared for: Roads and Maritime Services (Hunter)

Date: 22/04/2015

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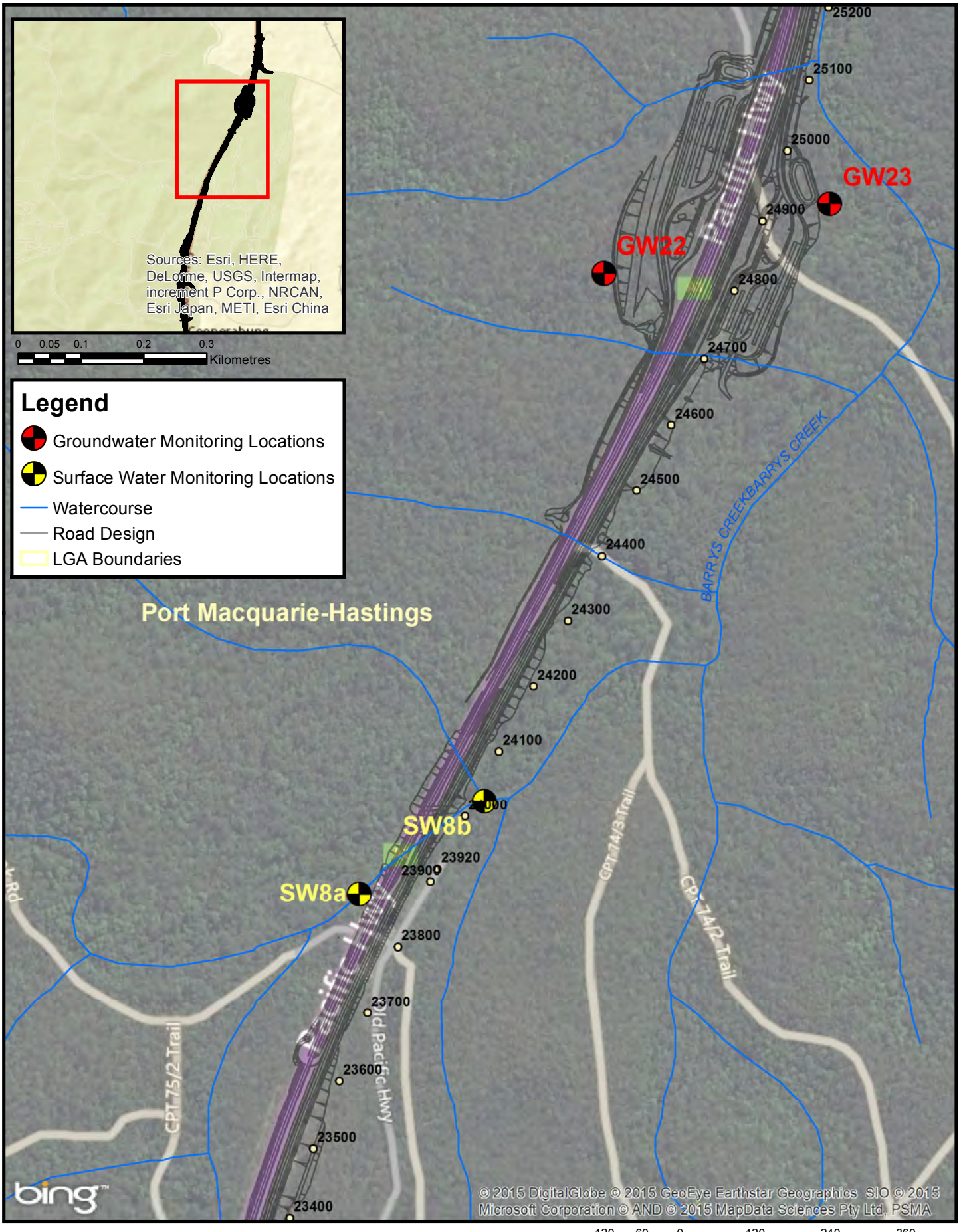

Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT Transport Roads & Maritime Services

Surface & groundwater monitoring locations

Drawn By: Stuart Hill

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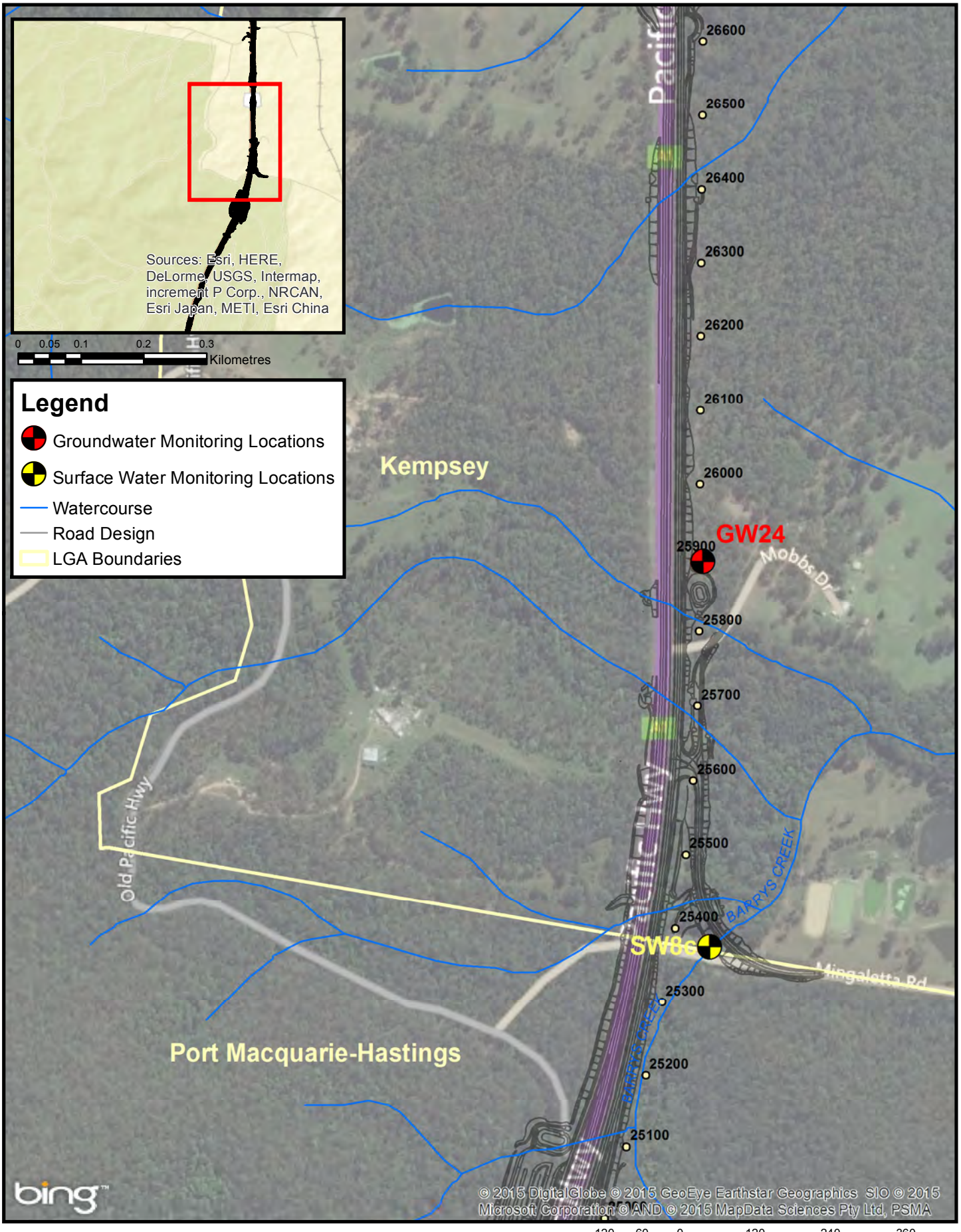

Pacific Highway Upgrade
Oxley Highway to Kempsey

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Surface & groundwater monitoring locations

Drawn By: Stuart Hill

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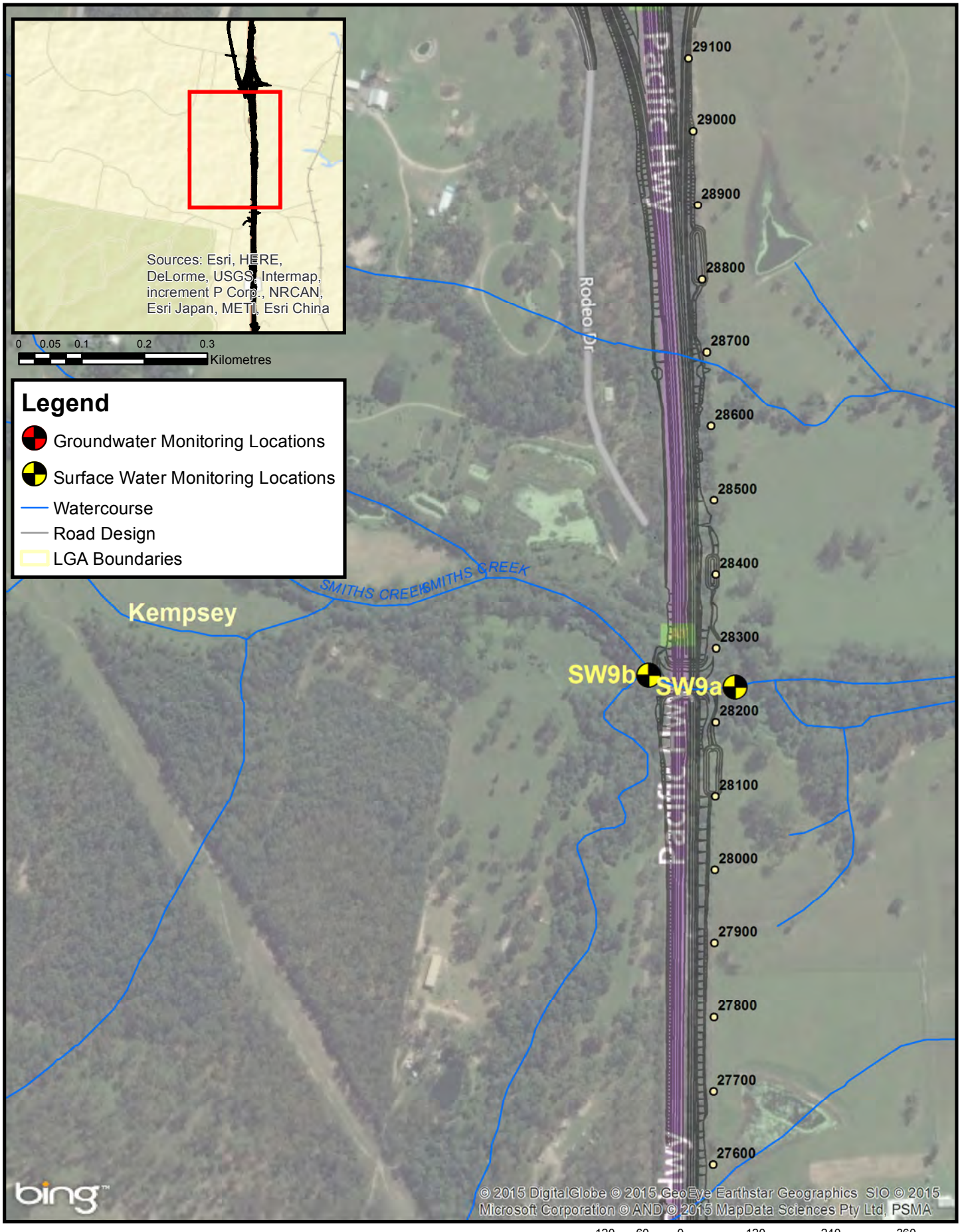

Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT | Transport Roads & Maritime Services

Surface & groundwater monitoring locations

Drawn By: Stuart Hill

Sheet 13 of 17

Prepared for: Roads and Maritime Services (Hunter)

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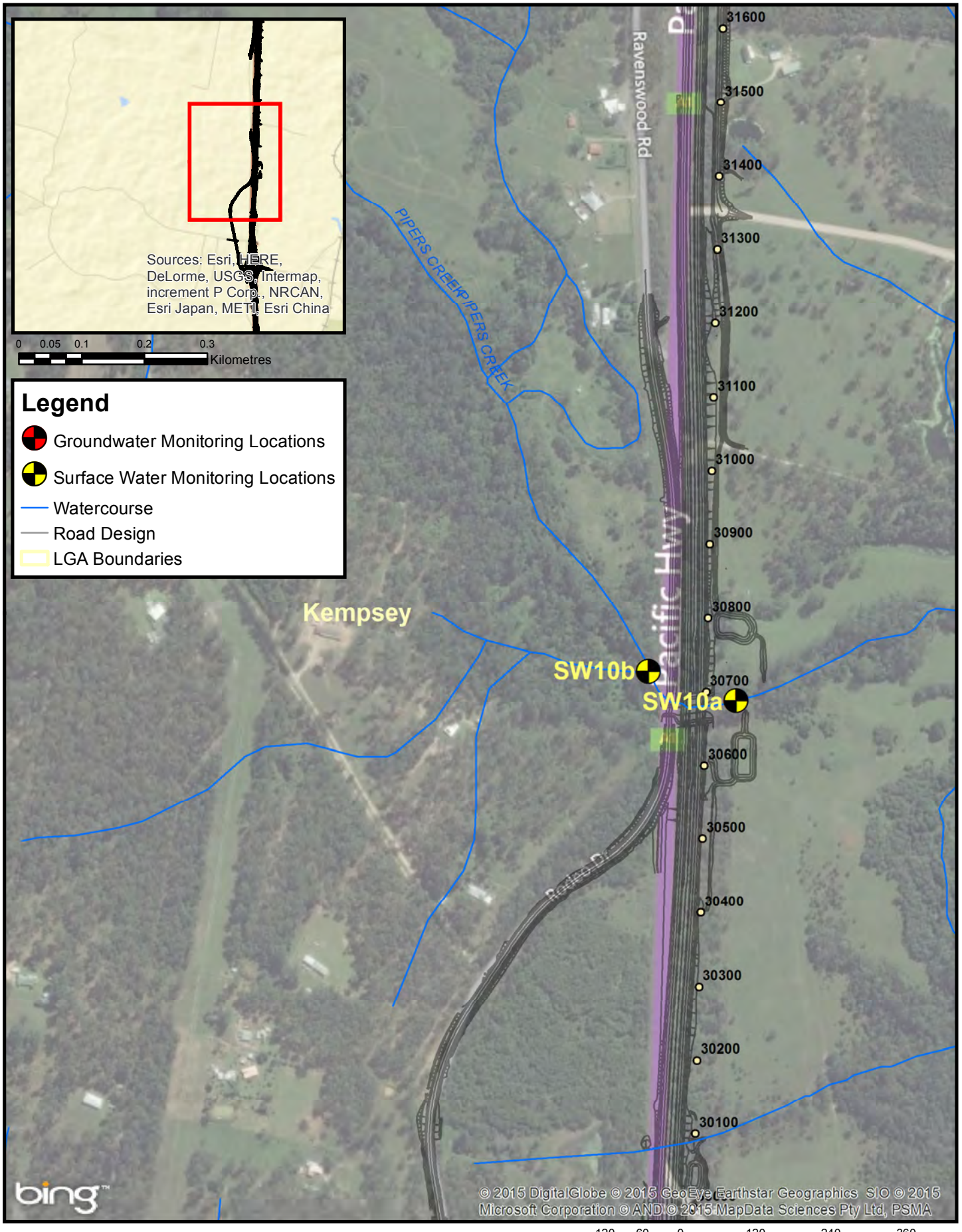

Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT | Transport Roads & Maritime Services

Surface & groundwater monitoring locations

Drawn By: Stuart Hill

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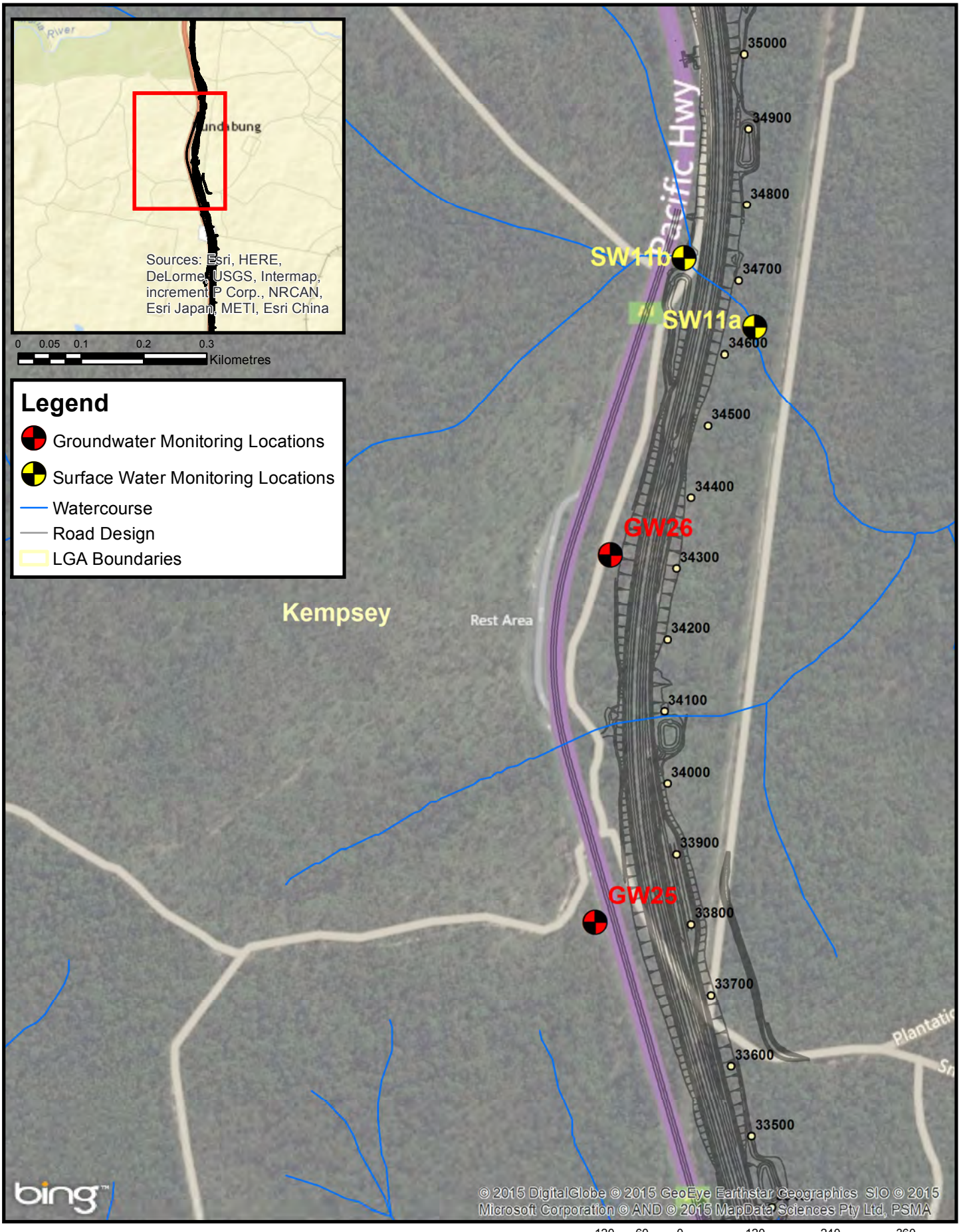
Prepared for: Roads and Maritime Services (Hunter)

Date: 22/04/2015



Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT | Transport Roads & Maritime Services

Surface & groundwater monitoring locations

Drawn By: Stuart Hill

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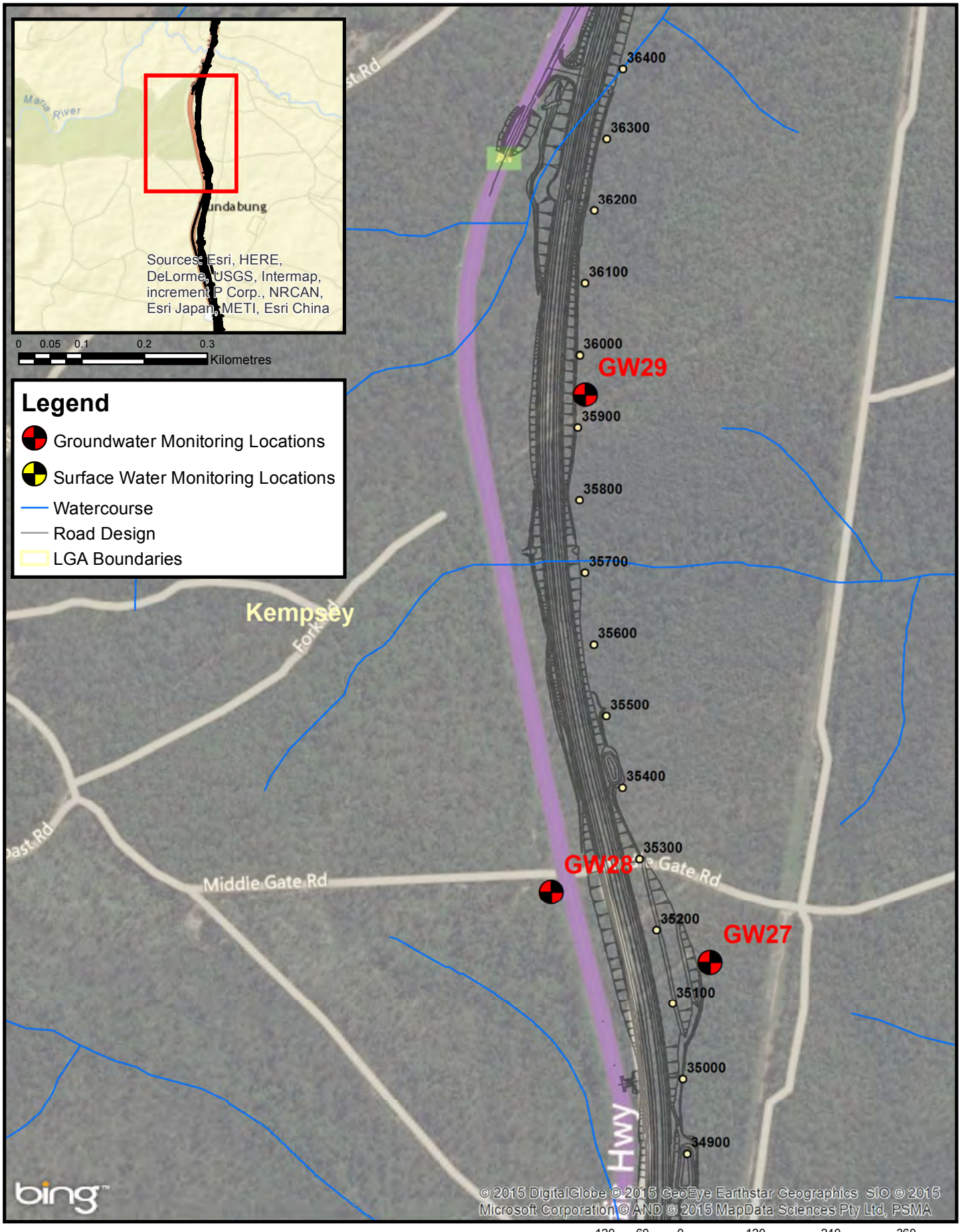
Prepared for: Roads and Maritime Services (Hunter)

Date: 22/04/2015



Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT | Transport Roads & Maritime Services

Surface & groundwater monitoring locations

Drawn By: Stuart Hill

Prepared for: Roads and Maritime Services (Hunter)

Date: 22/04/2015

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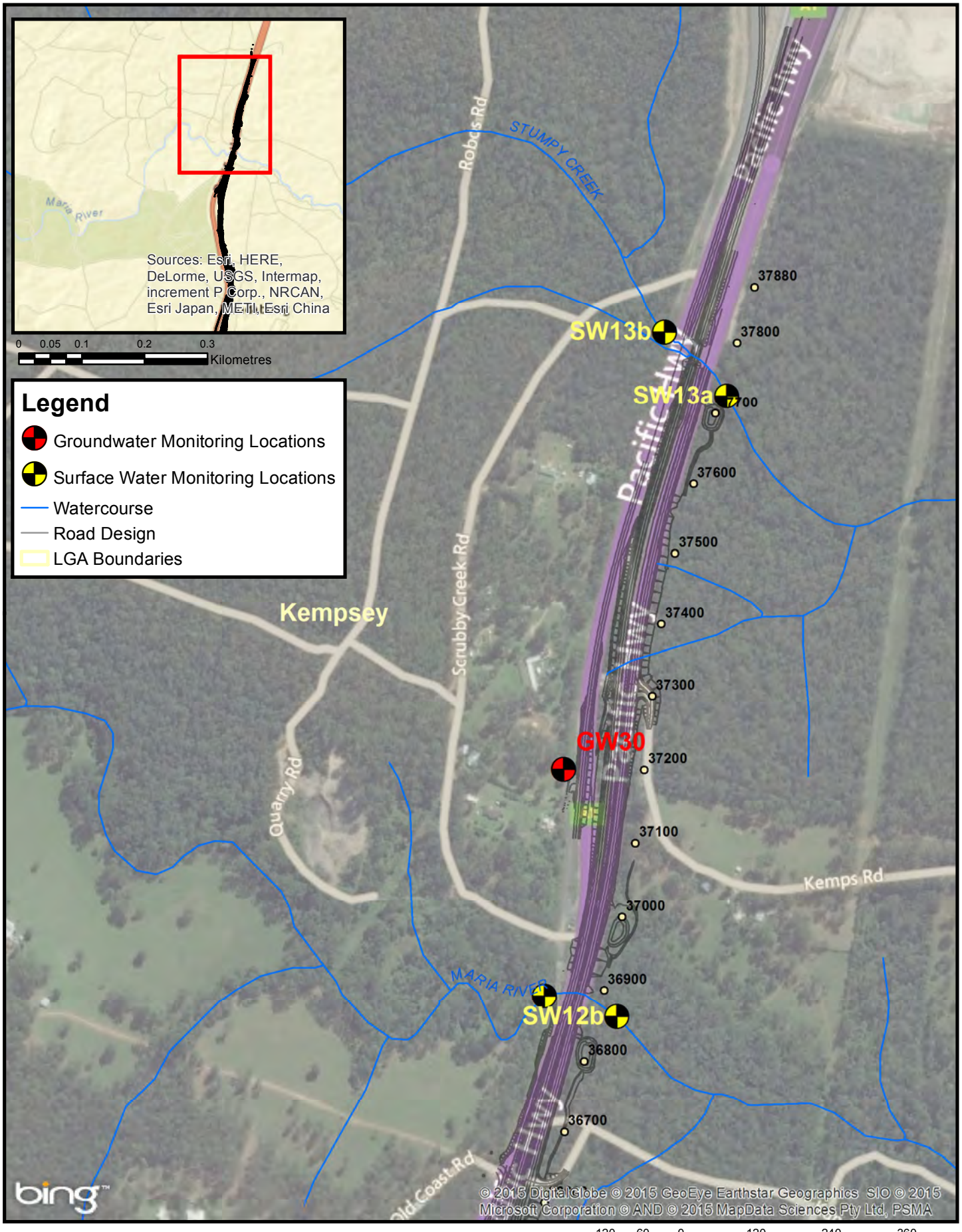

Pacific Highway Upgrade
Oxley Highway to Kempsey

NSW GOVERNMENT | Transport Roads & Maritime Services

Surface & groundwater monitoring locations

Drawn By: Stuart Hill

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Prepared for: Roads and Maritime Services (Hunter)

Date: 22/04/2015

Appendix B – Rainfall records

Kempsey airport rainfall records from July 2014 to January 2015

Day of month	July 2014	August 2014	September 2014	October 2014	November 2014	December 2014	January 2015
1	0	0	0	0	0	0	4.0
2	0	0	0	0	1.8	3.4	0
3	0	0	1.0	0	0	0.2	0
4	0	0	0	0	0	0	0
5	0	2.6	0	0.2	0	9.0	0
6	0		2.0	0	23.2	5.8	0
7	0	0	1.0	0	0	0.8	0.4
8	0	0.2	4.2	0	0	0.2	0
9	0.2	0	0.4	0	0	0.2	0
10	0	0	0	0	0	0	0
11	0	0	2.2	0	1.8	1.0	
12	0	0	0	1.0		35.4	14.0
13	0	0	0	0.2	0	1.0	1.8
14	0	0	0	9.6	0	0.4	0
15	0	0	0	0.2	0	0.2	7.6
16	0.2	0	0	0	0	0	0.4
17	0	46.2		0	0.2	0	0
18	0	0.2	0	0	0	1.2	0
19	0	0	0	0	8.0	10.8	0
20	0	1.2	0	0	0.2	0	121.2
21	0	0	0	0.6	0	0	37.0
22	3.6	1.2	0	0	7.2	0	12.4
23	1.6	4.0	0	0	0.2	0	10.4
24	0	6.6	0	0	0	0	0.4
25	0	1.8	0	0	0	0.6	0.4
26	0.2	3.6	2.2	0	1.0	12.6	9.2
27	6.6	115.0	0.2	0	0.6	49.2	55.4
28	0	24.8	0	0	6.0	25.2	21.2
29	0	0.8	0	0	0.4	42.4	0
30	0	0.2	0	0	0.2	0.4	0.2
31	0	0		0		0	
Highest Daily	6.6	115.0	4.2	9.6	23.2	49.2	121.2
Monthly Total	12.4	208.4	13.2	11.8	50.8	200.0	296.0

Statistics for all years												
Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	132.7	170.7	145.1	78	63.2	113.2	24.2	55	43	73.8	112.3	100.3
Median	126.5	141.2	133.2	45.1	28.6	91.8	20.6	17.8	20.4	45.6	106.5	92.9

Telegraph Point rainfall records from July 2014 to January 2015

Day of month	July 2014	August 2014	September 2014	October 2014	November 2014	December 2014	January 2015
1	0	0	9.5	0	0	0	1.9
2	0	0	0	0	0	9.8	0
3	0	0	0	0	0	0	0
4	0	1.2	0	0	0	0	0
5	0	0	0	0	0	3.4	0
6	0	0	13.0	0	23.0	0.2	0
7	0	0	0	0	0	0.5	0
8	0	0	7.0	0	0	0.2	0
9	0	0	0	0	0	13.2	0
10	0	0	5.6	0	0	0	0
11	0	0	2.7	0	3.8	2.8	0
12	0	0	0	12.2	0	22.8	17.4
13	0	0	0	0	0	5.1	4.7
14	0.8	1.0	0	13.2	0	1.2	0.5
15	0.7	0	0	10.0	0	0	0.6
16	1.6	0	0	0	0	0	0
17	0.6	39.4	0	0	0	0	0
18	0	0.2	0	7.0	0	1.7	0
19	0	0	0	0	5.0	11.6	0
20	0	3.4	0	0	0	0	32.5
21	1.4	0	0	1.0	0	0	94.5
22	1.2	4.2	0	0.4	3.2	0	3.2
23	3.3	14.4	0	0	0	0	18.5
24	0	4.3	0	0	0	0	0.6
25	0	0.4	0	0	10.1	0.4	0
26	0.3	10.3	9.2	0	3.8	8.4	1.2
27	13.2	46.0	0	0	2.0	48.8	126
28	0	29.1	0	0	22.0	25.3	12
29	0	4.1	0	0	0.6	52.5	2.8
30	0	0.2	0	0	0	2.0	0
31	0	0		0		0	0
Highest Daily	13.2	46.0	13.0	13.2	23.0	52.5	126
Monthly Total	23.1	158.2	47.0	43.8	73.5	209.9	316.4

Statistics for all years												
Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	136.9	176.0	164.7	128.0	104.1	107.9	68.3	58.1	60.3	83.4	108.4	114.1
Median	110.2	148.2	148.8	85.6	60.0	73.1	37.6	25.9	42.9	54.6	89.3	95.2

Port Macquarie Airport rainfall records from July 2014 to January 2015

Day of month	July 2014	August 2014	September 2014	October 2014	November 2014	December 2014	January 2015
1	0	0	0	0	0	0	3.2
2	0	0	0	0	0	3.0	0
3	0	0.4	6.6	0	0	0	0
4	0	3.4	0	0	0	0	0
5	0	0	0	0	0	4.8	0
6	0	0	13.6	0	19.0	0	0
7	0	0	1.2	0	0.4	0	0
8	0	0	2.4	0	0	0.2	0
9	0	0	2.4	0	0	1.6	0.2
10	0	0	0	0	0	0	0
11	0	0	1.4	0	3.8	2.6	0
12	0	0	0	0		21.8	11.6
13	0	0	0	0	0	11.6	0
14	0.2	1.6	0	10.8	0	3.8	1.4
15	0.8	0	0	5.4	0	0	0.8
16	2.6	0	0	0	0.8	0	0
17	0.8	42.8	0.6	0	0	1.6	0
18	0	0	0	8.0	0	0.4	0
19	0	0	0	0	3.8	5.4	0.8
20	0	1.0	0	0	0	0	26.8
21	4.8	0	0	4.4	0	0	125.0
22	1.0	2.0	0	0.8	0	0	15.2
23	9.6	20.2	0	0.2	0	0	52.6
24	0	17.2	0	0	0	0.6	1.2
25	0	0.4	0.4	0.4	14.4	0	0
26	0	19.4	6.0	0	2.0	8.4	6.2
27	10.2	35.8	0	2.6	0.8	22.6	165.8
28	0	33.2	0	0	20.4	22.2	7.8
29	0	8.0	0	0	4.8	57.0	0.2
30	0	0	0	0	0	0.2	0
31	0	0		0		0	0
Highest Daily	10.2	42.8	13.6	10.8	20.4	57.0	165.8
Monthly Total	30.0	185.4	34.6	32.6	70.2	167.8	418.8

Statistics for all years												
Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	157.9	168.7	165.7	146.6	114.6	140.9	68.9	66.1	59.8	73.5	158.7	103.7
Median	135.3	153.5	166.7	114.4	69.6	138.8	70.0	38.1	47.2	58.9	137.5	97.5

Kundabung site weather station rainfall records from July 2014 to January 2015

Day of month	July 2014	August 2014	September 2014	October 2014	November 2014	December 2014	January 2015
1		0	0	0	0.2	6	0
2		0	2.8	0	0	0	0
3		0.2	0	0	0	0	0
4		0	0	0	0	10	0
5		0	4.4	0	21.2	6.2	0
6		0	1.6	0	0	0	0.2
7		0	3	0	0	1.2	0
8		0	3.2	0	0	10.8	0
9		0	0	0	0	0	0
10		0	5	0	0.4	1.4	0
11		0	0	5	0	17.4	10.6
12		0	0	0	0	2.8	0.4
13		9.4	0	10.2	0	3	0.2
14		0	0	0.2	0	0	3.2
15		0	0	0	0	0	0
16		46	0	0	0	0	0
17		0.2	0	0.4	0	0.8	0
18		0	0	0	0	3.8	2.2
19		0.4	0	0	0	0	93.2
20		0	0	0.4	0	0	111
21		1.8	0	0.8	0	0	3
22		2.6	0	0	0	0	
23	0	16.6	0	0	0	0	
24	0	0.2	0.2	0	1.4	0.2	
25	0	5.8	8.4	0	5.8	12	
26	5.6	62	0.2	0	0.4	28.8	
27	0	27	0	0	17.4	25.8	
28	0	2.4	0	0	3.2	65.8	
29	0	0.2	0	0	0	21.2	
30	0	0	0	0	0	0	
31	0	0		0		1	

Telegraph Point site weather station rainfall records from July 2014 to January 2015

Day of month	July 2014	August 2014	September 2014	October 2014	November 2014	December 2014	January 2015
1		0	0	0	0	9.4	
2		0	0.4	0	0	0.2	
3		0.8	0	0	0	0	
4		0	0	0	0	4.2	
5		0	9.6	0	19	0.2	
6		0	0.4	0	0	0.2	
7		0	6.2	0	0	0.8	
8		0	2.8	0	0	13.2	
9		0.2	0.2	0	0	0	
10		0	1.2	0	2.2	2	
11		0	0	9	0	17.8	
12		0	0	0	0	4.4	
13		0	0	7.2	0	0.8	
14		0	0	4.6	0	0	
15		0	0	0	0	0	
16		40	0	0	0	0.2	
17		0.2	0	4	0	0.6	
18		0	0	0	0.6	15.4	
19		1.4	0	0	0.2	0.2	
20		0	0	0.6	0	0	7.6
21		6.2	0	1.2	1.4	0	2
22	4.6	15.4	0.2	0	0	0	
23	0	20.8	0	0	0	0	
24	0	0.2	0.2	0	12.4	0.2	
25	0	7.6	4.4	0	2.4	7	
26	7.8	41.2	0.2	0	0.6	50.4	
27	0	25.4	0.8	0	24.4	10	
28	0	7.4	0	0	0.4		
29	0	0	0	0	0		
30	0	0	0	0	0		
31	0	0		0			

* Note: Weather station system outages were experienced during the reporting period. These outages are reflected in the table by the absence of recorded data.

Sancrox site weather station rainfall records from July 2014 to January 2015

Day of month	July 2014	August 2014	September 2014	October 2014	November 2014	December 2014	January 2015
1				0	0	2.8	0
2				0	0	0	0
3				0	0	0.4	0
4				0	0	3.4	0
5				0	16.8	0.6	0
6				0	0.4	0	0
7				0	0	0.2	0
8				0	0	1.2	0
9				0	0	0	0
10			1	0	5.6	5.2	0
11			0	0	0	17.4	12.2
12			0	0	0	6.4	0.2
13			0	16	0	0	1.2
14			0	11.2	0	0	1.4
15			0	0	0.2	0	0
16			0	0	0	1.8	0
17			0	10	0	0.4	0
18			0	0	2.4	3.2	0.6
19			0	0	0	0	55.2
20			0	2.6	0	0	142
21			0	0.4	0.4	0	
22			0	0	0	0	
23			0	0	0	0.4	
24			0.4	0.8	10.8	0	
25			6.2	0.2	1.2	9.8	
26			0.4	2.8	1.8	21.4	
27			0	0	27	22.8	
28		0.2	0	0	4.6	46.6	
29		0	0	0	0	0.2	
30		0	0	0	0	0	
31		0		0		0	

* Note: Weather station system outages were experienced during the reporting period. These outages are reflected in the table by the absence of recorded data.

Appendix C – Water quality sampling results

Table 1 SW1 – Unnamed tributary or Fernbank Creek (Chainage 2500 to 2650)

No.	Parameter	Unit	23/07/14 (W)			13/08/14 (D)			18/08/14 (W)			28/08/14 (W)			01/09/14 (D)			07/09/14 (W)			01/10/14 (D)		
			SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)
1	Temperature	^{0}C	12.48	12.92	12.43	11.12	11.55	11.15	11.88	12.69	13.07	14.72	14.74	14.72	15.66	15.15	14.92	13.57	13.27	13.33	17.21	16.14	15.98
2	Electrical conductivity (EC)	uS/cm	570	631	590	758	1034	1456	371	480	441	250	300	301	290	660	692	288	618	703	1053	1139	1070
3	Dissolved oxygen (DO)	%	36.4	30.6	34	20	3.6	19.3	36.6	34.2	32.2	55.3	56.3	53.4	30.5	39.9	36.1	39.9	42.1	39.9	5.8	4.4	2.9
4	pH		6.58	7.23	7.09	7.51	7.53	6.89	7.36	7.11	7.09	6.71	6.85	6.7	6.69	7.33	6.85	7.17	7.24	6.65	6.34	7.03	6.6
5	Turbidity (NTU)	NTU	81.8	257.9	395.3	6.9	74.9	32.1	34.6	72.7	83.5	26.7	261.5	253.2	28.6	19.7	26	33.8	52.7	41.2	421.7	26.6	8.4
6	Total suspended solids (TSS)	mg/L	86	95	130	6	35	<5	6	14	17	5	121	116	<5	5	7	<5	<5	6	950	18	16
7	Total Petroleum Hydrocarbons	mg/L																					
8	Aluminium (Al)	mg/L	0.04	<0.01	<0.01				0.28	0.08	0.08				0.44	0.09	0.06	0.44	0.04	0.03	0.05	0.02	<0.01
9	Arsenic (As)	mg/L	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.002
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
12	Copper (Cu)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	0.001				0.002	0.002	0.002	0.001	0.002	0.001	<0.001	<0.001	<0.001
13	Iron (Fe)	mg/L	0.38	0.25	0.14	<0.05	2.84	0.07	0.57	0.36	0.39				0.84	0.4	0.56	0.77	0.25	0.39	11.4	2.56	2.32
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
15	Manganese (Mn)	mg/L	0.043	0.105	0.123	0.18	0.412	0.199	0.027	0.06	0.077				0.021	0.082	0.101	0.016	0.053	0.074	0.307	0.373	0.342
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L	<0.001	<0.001	0.001	<0.001	0.004	0.001	<0.001	0.001	<0.001				<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
19	Zinc (Zn)	mg/L	0.02	0.02	0.017	<0.005	0.023	<0.005	0.011	0.026	0.03				0.011	0.018	0.018	0.008	0.012	0.015	<0.005	<0.005	<0.005
20	Total Nitrogen (TN)	mg/L	0.4	1.7	1.4	0.2	17.4	2.8	0.6	0.8	0.8	0.6	0.8	0.7	0.4	0.5	0.6	0.4	0.5	0.5	4.8	3	1.1
21	Total Phosphorous (TP)	mg/L	0.03	0.32	0.22	0.02	4.82	0.2	0.02	0.1	0.14	0.02	0.07	0.07	0.01	0.06	0.08	0.01	<0.01	0.03	0.76	1.91	1.06
22	C6 - C10 Fraction	ug/L																					
23	>C10 - C16 Fraction	ug/L																					
24	>C16 - C34 Fraction	ug/L																					
25	>C34 - C40 Fraction	ug/L																					

Table 2 SW1 – Unnamed tributary or Fernbank Creek (Chainage 2500 to 2650) Cont.

No.	Parameter	Unit	15/10/14 (W)			6/11/14 (W)			20/11/14 (D)			27/11/14 (W)			10/12/14 (D)			12/12/14 (W)			19/12/14 (W)		
			SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a*# (US)	SW1b# (US)	SW1c# (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a# (US)	SW1b# (US)	SW1c# (DS)
1	Temperature	^{0}C	14.64	15.85	15.89	17.64	18.56	18.79		20.89	20.62	21.84	22.17	21.82	21.6	22.03	22.67	20.09	20.9	20.79	20.31	21.27	21.63
2	Electrical conductivity (EC)	uS/cm	450	407	502	1659	754	578		601	717	434	402	380	1367	493	462	325	376	393	950	348	351
3	Dissolved oxygen (DO)	%	47.8	49.1	36	9.1	25.9	25.7		2.4	5.1	40.6	12.4	1.4	6.1	4.9	2.4	47.3	39.8	28.2	13.6	2.2	1.7
4	pH		7.13	7.27	7.16	6.39	6.87	6.41		7.03	7.04		7.19	6.54	6.43	6.81	6.51	6.54	6.65	6.25	6.37	6.68	6.47
5	Turbidity (NTU)	NTU	13	317.9	421.7	53.9	138.9	148.7		33.2	49.5	113.1	122	169.2	57.4	20.4	18.6	28.7	262.4	267.9	22.5	97.7	119.2
6	Total suspended solids (TSS)	mg/L	5	98	180	49	32	39	42	56	32	27	52	83	20	22	22	5	130	103	16	80	63
7	Total Petroleum Hydrocarbons	mg/L																					
8	Aluminium (Al)	mg/L	0.11	0.02	0.03	0.02	0.02	0.01	0.08	0.03	0.01				0.01	0.03	0.01	0.36	0.02	0.02			
9	Arsenic (As)	mg/L	<0.001	<0.001	<0.001	<0.001	0.002	0.001	0.001	0.001	0.005				<0.001	0.003	0.003	<0.001	0.001	<0.001			
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	0.0001	0.0001				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
12	Copper (Cu)	mg/L	<0.001	0.001	<0.001	<0.001	<0.001	0.001	0.006	0.007	0.001				<0.001	<0.001	<0.001	0.002	0.002	0.003			
13	Iron (Fe)	mg/L	0.76	0.16	0.1	0.72	0.33	0.19	1.01	3.44	1.41				3.35	3.71	0.84	0.95	0.22	0.14			
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	0.001				<0.001	0.001	<0.001	<0.001	<0.001	<0.001			
15	Manganese (Mn)	mg/L	0.051	0.095	0.173	0.116	0.301	0.338	0.252	0.363	0.337				0.322	0.384	0.344	0.038	0.131	0.128			
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
17	Nickel (Ni)	mg/L	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.006	0.004				<0.001	0.002	0.001	<0.001	0.001	0.001			
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
19	Zinc (Zn)	mg/L	0.012	0.029	0.013	0.016	0.024	0.025	0.008	0.044	0.018				<0.005	0.016	0.01	0.009	0.029	0.017			
20	Total Nitrogen (TN)	mg/L	0.3	0.9	1.2	0.6	0.8	0.8	0.5	5.2	2	0.4	3.6	2.7	0.5	3.5	2	0.8	0.7	0.7	0.4	1.9	1.5
21	Total Phosphorous (TP)	mg/L	0.01	0.12	0.19	0.04	0.12	0.22	0.06	3.7	1.8	0.04	2.18	1.93	0.02	2.1	1.1	0.02	0.22	0.16	<0.01	2	1.06
22	C6 - C10 Fraction	ug/L											<20										
23	>C10 - C16 Fraction	ug/L											660										
24	>C16 - C34 Fraction	ug/L											5220										
25	>C34 - C40 Fraction	ug/L											2860										

* In-field measurement of water quality not undertaken due to insufficient water depth ie<75mm.

- Sample location persisting as an isolated pond.

Table 3 SW1 – Unnamed tributary or Fernbank Creek (Chainage 2500 to 2650) Cont.

No.	Parameter	Unit	08/01/15 (D)			12/01/15 (W)			20/01/15 (W)															
			SW1a# (US)	SW1b# (US)	SW1c# (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)
1	Temperature	^{0}C	23	23	24	23	23	23	22	22	22													
2	Electrical conductivity (EC)	uS/cm	957	782	696	1260	328	252	170	193	245													
3	Dissolved oxygen (DO)	%	9	5	82	6	12	15	48	69	60													
4	pH		7.1	7.2	7.4	6.7	6.8	6.8	8.0	6.1	6.1													
5	Turbidity (NTU)	NTU	17	37	27	25	22	30	158	440	440													
6	Total suspended solids (TSS)	mg/L	22	30	22	38	17	17	39	539	423													
7	Total Petroleum Hydrocarbons	mg/L																						
8	Aluminium (Al)	mg/L	0.06	0.05	0.01	0.01	0.02	0.02																
9	Arsenic (As)	mg/L	0.001	0.005	0.001	<0.001	0.002	0.002																
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001																
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001																
12	Copper (Cu)	mg/L	0.002	<0.001	<0.001	<0.001	0.001	0.001																
13	Iron (Fe)	mg/L	5.22	4.24	0.74	7.9	1.3	0.79																
14	Lead (Pb)	mg/L	<0.001	0.002	<0.001	<0.001	<0.001	<0.001																
15	Manganese (Mn)	mg/L	0.506	0.663	0.274	0.444	0.265	0.138																
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001																
17	Nickel (Ni)	mg/L	0.002	0.002	0.001	<0.001	<0.001	<0.001																
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001																
19	Zinc (Zn)	mg/L	0.012	0.013	0.008	<0.005	0.06	0.025																
20	Total Nitrogen (TN)	mg/L	0.7	2.6	1.3	0.7	0.7	0.6	0.9	1	1													
21	Total Phosphorous (TP)	mg/L	0.03	1.73	0.25	0.09	0.2	0.16	0.06	0.14	0.15													
22	C6 - C10 Fraction	ug/L																						
23	>C10 - C16 Fraction	ug/L																						
24	>C16 - C34 Fraction	ug/L																						
25	>C34 - C40 Fraction	ug/L																						

Table 4 SW2 – Fernbank Creek (Chainage 4620 to 4800)

No.	Parameter	Unit	15/10/14 (W)		6/11/14 (W)		20/11/14 (D)		28/11/14 (W)		10/12/14 (D)		12/12/14 (W)		19/12/14 (W)		08/01/15 (D)		12/01/15 (W)	
			SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a* (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)
1	Temperature	^{0}C	14.4	15.5	20.7	28.6	DNS	DNS		DNS	DNS	DNS	DNS	DNS	DNS	DNS	26.7	DNS	23.6	DNS
2	Electrical conductivity (EC)	uS/cm	514	571	553	1220											904		840	
3	Dissolved oxygen (DO)	%	59	57	74	71											73		53	
4	pH		5.8	5.5	5.8	4.8											3.5		4.3	
5	Turbidity (NTU)	NTU	7	5	20	75											34		19	
6	Total suspended solids (TSS)	mg/L	13	11	8	<5			13								13		20	
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.06	0.12	0.11	0.89											0.14		0.14	
9	Arsenic (As)	mg/L	<0.001	<0.001	<0.001	<0.001											<0.001		0.001	
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001											<0.0001		<0.0001	
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001											<0.001		<0.001	
12	Copper (Cu)	mg/L	0.001	<0.001	<0.001	0.001											<0.001		<0.001	
13	Iron (Fe)	mg/L	2.42	0.86	1.13	0.59											1.08		0.81	
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001											<0.001		<0.001	
15	Manganese (Mn)	mg/L	0.201	0.262	0.076	1.77											0.537		0.487	
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001											<0.0001		<0.0001	
17	Nickel (Ni)	mg/L	0.004	0.007	0.002	0.012											0.008		0.006	
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001											<0.001		<0.001	
19	Zinc (Zn)	mg/L	0.013	0.015	0.008	0.047											0.023		0.017	
20	Total Nitrogen (TN)	mg/L	1	0.7	1.3	0.5			1.9								0.8		0.8	
21	Total Phosphorous (TP)	mg/L	0.16	0.03	0.11	0.02			0.06								0.05		0.06	

[#] DNS (Did not sample) – Sample not taken due to absence of sufficient water to collect sample.

* In-field measurement of water quality not undertaken due to insufficient water depth ie<75mm.

Table 5 SW2 – Fernbank Creek (Chainage 4620 to 4800) Cont.

No.	Parameter	Unit	20/01/15 (W)																	
			SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)
1	Temperature	^{0}C	21.7	DNS																
2	Electrical conductivity (EC)	uS/cm	646																	
3	Dissolved oxygen (DO)	%	45																	
4	pH		5.0																	
5	Turbidity (NTU)	NTU	36																	
6	Total suspended solids (TSS)	mg/L	23																	
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L																		
9	Arsenic (As)	mg/L																		
10	Cadmium (Cd)	mg/L																		
11	Chromium (Cr)	mg/L																		
12	Copper (Cu)	mg/L																		
13	Iron (Fe)	mg/L																		
14	Lead (Pb)	mg/L																		
15	Manganese (Mn)	mg/L																		
16	Mercury (Hg)	mg/L																		
17	Nickel (Ni)	mg/L																		
18	Silver (Ag)	mg/L																		
19	Zinc (Zn)	mg/L																		
20	Total Nitrogen (TN)	mg/L	0.9																	
21	Total Phosphorous (TP)	mg/L	0.08																	

[#] DNS (Did not sample) - Sample not taken due to absence of sufficient water to collect sample.

Table 6 SW3 – Hastings River north bank (Chainage 6040 to 6080)

No.	Parameter	Unit	15/10/14 (W)		6/11/14 (W)		20/11/14 (D)		28/11/14 (W)		10/12/14 (W)		10/12/14 (W)		19/12/14 (W)		08/01/15 (D)		12/01/15 (W)	
			SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)
1	Temperature	^{0}C	21.65	21.62	24.64	24.89	26.55	26.68	25.05	25.32	26.76	26.8	23.9	24	25.01	24.65	28.8	28.7	27.6	27.7
2	Electrical conductivity (EC)	uS/cm	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000
3	Dissolved oxygen (DO)	%	90.2	90.2	103.8	99.4	97.8	96.7	71.6	69.4	89.7	89.6	90.2	90.6	91.3	89.5	109	109	90	89
4	pH		7.22	7.61	7.37	7.64	7.55	7.61	6.71	7.24	7.33	7.46	7.11	7.47	7.2	7.54	6.6	7.4	7.0	7.3
5	Turbidity (NTU)	NTU	39.8	33.3	41.3	53.3	14.6	17	9	6.4	7	7.2	22.6	22.4	22.4	7.8	69	34	26	23
6	Total suspended solids (TSS)	mg/L	<5	16	32	21	17	26	<5	<5	8	10	40	22	12	<5	18	19	19	13
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10			<0.10	<0.10	<0.10	<0.10			<0.10	<0.10	0.01	<0.01
9	Arsenic (As)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010			<0.010	<0.010	<0.010	<0.010			<0.010	<0.010	0.002	0.002
10	Cadmium (Cd)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010			<0.0010	<0.0010	<0.0010	<0.0010			<0.0010	<0.0010	<0.0001	<0.0001
11	Chromium (Cr)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010			<0.010	<0.010	<0.010	<0.010			<0.010	<0.010	<0.001	<0.001
12	Copper (Cu)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010			<0.010	<0.010	<0.010	<0.010			<0.010	<0.010	<0.001	0.001
13	Iron (Fe)	mg/L	<0.50	<0.50	<0.10	<0.10	<0.50	<0.50			<0.50	<0.50	<0.50	<0.50			<0.50	<0.50	<0.05	<0.05
14	Lead (Pb)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010			<0.010	<0.010	<0.010	<0.010			<0.010	<0.010	<0.001	<0.001
15	Manganese (Mn)	mg/L	0.045	0.044	0.019	0.019	0.028	0.035			0.011	0.01	0.018	0.019			<0.010	<0.010	0.017	0.017
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010			<0.010	<0.010	<0.010	<0.010			<0.010	<0.010	<0.001	<0.001
18	Silver (Ag)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010			<0.010	<0.010	<0.010	<0.010			<0.010	<0.010	0.008	0.004
19	Zinc (Zn)	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050			<0.050	<0.050	<0.050	<0.050			<0.050	<0.050	<0.005	<0.005
20	Total Nitrogen (TN)	mg/L	<0.2	0.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.2	0.3	<0.2	<0.2	<0.2	<0.2
21	Total Phosphorous (TP)	mg/L	0.08	0.06	<0.05	<0.05	0.08	0.09	<0.05	<0.05	<0.05	<0.05	0.08	0.08	<0.02	<0.02	0.04	0.04	0.08	0.08

Table 7 SW3 – Hastings River north bank (Chainage 6040 to 6080) cont.

No.	Parameter	Unit	20/01/15 (W)																	
			SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)
1	Temperature	^{0}C	25.4	25.2																
2	Electrical conductivity (EC)	uS/cm	8000	8000																
3	Dissolved oxygen (DO)	%	86	87																
4	pH		7.2	7.6																
5	Turbidity (NTU)	NTU	22	13																
6	Total suspended solids (TSS)	mg/L	9	<5																
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L																		
9	Arsenic (As)	mg/L																		
10	Cadmium (Cd)	mg/L																		
11	Chromium (Cr)	mg/L																		
12	Copper (Cu)	mg/L																		
13	Iron (Fe)	mg/L																		
14	Lead (Pb)	mg/L																		
15	Manganese (Mn)	mg/L																		
16	Mercury (Hg)	mg/L																		
17	Nickel (Ni)	mg/L																		
18	Silver (Ag)	mg/L																		
19	Zinc (Zn)	mg/L																		
20	Total Nitrogen (TN)	mg/L	0.3	<0.2																
21	Total Phosphorous (TP)	mg/L	0.05	0.05																

Table 8 SW5 – Unnamed tributary of the Wilson River (Chainage 15820)

No.	Parameter	Unit	15/10/14 (W)	6/11/14 (W)	20/11/14 (D)	28/11/14 (W)	10/12/14 (D)	12/12/14 (W)	19/12/14 (W)	08/01/15 (D)	12/01/15 (W)
			SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)
1	Temperature	^{0}C	20.38	DNS	DNS	DNS	DNS	DNS	DNS	32.8	27.8
2	Electrical conductivity (EC)	uS/cm	1134							762	784
3	Dissolved oxygen (DO)	%	105.6							129	115
4	pH		5.2							4.1	4.4
5	Turbidity (NTU)	NTU	51.2							8	7
6	Total suspended solids (TSS)	mg/L	44							<5	7
7	Total Petroleum Hydrocarbons	mg/L									
8	Aluminium (Al)	mg/L	0.91							0.38	0.48
9	Arsenic (As)	mg/L	<0.001							0.002	0.002
10	Cadmium (Cd)	mg/L	0.0002							0.0001	0.0002
11	Chromium (Cr)	mg/L	<0.001							<0.001	<0.001
12	Copper (Cu)	mg/L	0.002							0.003	0.002
13	Iron (Fe)	mg/L	1.35							0.44	0.38
14	Lead (Pb)	mg/L	<0.001							<0.001	<0.001
15	Manganese (Mn)	mg/L	3.17							1.7	1.62
16	Mercury (Hg)	mg/L	<0.0001							<0.0001	<0.0001
17	Nickel (Ni)	mg/L	0.013							0.012	0.011
18	Silver (Ag)	mg/L	<0.001							<0.001	<0.001
19	Zinc (Zn)	mg/L	0.102							0.345	0.364
20	Total Nitrogen (TN)	mg/L	3.6							0.4	0.4
21	Total Phosphorous (TP)	mg/L	0.16							0.01	0.16

[#] DNS (Did not sample) - Sample not taken due to absence of sufficient water to collect sample.

Table 9 SW5 – Unnamed tributary of the Wilson River (Chainage 15820) cont.

No.	Parameter	Unit	20/01/15 (W) SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)
1	Temperature	^{0}C	24.0								
2	Electrical conductivity (EC)	uS/cm	529								
3	Dissolved oxygen (DO)	%	99								
4	pH		4.7								
5	Turbidity (NTU)	NTU	12								
6	Total suspended solids (TSS)	mg/L	8								
7	Total Petroleum Hydrocarbons	mg/L									
8	Aluminium (Al)	mg/L									
9	Arsenic (As)	mg/L									
10	Cadmium (Cd)	mg/L									
11	Chromium (Cr)	mg/L									
12	Copper (Cu)	mg/L									
13	Iron (Fe)	mg/L									
14	Lead (Pb)	mg/L									
15	Manganese (Mn)	mg/L									
16	Mercury (Hg)	mg/L									
17	Nickel (Ni)	mg/L									
18	Silver (Ag)	mg/L									
19	Zinc (Zn)	mg/L									
20	Total Nitrogen (TN)	mg/L	0.3								
21	Total Phosphorous (TP)	mg/L	0.02								

[#] DNS (Did not sample) - Sample not taken due to absence of sufficient water to collect sample.

Table 10 SW6 – Wilson River south bank (Chainage 16460 to 16600)

No.	Parameter	Unit	15/10/14 (W)		6/11/14 (W)		20/11/14 (D)		28/11/14 (W)		10/12/14 (D)		12/12/14 (W)		19/12/14 (W)		08/01/15 (D)		12/01/15 (W)	
			SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)
1	Temperature	^{0}C	21.3	21.8	24.9	24.7	26.1	26.1	25.3	25.3	27.0	27.2	25.1	25.1	24.9	24.8	28.8	29.1	28.4	28.6
2	Electrical conductivity (EC)	uS/cm	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	3959	4180	3354	3421
3	Dissolved oxygen (DO)	%	87	89	87	83	81	79	62	63	84	84	77	81	90	90	76	78	76	74
4	pH		6.0	6.5	7.5	7.6	7.5	7.4	7.3	7.2	7.4	7.2	7.4	7.3	7.5	7.4	6.7	6.8	6.5	6.7
5	Turbidity (NTU)	NTU	14	22	37	6	6	7	7	6	5	7	8	10	6	7	10	10	46	62
6	Total suspended solids (TSS)	mg/L	22	8	<5	<5	<5	<5	<5	<5	7	<5	5	8	<5	<5	<5	<5	57	58
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.01	0.02	0.01	<0.01	0.03	0.12			<0.01	<0.01	<0.01	0.01			0.1	0.09	0.04	0.03
9	Arsenic (As)	mg/L	<0.001	<0.001	<0.001	0.001	0.002	<0.001			0.001	0.001	0.002	0.001			0.001	0.001	0.001	0.002
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
12	Copper (Cu)	mg/L	0.002	<0.001	<0.001	<0.001	<0.001	0.014			<0.001	0.002	<0.001	<0.001			0.001	0.001	<0.001	<0.001
13	Iron (Fe)	mg/L	0.06	0.06	<0.05	<0.05	<0.05	0.07			<0.05	<0.05	<0.05	<0.05			0.26	0.26	0.26	0.25
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
15	Manganese (Mn)	mg/L	0.08	0.074	0.072	0.069	0.09	0.1			0.088	0.084	0.092	0.089			0.059	0.057	0.037	0.04
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
19	Zinc (Zn)	mg/L	0.009	0.007	<0.005	<0.005	0.005	0.011			0.006	<0.005	<0.005	<0.005			0.007	<0.005	<0.005	<0.005
20	Total Nitrogen (TN)	mg/L	0.4	0.4	0.4	0.4	0.2	0.4	0.4	0.4	<0.5	<0.5	<0.5	<0.5	0.2	0.2	0.3	0.3	0.4	0.6
21	Total Phosphorous (TP)	mg/L	0.06	0.02	0.02	<0.01	0.02	0.03	0.02	0.02	0.15	<0.05	<0.05	<0.05	<0.01	<0.01	0.01	0.01	0.03	0.08

Table 11 SW6 – Wilson River south bank (Chainage 16460 to 16600) cont.

No.	Parameter	Unit	20/01/15 (W)																	
			SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)
1	Temperature	^{0}C	27.7	27.7																
2	Electrical conductivity (EC)	uS/cm	2074	2168																
3	Dissolved oxygen (DO)	%	70	69																
4	pH		7.0	7.0																
5	Turbidity (NTU)	NTU	13	14																
6	Total suspended solids (TSS)	mg/L	8	8																
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L																		
9	Arsenic (As)	mg/L																		
10	Cadmium (Cd)	mg/L																		
11	Chromium (Cr)	mg/L																		
12	Copper (Cu)	mg/L																		
13	Iron (Fe)	mg/L																		
14	Lead (Pb)	mg/L																		
15	Manganese (Mn)	mg/L																		
16	Mercury (Hg)	mg/L																		
17	Nickel (Ni)	mg/L																		
18	Silver (Ag)	mg/L																		
19	Zinc (Zn)	mg/L																		
20	Total Nitrogen (TN)	mg/L	0.4	0.4																
21	Total Phosphorous (TP)	mg/L	0.02	0.02																

Table 12 SW6 – Wilson River north bank (Chainage 16830 to 16840)

No.	Parameter	Unit	15/10/14 (W)		6/11/14 (W)		20/11/14 (D)		28/11/14 (W)		10/12/14 (D)		12/12/14 (W)		19/12/14 (W)		08/01/15 (D)		12/01/15 (W)	
			SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)
1	Temperature	^{0}C	21.3	21.6	25.8	25.7	27.8	27.7	25.1	25.4	27.6	27.5	25.0	24.8	25.7	25.2	28.8	28.7	28.6	28.6
2	Electrical conductivity (EC)	uS/cm	7845	7851	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000	4102	4213	2879	2886
3	Dissolved oxygen (DO)	%	88	89	84	85	80	80	55	65	82	83	81	84	96	95	72	74	75	77
4	pH		7.0	7.2	6.8	7.2	6.8	7.0	6.4	6.8	6.9	7.1	6.5	7.0	7.2	7.3	6.2	6.5	6.7	6.8
5	Turbidity (NTU)	NTU	115	98	7	6	7	7	7	8	11	7	10	13	7	7	9	10	25	25
6	Total suspended solids (TSS)	mg/L	78	136	<5	<5	<5	<5	<5	<5	10	<5	8	9	<5	<5	8	11	21	26
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.02	0.02	<0.01	<0.01	0.02	0.04			<0.01	<0.01	<0.01	<0.01			0.1	0.09	0.05	0.05
9	Arsenic (As)	mg/L	<0.001	<0.001	0.001	<0.001	0.002	0.001			0.001	0.001	0.002	0.002			0.001	0.001	0.003	0.002
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	0.0003	0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
12	Copper (Cu)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.002			<0.001	<0.001	<0.001	<0.001			0.001	<0.001	<0.001	<0.001
13	Iron (Fe)	mg/L	0.06	<0.05	<0.05	<0.05	<0.05	<0.05			<0.05	<0.05	<0.05	<0.05			0.26	0.26	0.28	0.26
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
15	Manganese (Mn)	mg/L	0.077	0.078	0.082	0.075	0.097	0.11			0.086	0.083	0.098	0.094			0.052	0.054	0.033	0.032
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
19	Zinc (Zn)	mg/L	0.006	0.007	<0.005	<0.005	0.006	<0.005			<0.005	<0.005	<0.005	<0.005			<0.005	<0.005	<0.005	<0.005
20	Total Nitrogen (TN)	mg/L	0.4	0.6	0.2	0.2	0.2	0.2	0.4	0.3	<0.5	<0.5	<0.5	<0.5	0.2	0.2	0.4	0.4	0.4	0.3
21	Total Phosphorous (TP)	mg/L	0.06	0.07	<0.01	0.01	0.03	0.03	0.02	0.02	<0.05	<0.05	<0.05	<0.05	<0.01	<0.01	<0.01	<0.01	0.09	0.05

* Elevated turbidity for 15 October 2014 sampling event attributable to wind and wave action close to sure at time of sampling.

Table 13 SW6 – Wilson River north bank (Chainage 16830 to 16840) cont.

No.	Parameter	Unit	20/01/15 (W)																	
			SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)
1	Temperature	^{0}C	27.6	27.6																
2	Electrical conductivity (EC)	uS/cm	2303	2315																
3	Dissolved oxygen (DO)	%	72	73																
4	pH		6.5	6.8																
5	Turbidity (NTU)	NTU	14	14																
6	Total suspended solids (TSS)	mg/L	12	11																
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L																		
9	Arsenic (As)	mg/L																		
10	Cadmium (Cd)	mg/L																		
11	Chromium (Cr)	mg/L																		
12	Copper (Cu)	mg/L																		
13	Iron (Fe)	mg/L																		
14	Lead (Pb)	mg/L																		
15	Manganese (Mn)	mg/L																		
16	Mercury (Hg)	mg/L																		
17	Nickel (Ni)	mg/L																		
18	Silver (Ag)	mg/L																		
19	Zinc (Zn)	mg/L																		
20	Total Nitrogen (TN)	mg/L	0.3	0.3																
21	Total Phosphorous (TP)	mg/L	0.02	0.02																

Table 14 SW7 – Cooperabung Creek (Chainage 19660)

No.	Parameter	Unit	15/10/14 (W)		6/11/14 (W)		20/11/14 (D)		28/11/14 (W)		10/12/14 (D)		12/12/14 (W)		19/12/14 (W)		08/01/15 (D)		12/01/15 (W)	
			SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b* (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)
1	Temperature	^{0}C	16.5	16.6	20.7	19.4	22.3	19.7	20.1	20.6	22.5		19.9	19.5	22.5		23.9	24.26	24.1	24.0
2	Electrical conductivity (EC)	uS/cm	220	223	205	245	201	287	198	90	278		223	115	226		208	207	217	217
3	Dissolved oxygen (DO)	%	42	32	91	13	90	8	13	38	18		6	14	35		32	38	28	26
4	pH		7.5	7.3	7.3	7.1	7.7	7.0	7.1	6.7	7.1		6.9	6.7	7.7		6.0	6.1	6.6	6.6
5	Turbidity (NTU)	NTU	6	4	11	19	8	10	14	129	11		18	124	26		11	12	8	8
6	Total suspended solids (TSS)	mg/L	8	<5	20	8	10	9	14	21	33	15	23	21	18		10	6	9	8
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.06	0.03	0.09	0.06	0.09	0.06			0.03	0.15	<0.01	0.41			0.16	0.15	0.08	0.05
9	Arsenic (As)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.002			0.003	0.003	0.002	0.002			<0.001	<0.001	0.001	0.002
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001	0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
12	Copper (Cu)	mg/L	<0.001	<0.001	<0.001	0.014	0.008	<0.001			0.001	<0.001	<0.001	0.001			<0.001	<0.001	<0.001	<0.001
13	Iron (Fe)	mg/L	0.41	0.23	0.31	0.69	0.48	1.39			11.8	3.36	1.64	1.07			0.8	0.71	1.01	0.78
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
15	Manganese (Mn)	mg/L	0.338	0.037	0.09	1.48	0.237	3.13			2.82	2.55	4.02	0.86			0.094	0.064	0.172	0.179
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L	<0.001	<0.001	<0.001	<0.001	0.001	0.002			<0.001	0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
19	Zinc (Zn)	mg/L	0.008	<0.005	0.005	0.007	0.012	0.009			0.007	<0.005	<0.005	<0.005			<0.005	0.006	<0.005	0.005
20	Total Nitrogen (TN)	mg/L	0.1	0.1	0.2	0.4	0.3	0.5	0.4	0.7	0.8	0.9	0.6	0.7	0.6		0.2	0.3	0.3	0.3
21	Total Phosphorous (TP)	mg/L	0.02	<0.01	0.01	0.04	0.01	0.04	0.03	0.06	0.04	0.11	0.03	0.08	0.05		0.02	0.02	0.03	0.02

[#] DNS (Did not sample) - Sample not taken due to absence of sufficient water to collect sample.

* In-field measurement of water quality not undertaken due to insufficient water depth ie<75mm.

Note – Elevated turbidity levels at SW7b on 28 November 2014 and 12 December 2014 were observed to be attributable to runoff from a private access track adjacent to the sampling point unrelated to the project.

Table 15 SW7 – Cooperabung Creek (Chainage 19660) cont.

No.	Parameter	Unit	20/01/15 (W)																	
			SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)
1	Temperature	^{0}C	21.7	21.8																
2	Electrical conductivity (EC)	uS/cm	108	111																
3	Dissolved oxygen (DO)	%	72	72																
4	pH		6.1	6.5																
5	Turbidity (NTU)	NTU	49	49																
6	Total suspended solids (TSS)	mg/L	12	13																
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L																		
9	Arsenic (As)	mg/L																		
10	Cadmium (Cd)	mg/L																		
11	Chromium (Cr)	mg/L																		
12	Copper (Cu)	mg/L																		
13	Iron (Fe)	mg/L																		
14	Lead (Pb)	mg/L																		
15	Manganese (Mn)	mg/L																		
16	Mercury (Hg)	mg/L																		
17	Nickel (Ni)	mg/L																		
18	Silver (Ag)	mg/L																		
19	Zinc (Zn)	mg/L																		
20	Total Nitrogen (TN)	mg/L	0.6	0.6																
21	Total Phosphorous (TP)	mg/L	0.04	0.04																

Table 16 SW8 – Barrys Creek (Chainage 23775 to 25325)

No.	Parameter	Unit	15/10/14 (W)			6/11/14 (W)			19-20/11/14 (D)			27-28/11/14 (W)			10/12/14 (D)			12/12/14 (W)			19/12/14 (W)		
			SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b* (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)
1	Temperature	^{0}C	DNS	15.37	16.69	DNS	23.07	19.41	DNS		22.21	DNS	19.38	21.86	DNS	DNS	24.26	DNS	19.31	21.44	DNS	DNS	22.36
2	Electrical conductivity (EC)	uS/cm		248	164		269	170			176		245	183			158		285	156			159
3	Dissolved oxygen (DO)	%		31.4	52.9		29.5	38.6			37.4		38.1	9.3			30.3		11.8	15.6			20
4	pH			6.66	6.4		6.78	6.57			6.32		7.19	6.25			6.96		7.26	6.68			6.81
5	Turbidity (NTU)	NTU		5.8	7.7		5.5	8.9			7.4		8.9	52.7			14.3		11.8	38.7			11
6	Total suspended solids (TSS)	mg/L		<5	<5		<5	<5		18	9		<5	18			7		12	18			<5
7	Total Petroleum Hydrocarbons	mg/L																					
8	Aluminium (Al)	mg/L		0.06	0.15		0.02	0.04		0.07	0.08						0.13		0.12	0.08			
9	Arsenic (As)	mg/L		<0.001	<0.001		<0.001	<0.001		<0.001	<0.001						0.001		0.001	0.001			
10	Cadmium (Cd)	mg/L		<0.0001	<0.0001		<0.0001	<0.0001		<0.0001	<0.0001						<0.0001		<0.0001	<0.0001			
11	Chromium (Cr)	mg/L		<0.001	<0.001		<0.001	<0.001		<0.001	<0.001						<0.001		<0.001	<0.001			
12	Copper (Cu)	mg/L		<0.001	<0.001		<0.001	<0.001		0.004	0.003						<0.001		<0.001	<0.001			
13	Iron (Fe)	mg/L		0.27	0.34		0.71	0.46		1.99	0.68						0.86		3.23	1.15			
14	Lead (Pb)	mg/L		<0.001	<0.001		<0.001	<0.001		<0.001	<0.001						<0.001		<0.001	<0.001			
15	Manganese (Mn)	mg/L		0.032	0.162		0.075	0.506		0.142	0.551						0.435		0.2	0.83			
16	Mercury (Hg)	mg/L		<0.0001	<0.0001		<0.0001	<0.0001		<0.0001	<0.0001						0.0001		<0.0001	<0.0001			
17	Nickel (Ni)	mg/L		<0.001	<0.001		<0.001	<0.001		<0.001	<0.001						<0.001		<0.001	<0.001			
18	Silver (Ag)	mg/L		<0.001	<0.001		<0.001	<0.001		<0.001	<0.001						<0.001		<0.001	<0.001			
19	Zinc (Zn)	mg/L		<0.005	0.006		<0.005	<0.005		0.01	0.006						<0.005		<0.005	<0.005			
20	Total Nitrogen (TN)	mg/L		0.1	0.2		0.2	0.2		0.7	0.3		0.6	0.4			0.3		0.6	0.3			0.2
21	Total Phosphorous (TP)	mg/L		<0.01	0.01		<0.01	<0.01		0.03	0.01		0.03	0.02			<0.01		0.05	<0.01			0.02

DNS (Did not sample) - Sample not taken due to absence of sufficient water to collect sample.

* In-field measurement of water quality not undertaken due to insufficient water depth ie<75mm.

Note - SW8b and SW8c persisted as isolated ponds for the entire monitoring period with the exception of the 20 January 2015 monitoring event.

Table 17 SW8 – Barrys Creek (Chainage 23775 to 25325) cont.

No.	Parameter	Unit	08/01/15 (D)			12/01/15 (W)			20/01/15 (W)															
			SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)
1	Temperature	^{0}C	DNS	19.4	21.5	DNS	19.4	22.8	21.0	20.9	21.2												
2	Electrical conductivity (EC)	uS/cm		166	151		186	153	103	100	106												
3	Dissolved oxygen (DO)	%		22	28		28	36	90	88	80												
4	pH			5.6	5.7		6.4	5.8	5.76	5.8	5.9												
5	Turbidity (NTU)	NTU		15	12		13	12	30	29	47												
6	Total suspended solids (TSS)	mg/L		<5	<5		8	8	9	9	13												
7	Total Petroleum Hydrocarbons	mg/L																					
8	Aluminium (Al)	mg/L		0.87	0.31		0.11	0.21															
9	Arsenic (As)	mg/L		<0.001	<0.001		<0.001	<0.001															
10	Cadmium (Cd)	mg/L		<0.0001	<0.0001		<0.0001	<0.0001															
11	Chromium (Cr)	mg/L		<0.001	<0.001		<0.001	<0.001															
12	Copper (Cu)	mg/L		<0.001	<0.001		<0.001	<0.001															
13	Iron (Fe)	mg/L		0.31	0.43		0.08	0.27															
14	Lead (Pb)	mg/L		<0.001	<0.001		<0.001	<0.001															
15	Manganese (Mn)	mg/L		0.022	0.147		0.007	0.122															
16	Mercury (Hg)	mg/L		<0.0001	<0.0001		<0.0001	<0.0001															
17	Nickel (Ni)	mg/L		<0.001	<0.001		<0.001	<0.001															
18	Silver (Ag)	mg/L		<0.001	<0.001		<0.001	<0.001															
19	Zinc (Zn)	mg/L		0.005	0.006		<0.005	<0.005															
20	Total Nitrogen (TN)	mg/L		0.1	0.3		0.1	0.1	0.5	0.6	1.3												
21	Total Phosphorous (TP)	mg/L		0.01	0.02		0.02	0.01	0.02	0.02	0.02												

[#] DNS (Did not sample) - Sample not taken due to absence of sufficient water to collect sample.

Note - SW8b and SW8c persisted as isolated ponds for the entire monitoring period with the exception of the 20 January 2015 monitoring event.

Table 18 SW9 – Smiths Creek (Chainage 28300)

No.	Parameter	Unit	19/11/14 (D)		27/11/14 (W)		10/12/14 (D)		12/12/14 (W)		19/12/14 (W)		08/01/15 (D)		12/01/15 (W)		20/01/15 (W)			
			SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)
1	Temperature	^{0}C	21.4	22.2	21.3	22.3	24.8	24.3	21.6	21.8	21.5	22.4	22.6	22.6	24.1	23.9	21.2	21.2		
2	Electrical conductivity (EC)	uS/cm	345	320	358	325	355	323	339	316	424	321	224	224	235	236	96	96		
3	Dissolved oxygen (DO)	%	6	11	14	10	13	14	8	3	8	16	17	23	19	19	76	77		
4	pH		6.5	6.7	6.7	6.7	6.8	7.0	6.8	6.8	7.0	6.9	6.2	6.5	6.5	6.6	6.0	6.0		
5	Turbidity (NTU)	NTU	17	17	19	26	36	22	21	34	25	28	9	9	9	10	43	42		
6	Total suspended solids (TSS)	mg/L	22	10	9	6	21	10	12	14	8	6	7	8	8	6	14	14		
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.04	0.04			0.02	0.02	0.03	0.02			0.1	0.07	0.05	0.04				
9	Arsenic (As)	mg/L	0.002	<0.001			0.004	0.002	0.004	0.002			<0.001	<0.001	<0.001	<0.001				
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001				
11	Chromium (Cr)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
12	Copper (Cu)	mg/L	<0.001	0.004			<0.001	<0.001	<0.001	0.005			<0.001	<0.001	<0.001	<0.001				
13	Iron (Fe)	mg/L	5.61	2.63			4.64	3.48	6.56	4.12			1.02	0.96	1.11	1				
14	Lead (Pb)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
15	Manganese (Mn)	mg/L	1.14	0.969			0.702	1.22	0.756	1.36			0.146	0.183	0.269	0.283				
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001				
17	Nickel (Ni)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
19	Zinc (Zn)	mg/L	0.007	0.01			<0.005	<0.005	<0.005	<0.005			<0.005	<0.005	0.024	<0.005				
20	Total Nitrogen (TN)	mg/L	0.8	1	0.8	1.1	0.8	0.9	0.7	1	0.7	0.8	0.5	0.4	0.4	0.4	1.3	0.8		
21	Total Phosphorous (TP)	mg/L	0.07	0.08	0.07	0.09	0.09	0.09	0.07	0.09	0.01	0.06	0.03	0.03	0.03	0.02	0.03	0.03		

Note - Water generally still / stagnant (tannin affected) for all monitoring events with the exception of the 20 January 2015 sampling event. During this sampling event, water levels were elevated and moving quickly between sampling points.

Table 19 SW10 – Pipers Creek (Chainage 30700)

No.	Parameter	Unit	19/11/14 (D)		27/11/14 (W)		10/12/14 (D)		12/12/14 (W)		19/12/14 (W)		08/01/15 (D)		12/01/15 (W)		20/01/15 (W)			
			SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)
1	Temperature	^{0}C	22.4	24.1	22.3	22.4	24.5	26.1	21.9	22.5	23.6	24.2	23.3	22.9	24.8	24.5	21.5	21.5		
2	Electrical conductivity (EC)	uS/cm	276	276	280	277	242	243	223	226	238	238	221	223	223	227	122	122		
3	Dissolved oxygen (DO)	%	7.7	28.1	6.2	24.4	14.8	33.8	3.5	35.9	23	13.5	5	3	16	8.5	66	65		
4	pH		6.5	6.6	6.7	6.7	6.9	6.8	6.6	6.7	6.9	6.8	6.2	6.2	6.3	6.2	6.1	6.1		
5	Turbidity (NTU)	NTU	15	35	19	11	19	21	29	29	19	24	14	11	10	12	54	55		
6	Total suspended solids (TSS)	mg/L	8	8	6	9	8	8	14	15	5	<5	16	15	8	14	17	17		
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.04	0.01			0.1	0.12	0.21	0.19			0.17	0.13	0.1	0.12				
9	Arsenic (As)	mg/L	<0.001	0.002			0.002	0.001	0.002	0.001			0.001	0.001	<0.001	0.002				
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001				
11	Chromium (Cr)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
12	Copper (Cu)	mg/L	<0.001	<0.001			<0.001	<0.001	0.002	0.001			<0.001	<0.001	<0.001	<0.001				
13	Iron (Fe)	mg/L	1.1	1.07			1.35	1.38	1.75	1.68			1.26	1.18	1.04	0.92				
14	Lead (Pb)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
15	Manganese (Mn)	mg/L	0.255	0.265			0.262	0.291	0.328	0.38			0.333	0.312	0.239	0.272				
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001				
17	Nickel (Ni)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			0.001	0.001	<0.001	0.001				
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
19	Zinc (Zn)	mg/L	0.006	<0.005			<0.005	<0.005	<0.005	<0.005			0.024	0.006	<0.005	0.011				
20	Total Nitrogen (TN)	mg/L	0.7	0.6	0.8	0.8	0.8	1	0.8	0.8	0.7	0.8	0.9	1	0.8	0.8	0.9	0.9		
21	Total Phosphorous (TP)	mg/L	0.03	0.03	0.04	0.05	0.04	0.06	0.03	0.04	0.01	0.02	0.06	0.1	0.08	0.07	0.04	0.04		

Note - Water generally still / stagnant (tannin affected) for all monitoring events with the exception of the 20 January 2015 sampling event. During this sampling event, water levels were elevated and moving quickly between sampling points.

Table 20 SW11 – Unnamed drainage line (Chainage 34650 to 34700) cont.

No.	Parameter	Unit	19/11/14 (D)		27/11/14 (W)		10/12/14 (D)		12/12/14 (W)		19/12/14 (W)		08/01/15 (D)		12/01/15 (W)		20/01/15 (W)			
			SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)
1	Temperature	^{0}C	20.1	21.1	21.1	21.7	21.9	23.8	20.4	20.9	21	26.2	23.2	24.9	24.8	26.6	22.2	22.3		
2	Electrical conductivity (EC)	uS/cm	191	249	184	246	192	178	186	86	193	107	278	283	345	188	103	103		
3	Dissolved oxygen (DO)	%	45	22	45	28	5	10	9	24	23	67	21	65	47	45	92	92		
4	pH		7.1	6.8	6.9	6.9	6.6	6.4	6.3	5.9	6.9	6.8	5.2	5.6	5.3	6.1	5.3	5.4		
5	Turbidity (NTU)	NTU	21	39	13	29	23	43	20	51	17	113	47	14	186	62	73	49		
6	Total suspended solids (TSS)	mg/L	8	15	<5	12	<5	8	8	15	10	22	26	14	86	13	18	10		
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.13	0.04			0.11	0.26	0.14	0.88			0.19	0.25	0.17	0.19				
9	Arsenic (As)	mg/L	0.002	0.001			0.003	0.002	0.003	0.001			0.001	<0.001	0.002	0.001				
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001				
11	Chromium (Cr)	mg/L	0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
12	Copper (Cu)	mg/L	0.001	<0.001			<0.001	0.001	<0.001	0.006			<0.001	0.002	0.001	0.002				
13	Iron (Fe)	mg/L	1.98	3			3.25	1.54	4.92	0.86			1.06	1.01	1.22	1.66				
14	Lead (Pb)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	0.002			<0.001	<0.001	<0.001	<0.001				
15	Manganese (Mn)	mg/L	0.074	0.388			0.098	0.164	0.172	0.076			0.257	0.077	0.31	0.159				
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001				
17	Nickel (Ni)	mg/L	0.001	<0.001			<0.001	<0.001	<0.001	0.001			0.001	<0.001	0.002	<0.001				
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
19	Zinc (Zn)	mg/L	0.008	0.011			<0.005	0.007	<0.005	0.019			0.008	0.01	0.008	0.014				
20	Total Nitrogen (TN)	mg/L	0.8	1	1	1.5	0.9	2.8	0.9	2.2	0.6	1.3	0.5	0.6	0.7	0.6	0.8	0.8		
21	Total Phosphorous (TP)	mg/L	0.04	0.07	0.08	0.11	0.04	0.06	0.04	0.21	<0.01	0.09	0.03	0.08	0.07	0.03	0.02	0.02		

Note - Water generally still / stagnant (tannin affected) isolated pondages for all monitoring events with the exception of the 12 and 20 January 2015 sampling events. During these sampling events, water levels were elevated, moving quickly and connected via a recently installed waterway diversion.

Note – High turbidity for upstream location recorded on 19 December 2014 attributable to existing highway runoff.

Table 21 SW12 – Maria River (Chainage 36850)

No.	Parameter	Unit	19/11/14 (D)		27/11/14 (W)		10/12/14 (D)		12/12/14 (W)		19/12/14 (W)		08/01/15 (D)		12/01/15 (W)		20/01/15 (W)			
			SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)
1	Temperature	^{0}C	21.0	23.1	21.6	22.9	23.8	25.6	21.8	22.1	25.4	25.7	22.1	22.8	24.6	23.9	21.4	21.4		
2	Electrical conductivity (EC)	uS/cm	151	260	97	251	216	257	201	243	267	248	194	201	202	199	99	99		
3	Dissolved oxygen (DO)	%	39	21	77	51	48	19	56	24	47	29	11	3	23	4	69	70		
4	pH		6.8	6.4	6.7	6.6	7.2	6.5	6.8	6.7	6.6	6.7	5.8	5.6	6.2	6.0	5.4	5.4		
5	Turbidity (NTU)	NTU	33	16	63	26	15	21	32	33	20	21	12	16	19	18	41	41		
6	Total suspended solids (TSS)	mg/L	19	15	26	13	<5	19	6	5	8	8	14	15	14	10	12	10		
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.1	0.05			0.04	0.02	0.12	0.05			0.65	0.55	0.3	0.29				
9	Arsenic (As)	mg/L	0.001	0.002			<0.001	0.002	<0.001	0.002			0.002	0.002	0.001	0.001				
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001				
11	Chromium (Cr)	mg/L	<0.001	0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
12	Copper (Cu)	mg/L	0.003	<0.001			0.002	<0.001	0.003	<0.001			0.002	0.003	0.002	0.003				
13	Iron (Fe)	mg/L	0.69	1.05			0.3	0.81	0.4	1.3			1.6	1.8	1.58	1.11				
14	Lead (Pb)	mg/L	<0.001	0.004			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
15	Manganese (Mn)	mg/L	0.138	0.293			0.043	0.372	0.068	0.397			0.264	0.264	0.287	0.241				
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001				
17	Nickel (Ni)	mg/L	<0.001	<0.001			<0.001	<0.001	0.001	<0.001			0.003	0.002	0.003	0.002				
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
19	Zinc (Zn)	mg/L	0.019	0.012			0.007	<0.005	0.017	<0.005			0.011	0.01	0.012	0.012				
20	Total Nitrogen (TN)	mg/L	1	0.7	1.1	1	0.3	0.6	0.4	0.5	0.5	0.4	1	0.8	0.8	0.7	0.2	0.8		
21	Total Phosphorous (TP)	mg/L	0.04	0.02	0.07	0.07	0.02	0.03	0.02	0.02	<0.01	<0.01	0.03	0.03	0.04	0.04	0.11	0.03		

Note - Water generally still / stagnant (tannin affected) isolated pondages for all monitoring events with the exception of the 20 January 2015 sampling event. During this sampling event, water levels were elevated, moving quickly and connected up and downstream.

Table 22 SW13 – Stumpy Creek (Chainage 37700 to 37750)

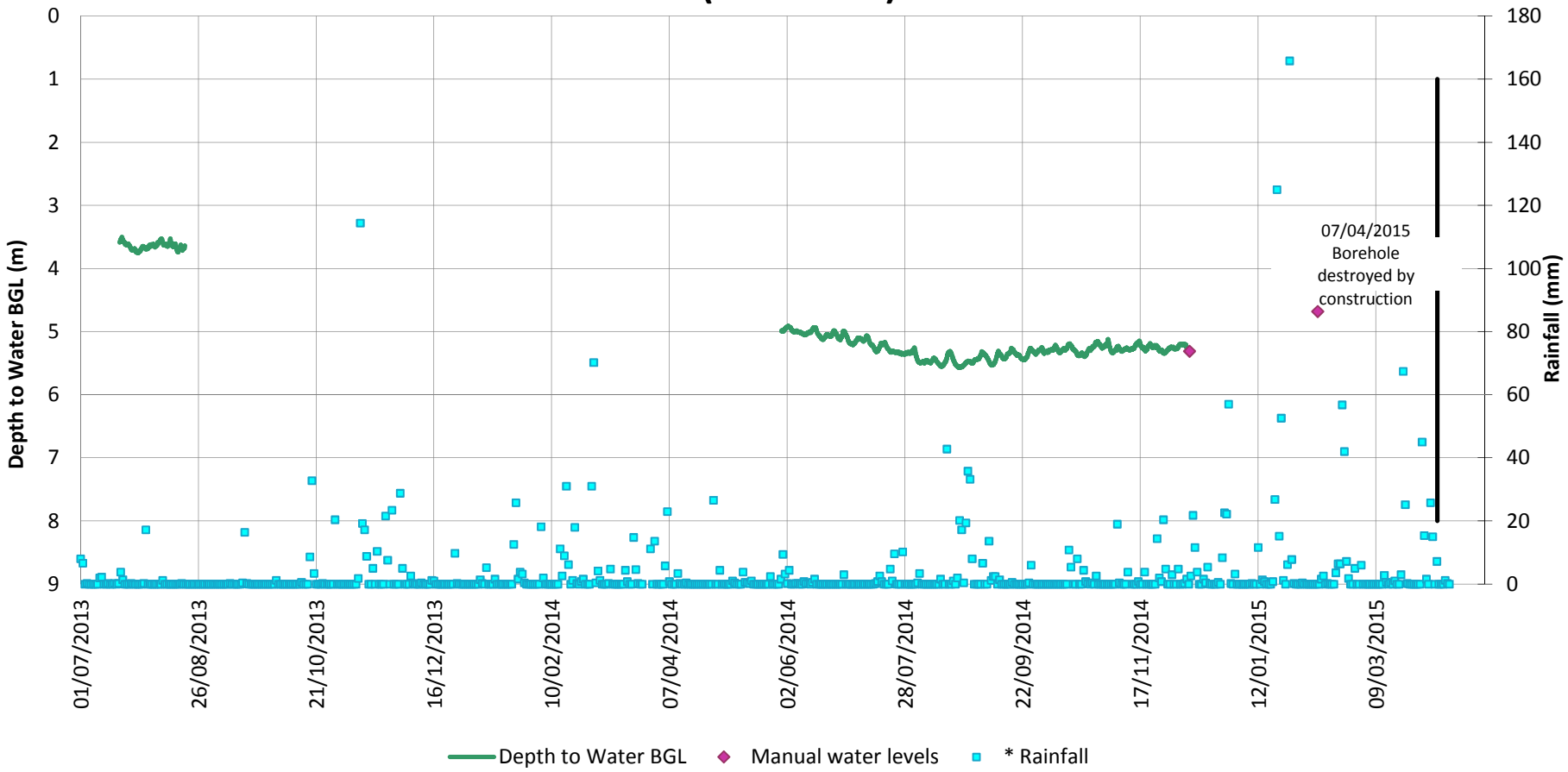
No.	Parameter	Unit	19/11/14 (D)		27/11/14 (W)		10/12/14 (D)		12/12/14 (W)		19/12/14 (W)		08/01/15 (D)		12/01/15 (W)		20/01/15 (W)			
			SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)
1	Temperature	^{0}C	20.6	21.0	22.6	22.7	22.0	22.6	20.6	20.6	21.0	21.5	20.9	21.3	22.9	23.4	21.2	21.3		
2	Electrical conductivity (EC)	uS/cm	288	295	120	120	339	366	357	385	360	377	346	346	337	346	90	93		
3	Dissolved oxygen (DO)	%	49.1	54	76	78.3	42.7	39.3	52.5	25.1	50	34	44.6	30.3	55	46	74	75		
4	pH		6.4	6.1	6.7	8.0	7.3	7.6	6.9	7.1	6.8	6.7	6.1	5.7	6.5	6.6	5.6	6.6		
5	Turbidity (NTU)	NTU	43	59	371	389	28	44	45	48	48	60	22	36	30	26	42	44		
6	Total suspended solids (TSS)	mg/L	18	20	162	168	<5	6	9	10	10	20	10	17	10	14	12	13		
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.09	0.08			0.06	0.04	0.13	0.12			0.06	0.1	0.1	0.12				
9	Arsenic (As)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001				
11	Chromium (Cr)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
12	Copper (Cu)	mg/L	0.001	0.001			<0.001	<0.001	0.002	0.001			<0.001	0.002	0.001	0.002				
13	Iron (Fe)	mg/L	0.58	0.41			0.58	0.47	0.51	0.65			0.87	0.78	0.58	0.85				
14	Lead (Pb)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
15	Manganese (Mn)	mg/L	0.077	0.08			0.18	0.161	0.105	0.155			0.146	0.177	0.08	0.095				
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001				
17	Nickel (Ni)	mg/L	0.001	0.001			0.001	0.001	0.001	0.001			<0.001	0.001	<0.001	<0.001				
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001				
19	Zinc (Zn)	mg/L	0.014	0.021			0.008	0.008	0.013	0.009			0.006	0.008	0.007	0.009				
20	Total Nitrogen (TN)	mg/L	0.7	1.1	1.3	1.4	0.4	0.7	0.6	0.6	0.4	0.6	0.4	0.7	0.4	0.4	1	1		
21	Total Phosphorous (TP)	mg/L	0.03	0.05	0.19	0.2	0.01	0.03	0.04	0.05	<0.01	<0.01	0.01	0.03	0.02	0.02	0.02	0.04		

Note - Water generally moving between sample points during all monitoring events with the exception of 10 December 2014 event where the sampling points were still and present as isolated ponds.

Appendix D – Borehole water level data plots

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW01 (A-BH3101) Water Level BGL



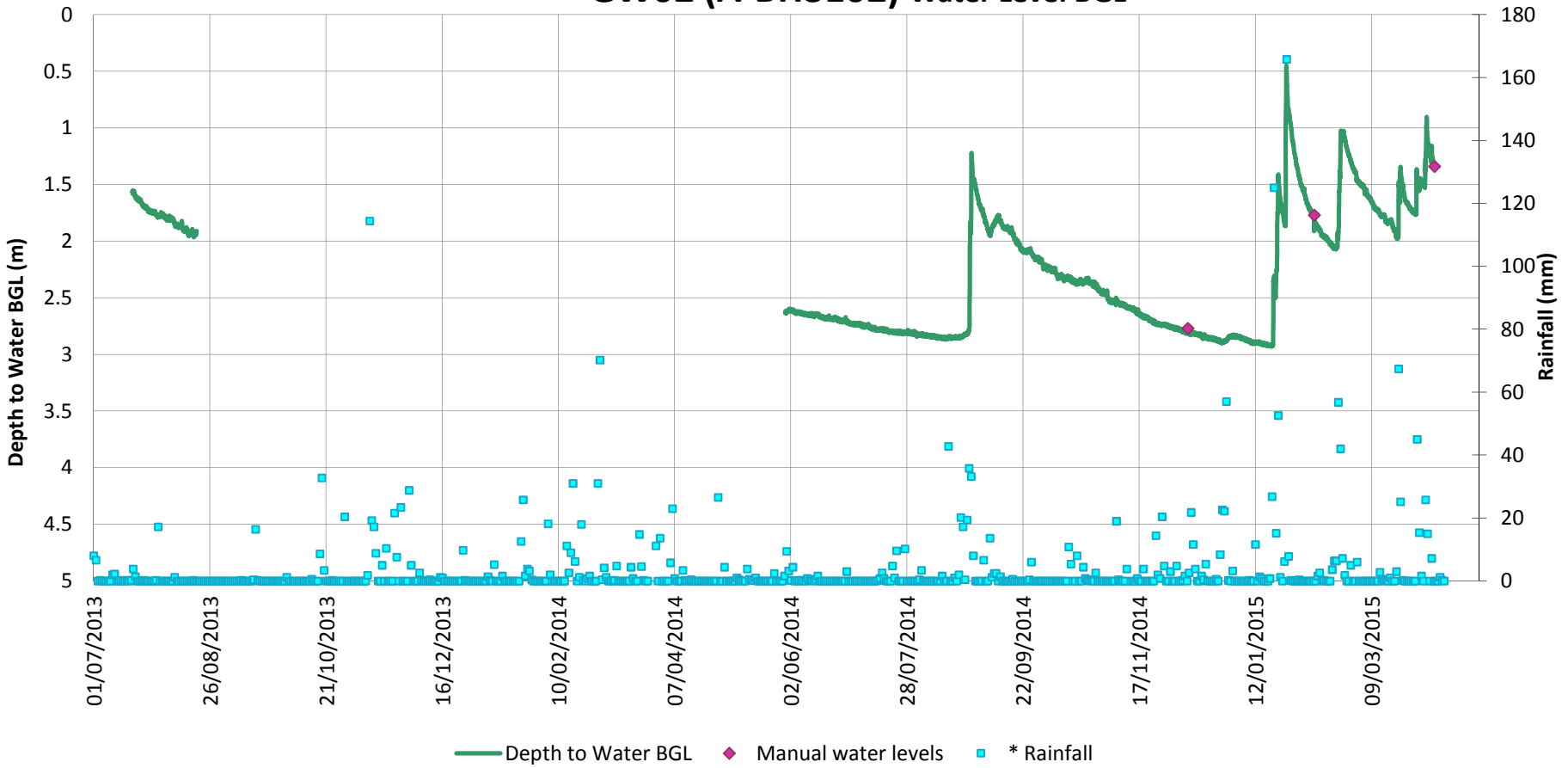
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N10217741	
Date	14/04/2015		BH ID	A-BH3101	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-1

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW02 (A-BH3102) Water Level BGL



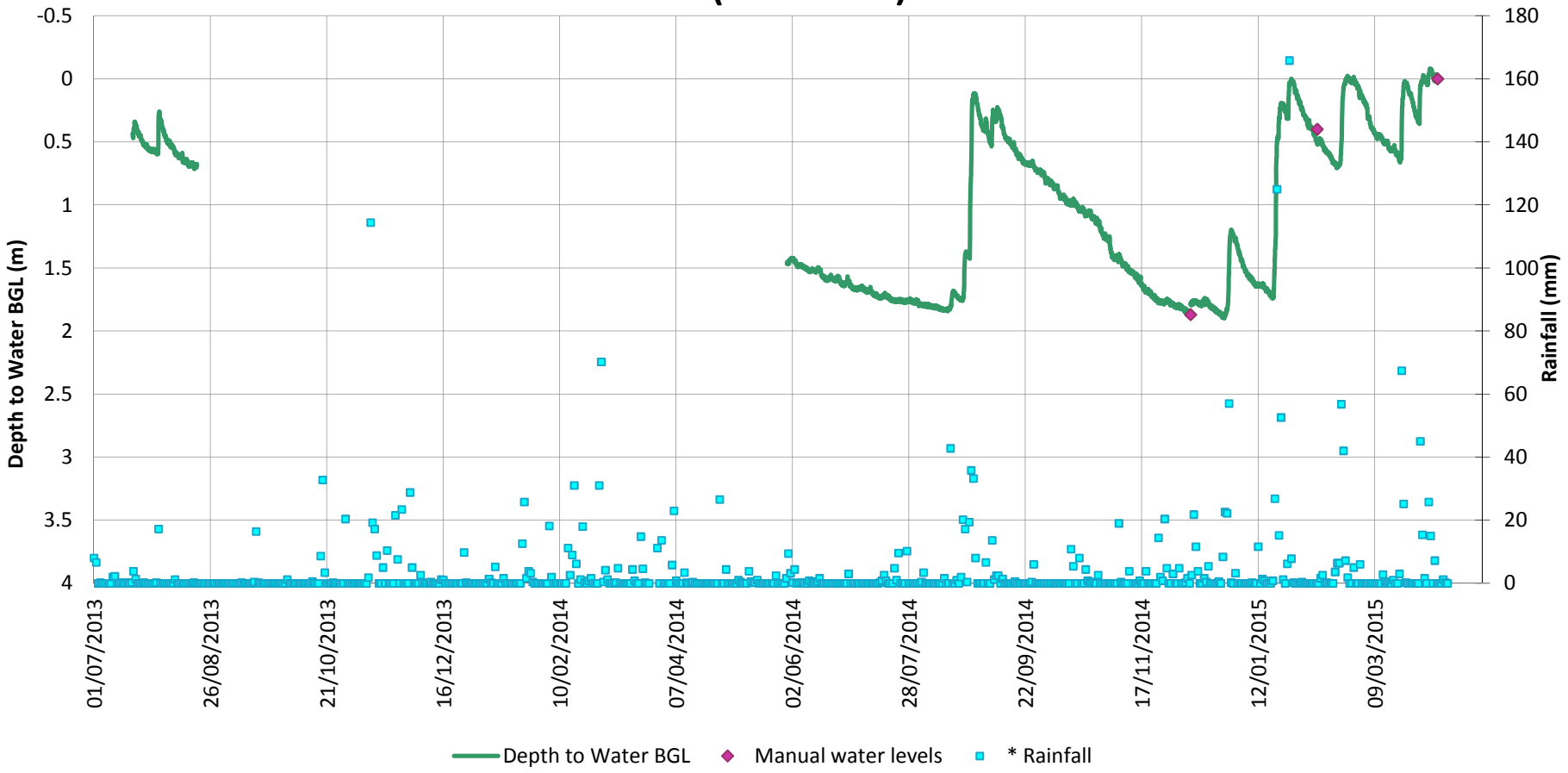
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10283850	
Date	14/04/2015		BH ID	A-BH3102	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-2

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW03 (A-BH3103) Water Level BGL

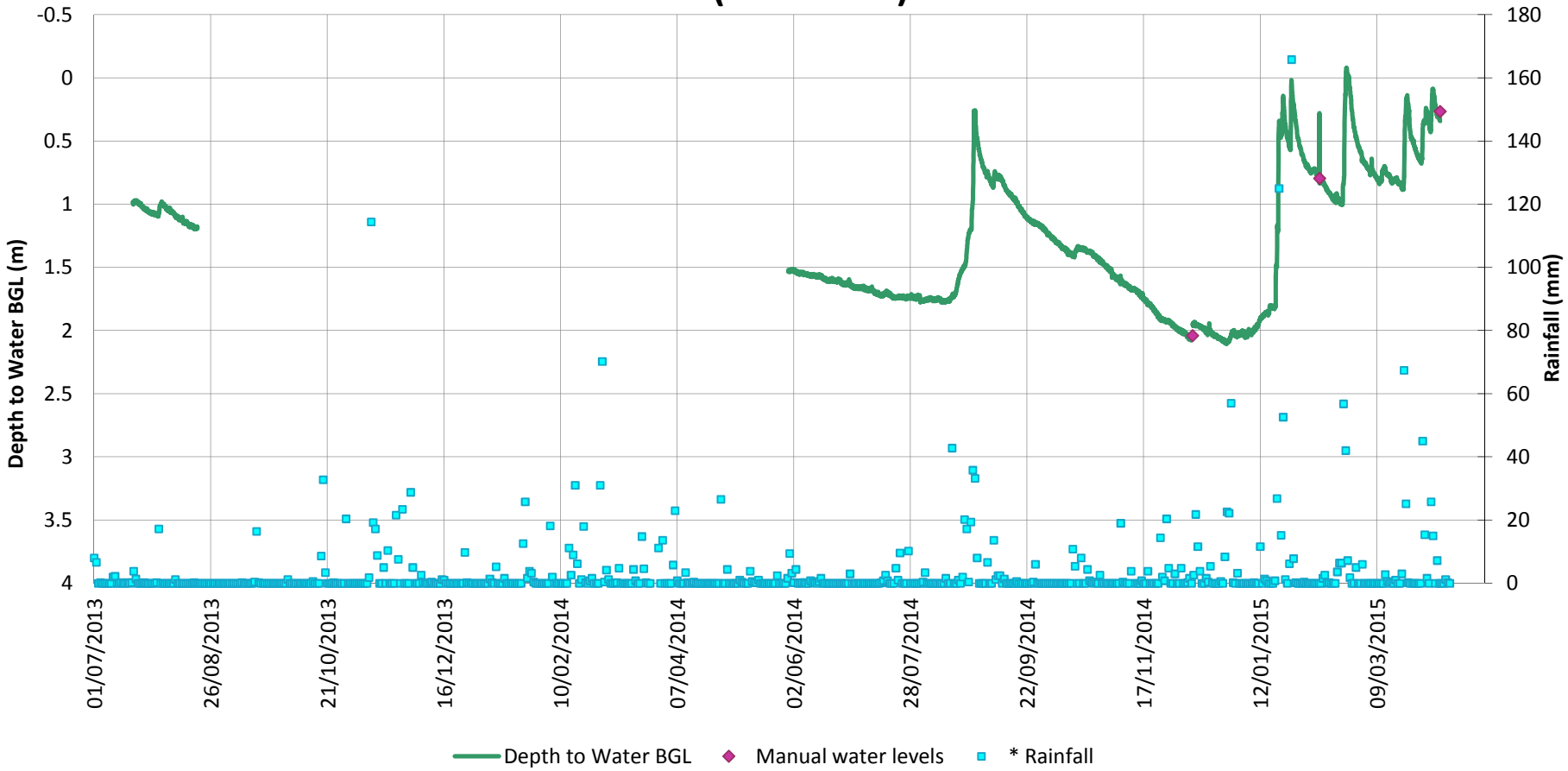


Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10229626	
Date	14/04/2015		BH ID	A-BH3103	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-3

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW04 (A-BH3104) Water Level BGL



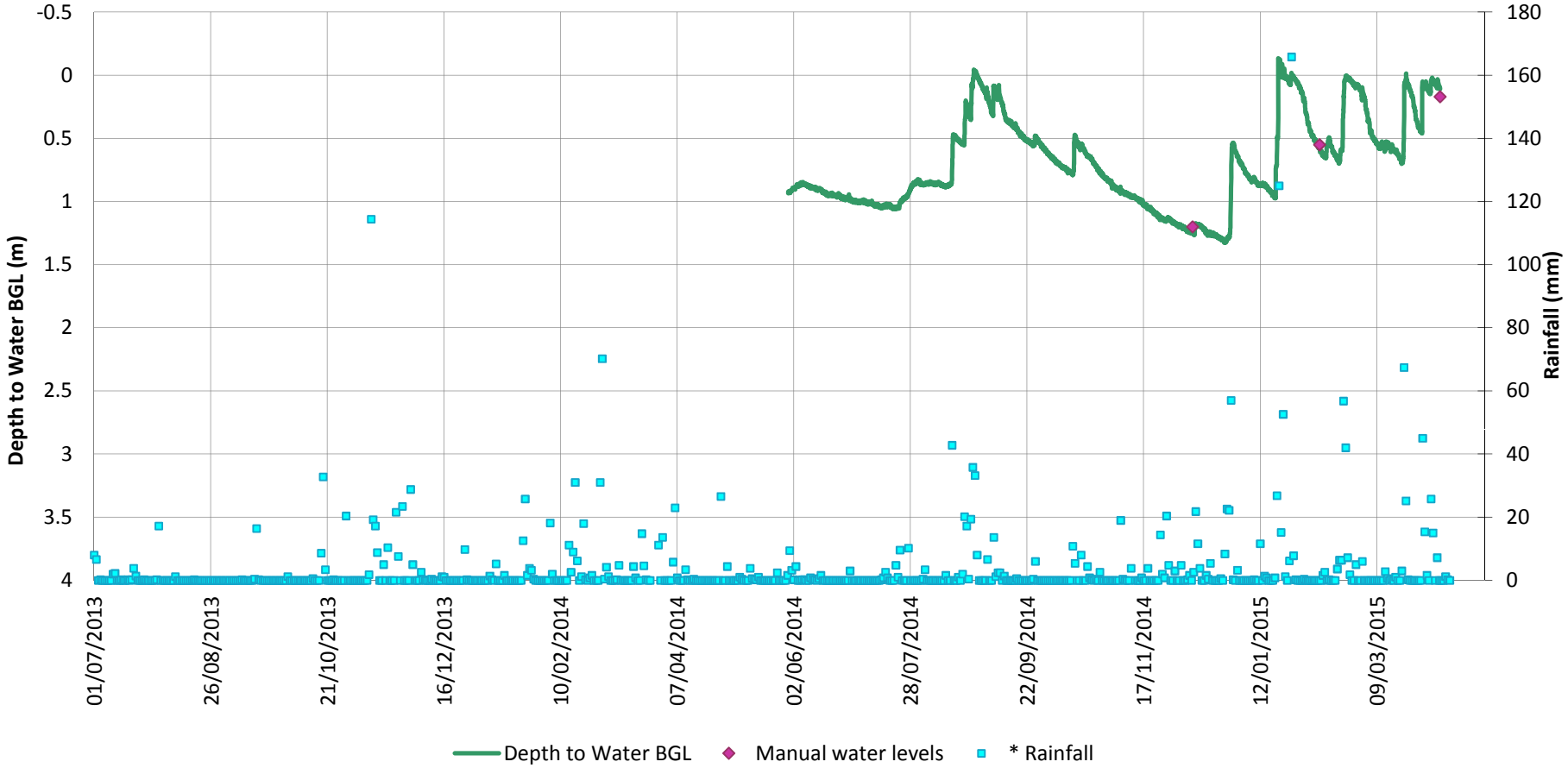
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10229629	
Date	14/04/2015		BH ID	A-BH3104	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-4

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW05 (A-BH3105) Water Level BGL



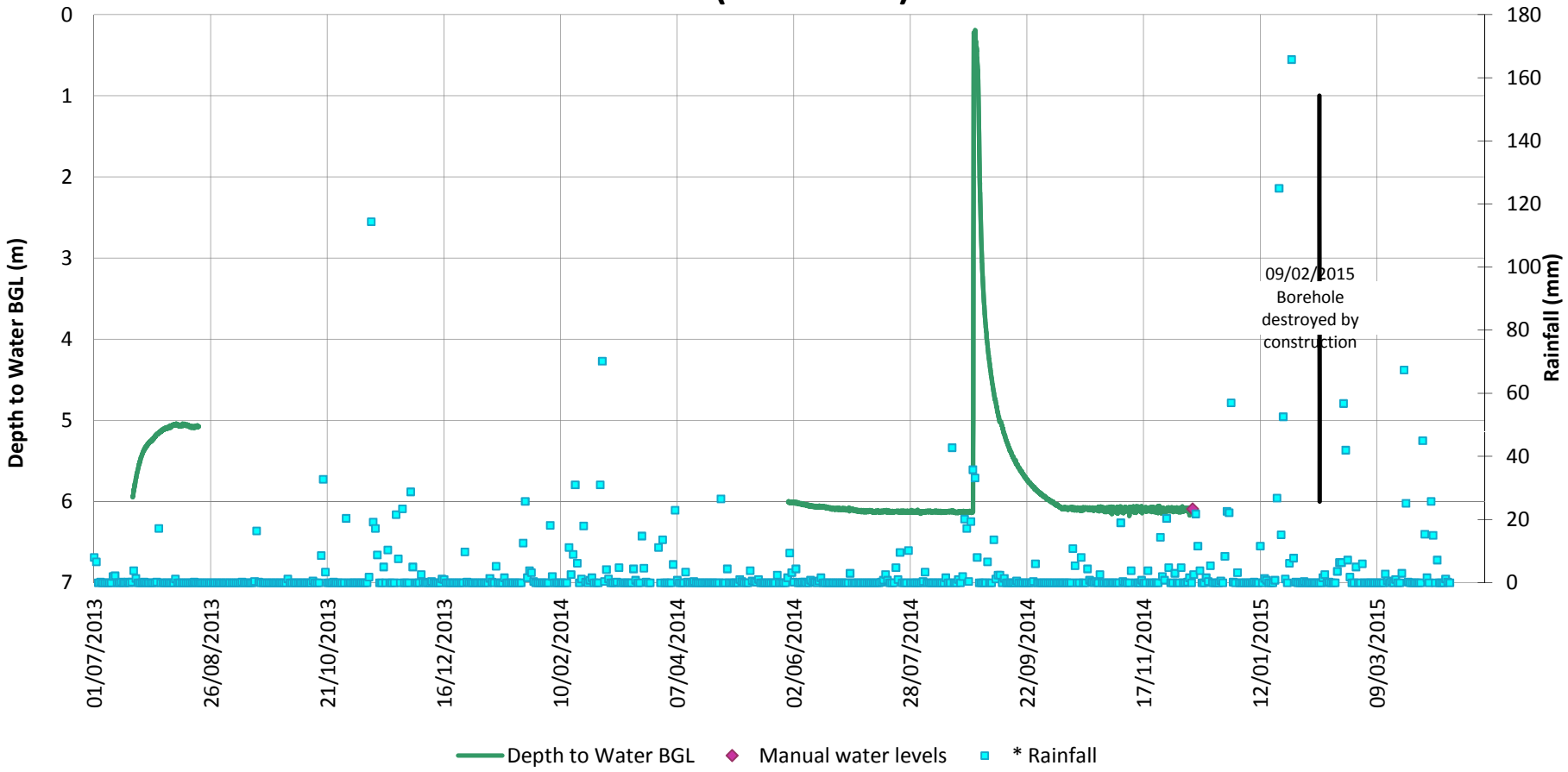
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262196	
Date	14/04/2015		BH ID	A-BH3105	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-5

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW06 (A-BH3106) Water Level BGL



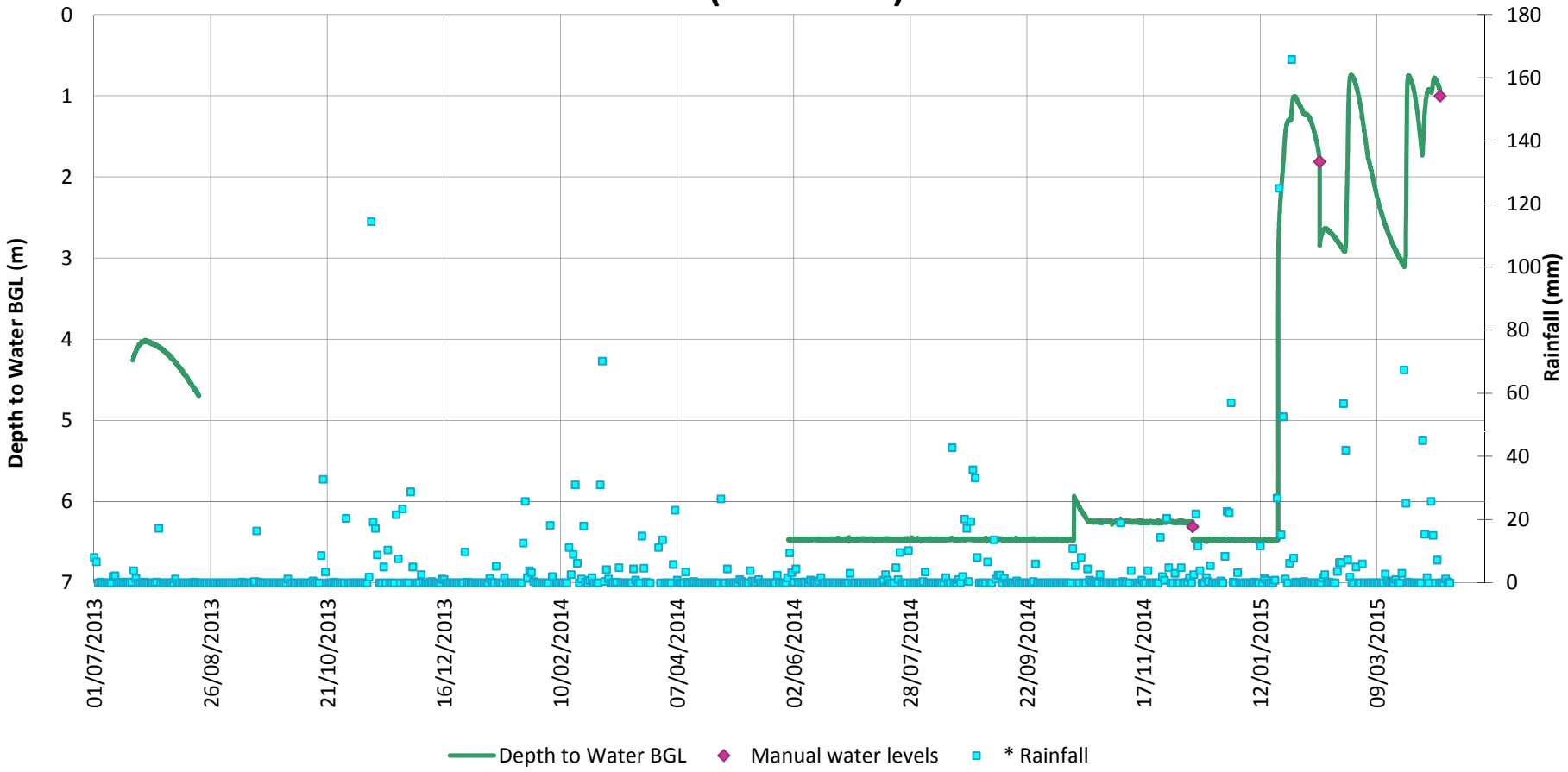
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10229628	
Date	14/04/2015		BH ID	A-BH3106	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-6

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW07 (A-BH3107) Water Level BGL



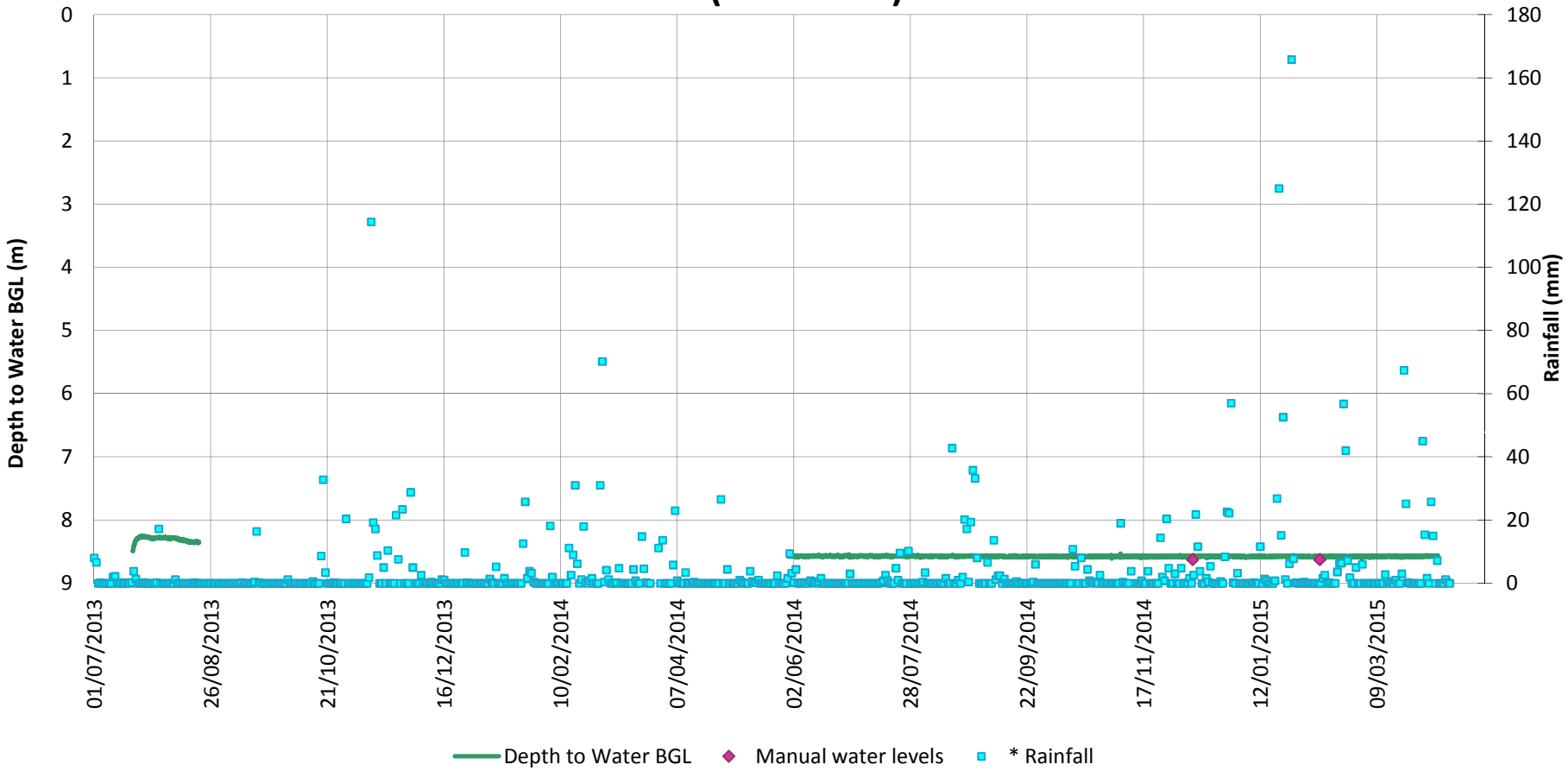
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10229627	
Date	14/04/2015		BH ID	A-BH3107	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-7

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW09 (B-BH3102) Water Level BGL



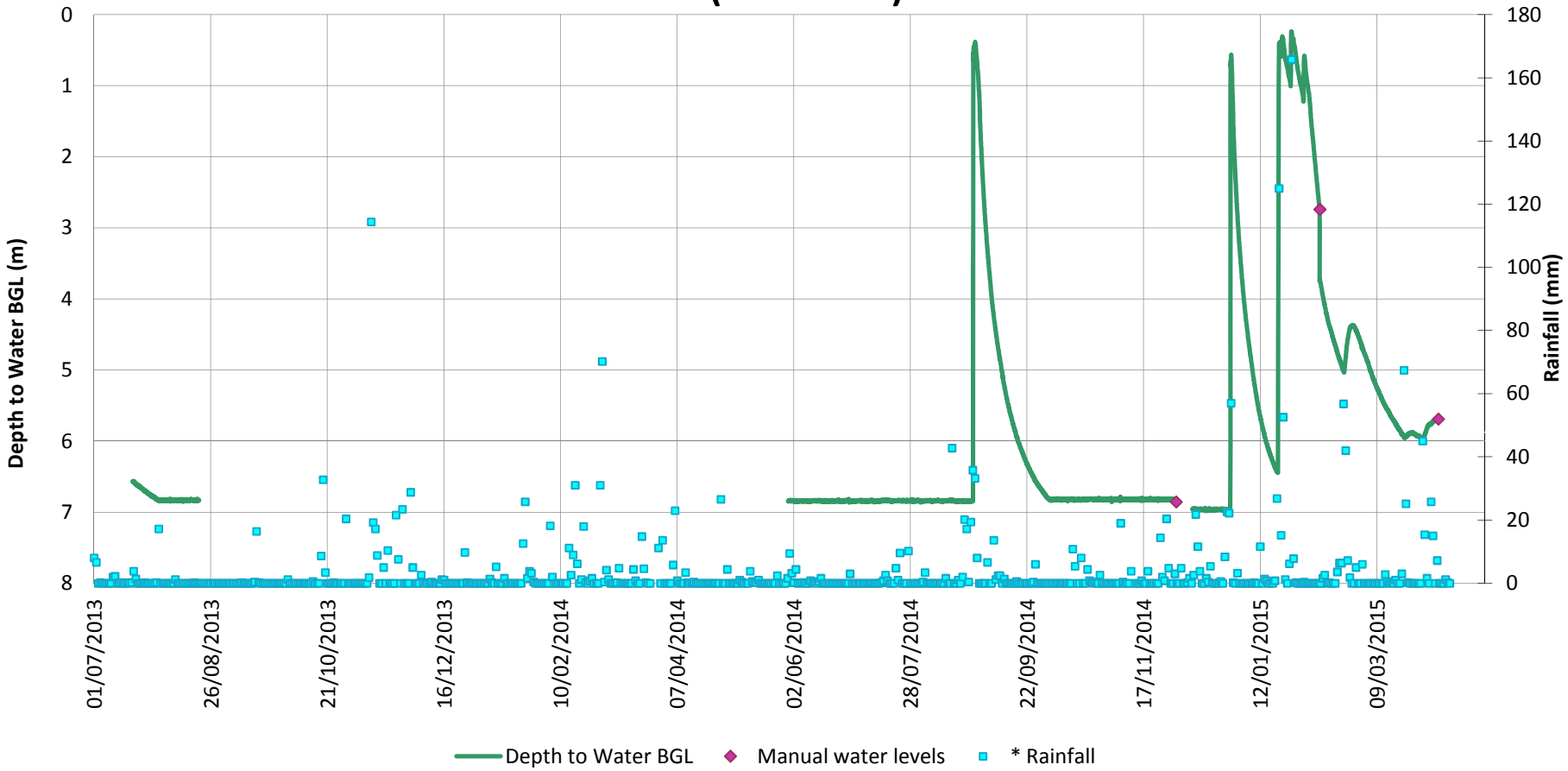
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262198	
Date	14/04/2015		BH ID	B-BH3102	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-8

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW10 (B-BH3103) Water Level BGL



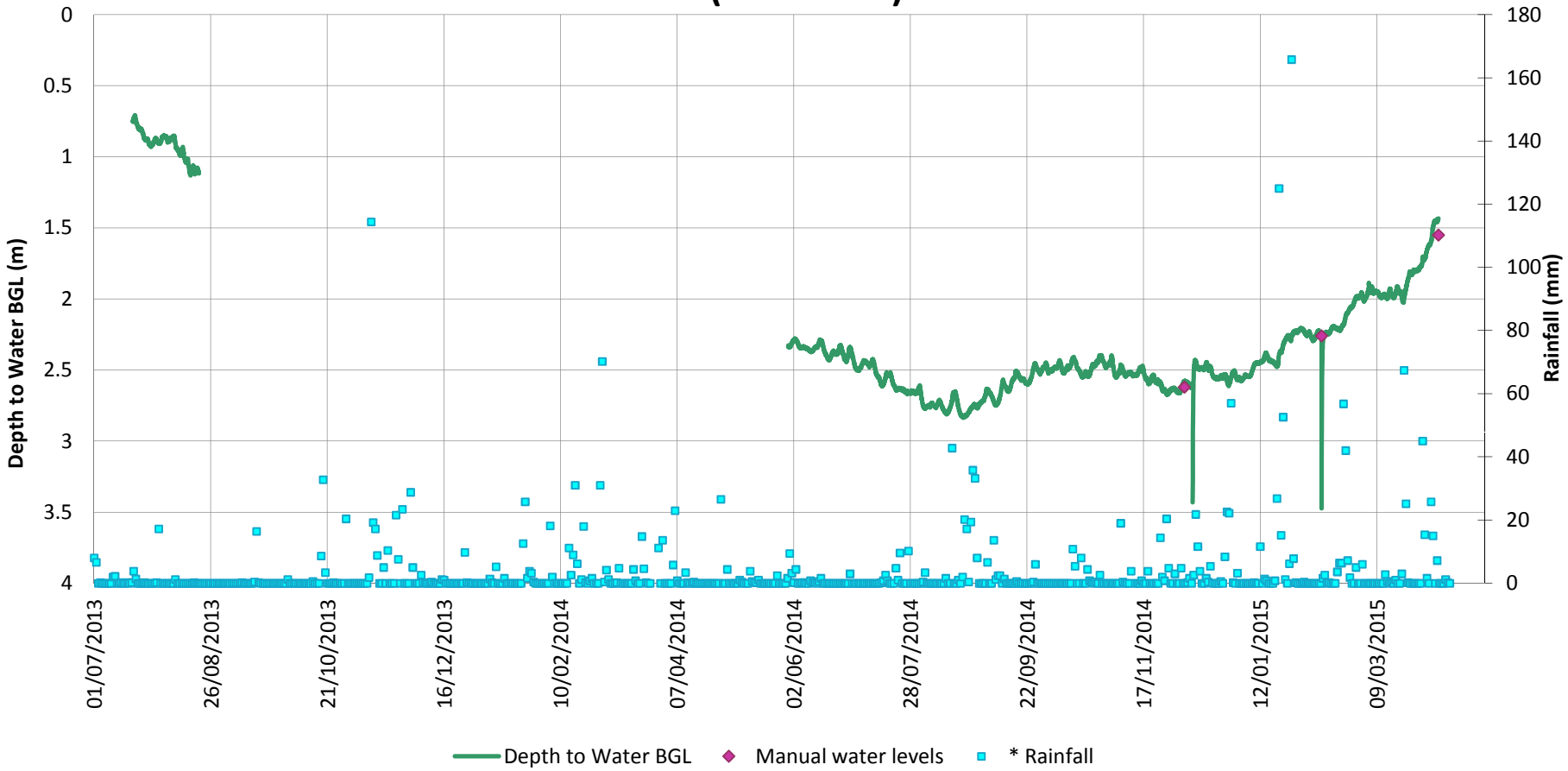
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10238337	
Date	14/04/2015		BH ID	B-BH3103	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-9

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW11 (B-BH3104) Water Level BGL



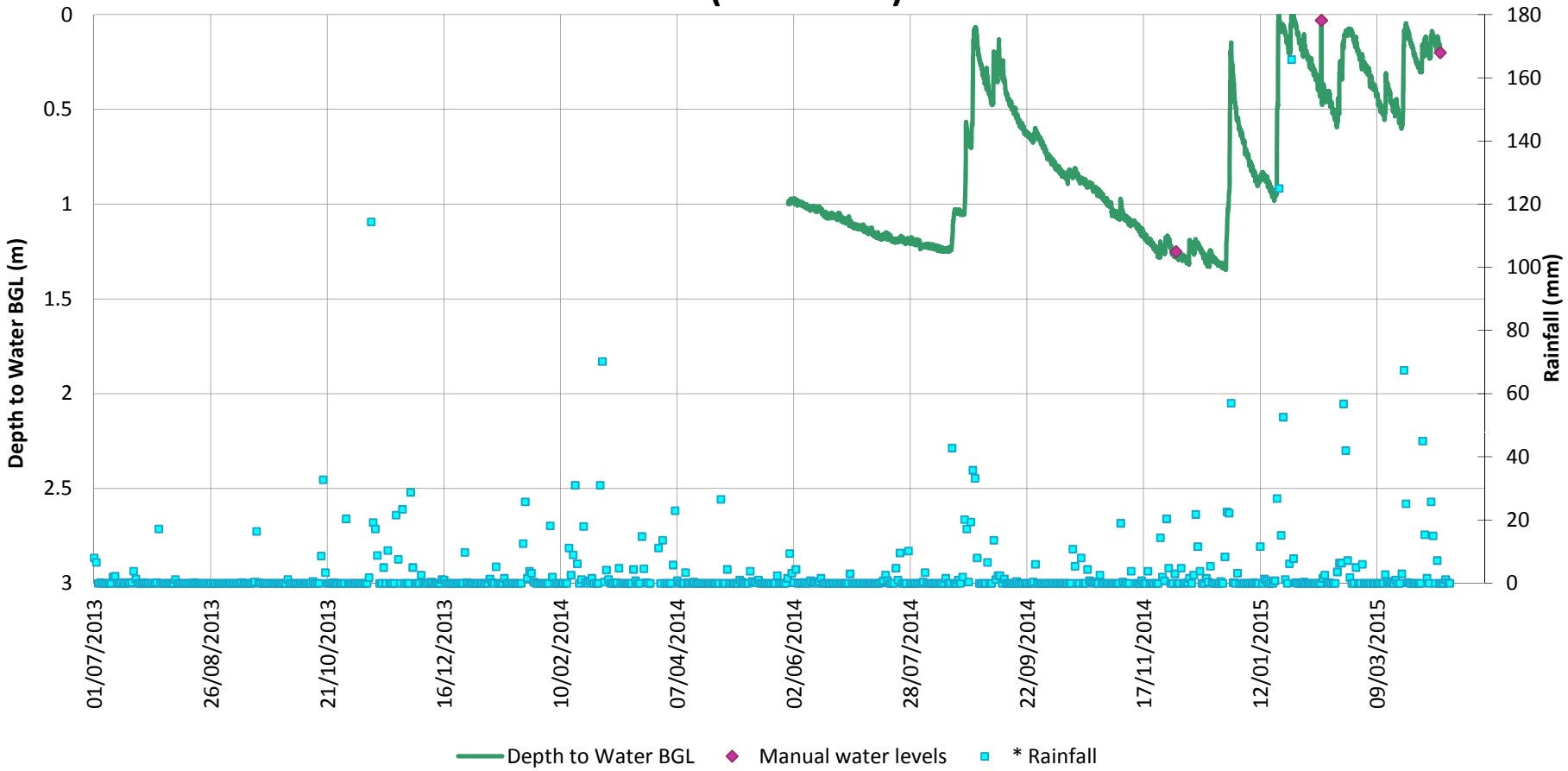
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10224040	
			BH ID	B-BH3104	
Date	14/04/2015		Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-10

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW12 (B-BH3105) Water Level BGL



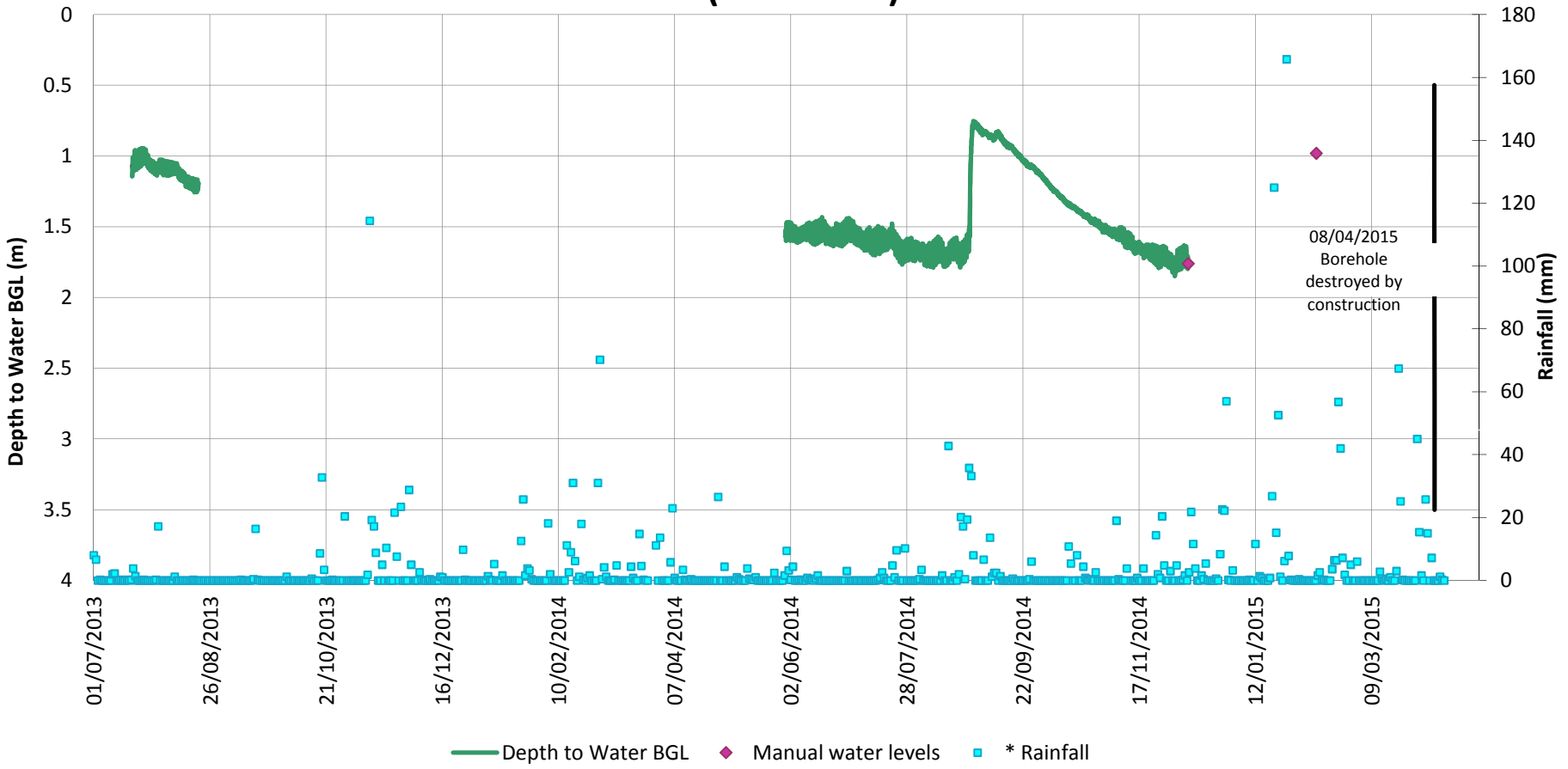
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262196	
			BH ID	B-BH3105	
Date	14/04/2015		Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-11

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW13 (B-BH3106) Water Level BGL



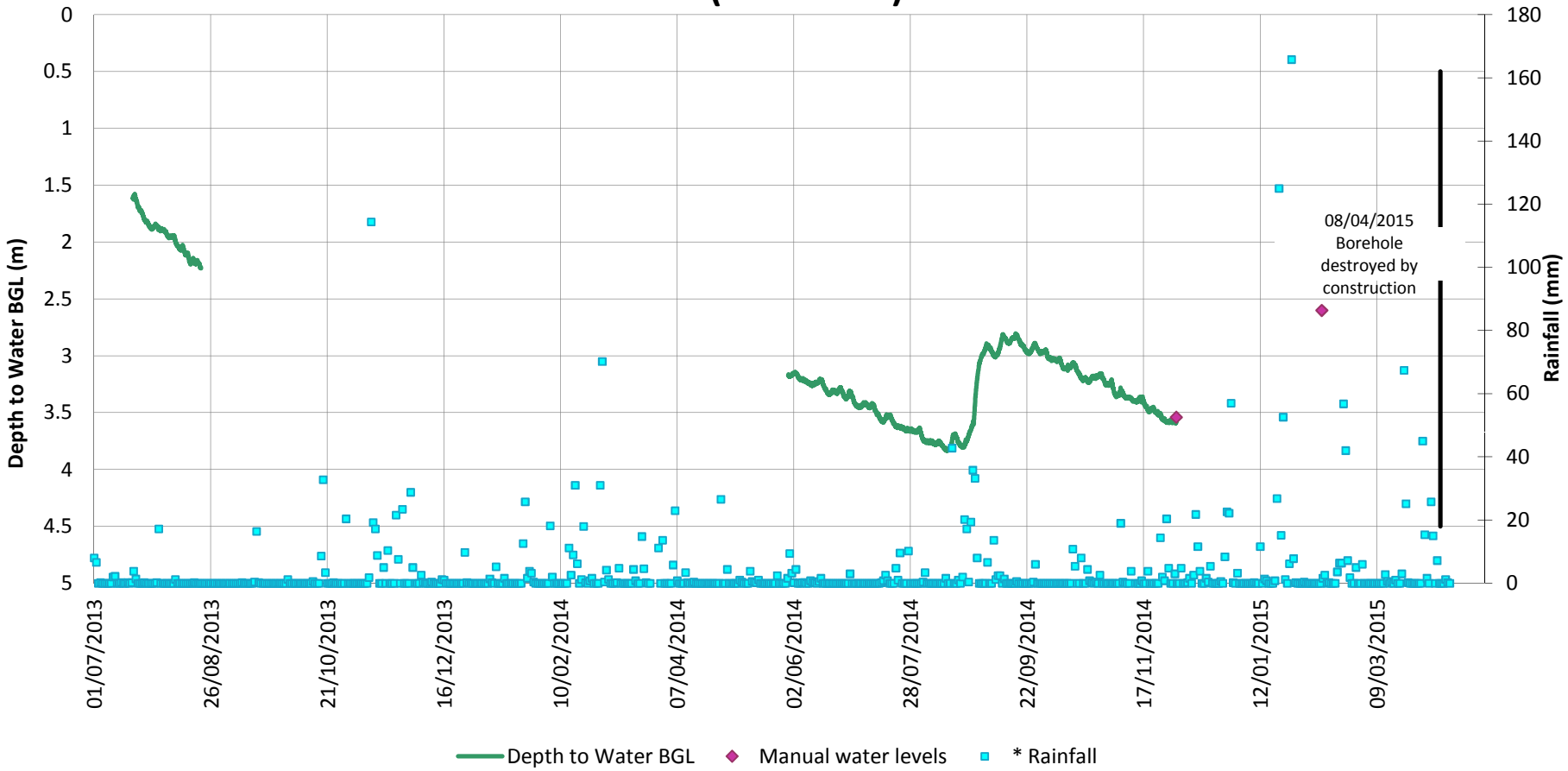
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10280411	
			BH ID	B-BH3106	
Date	14/04/2015		Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-12

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW14 (B-BH3107) Water Level BGL



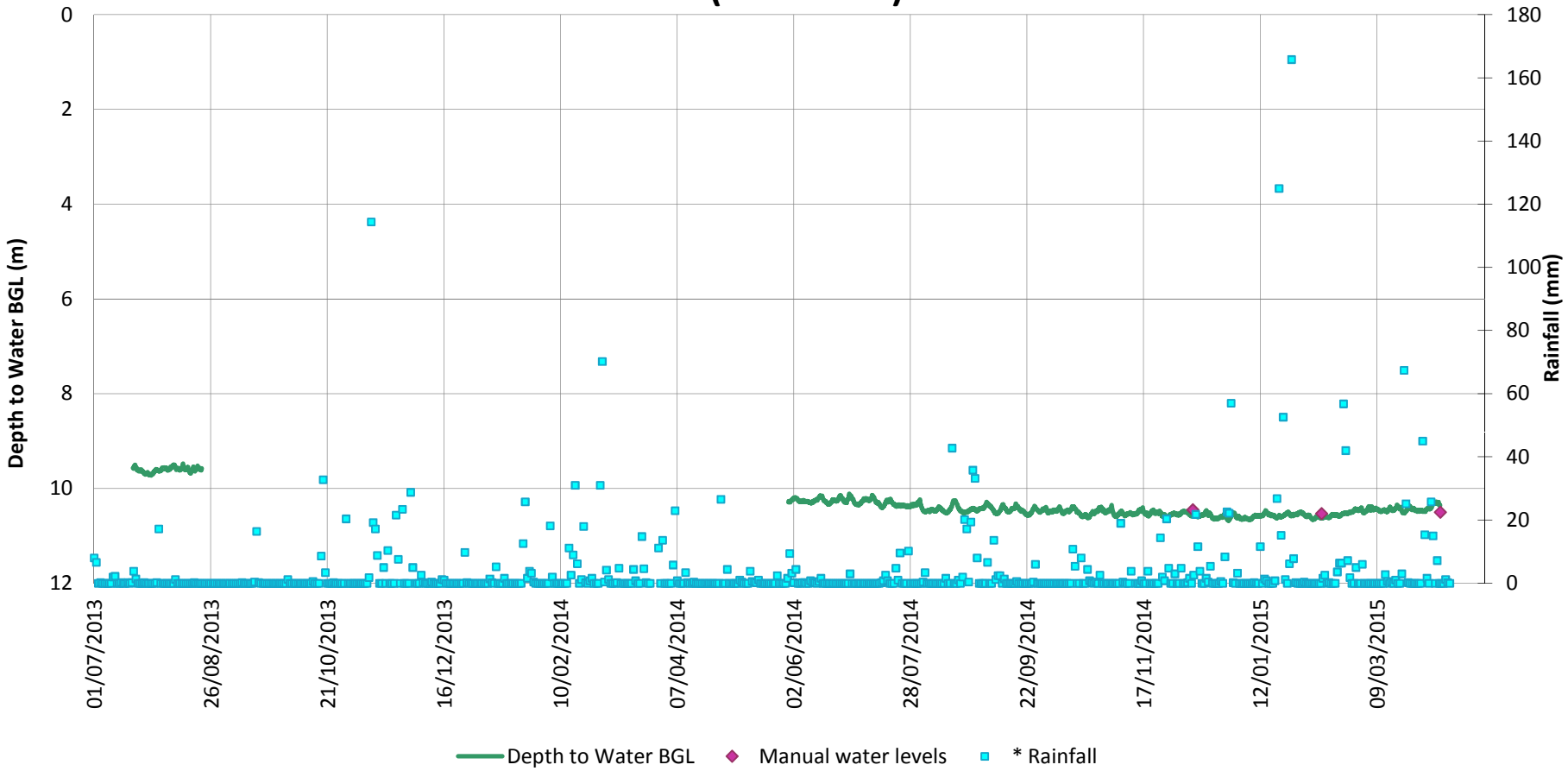
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10238338	
			BH ID	B-BH3107	
Date	14/04/2015		Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-13

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW15 (B-BH3108) Water Level BGL



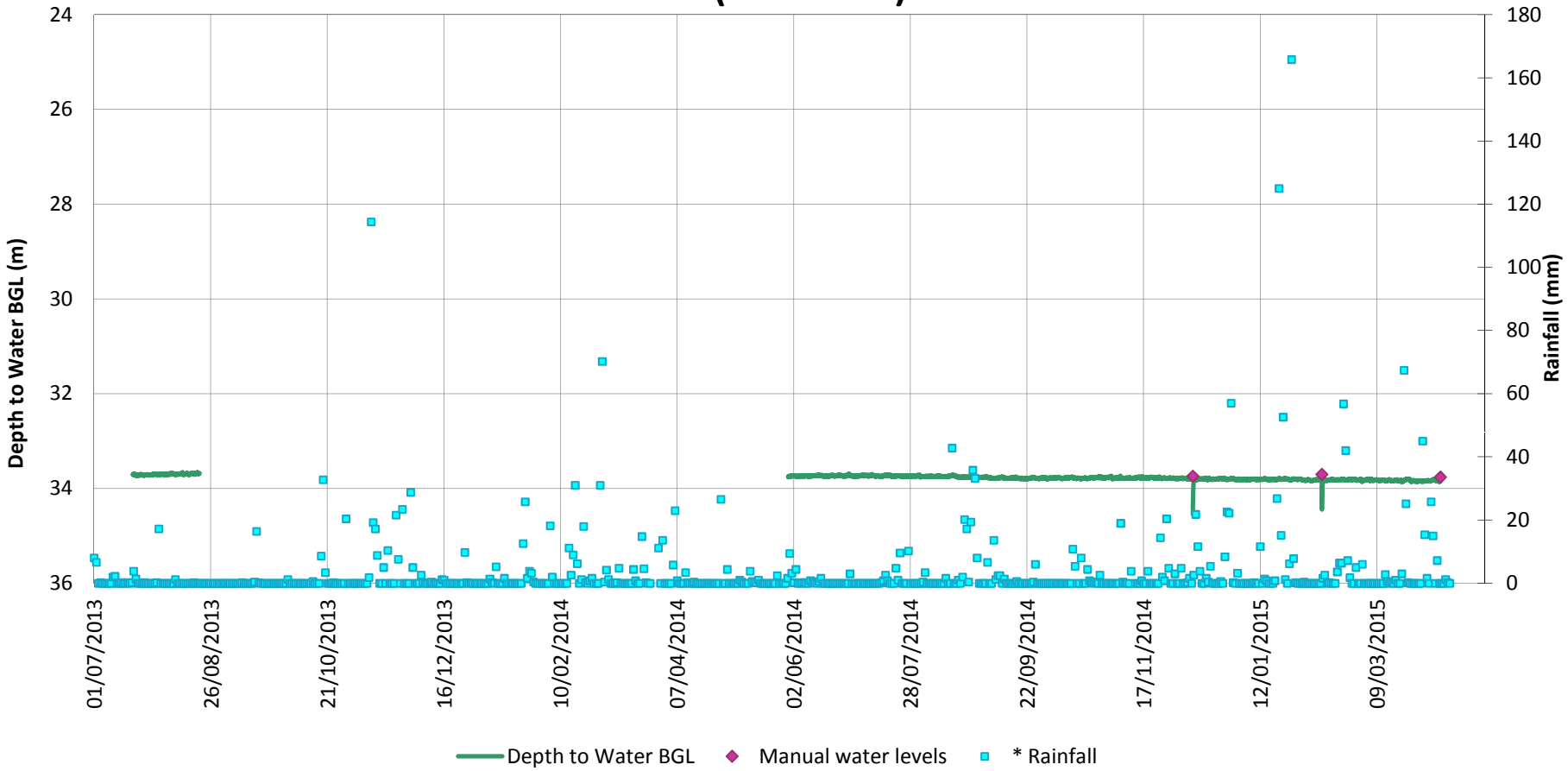
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10238352	
			BH ID	B-BH3108	
Date	14/04/2015		Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-14

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW18 (C-BH3102) Water Level BGL



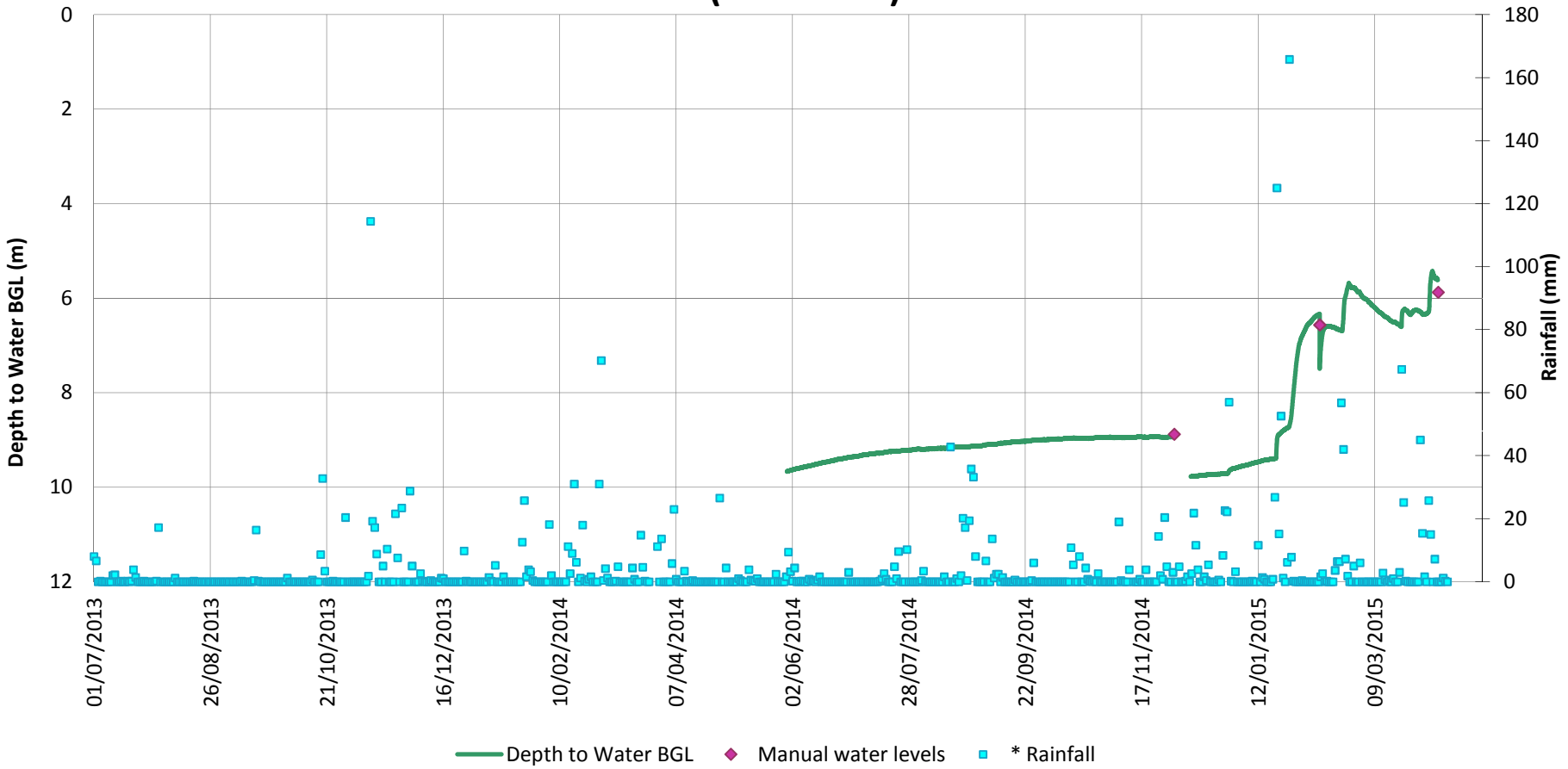
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N10262195	
			BH ID	C-BH3102	
Date	14/04/2015		Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-15

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW19 (C-BH3103) Water Level BGL



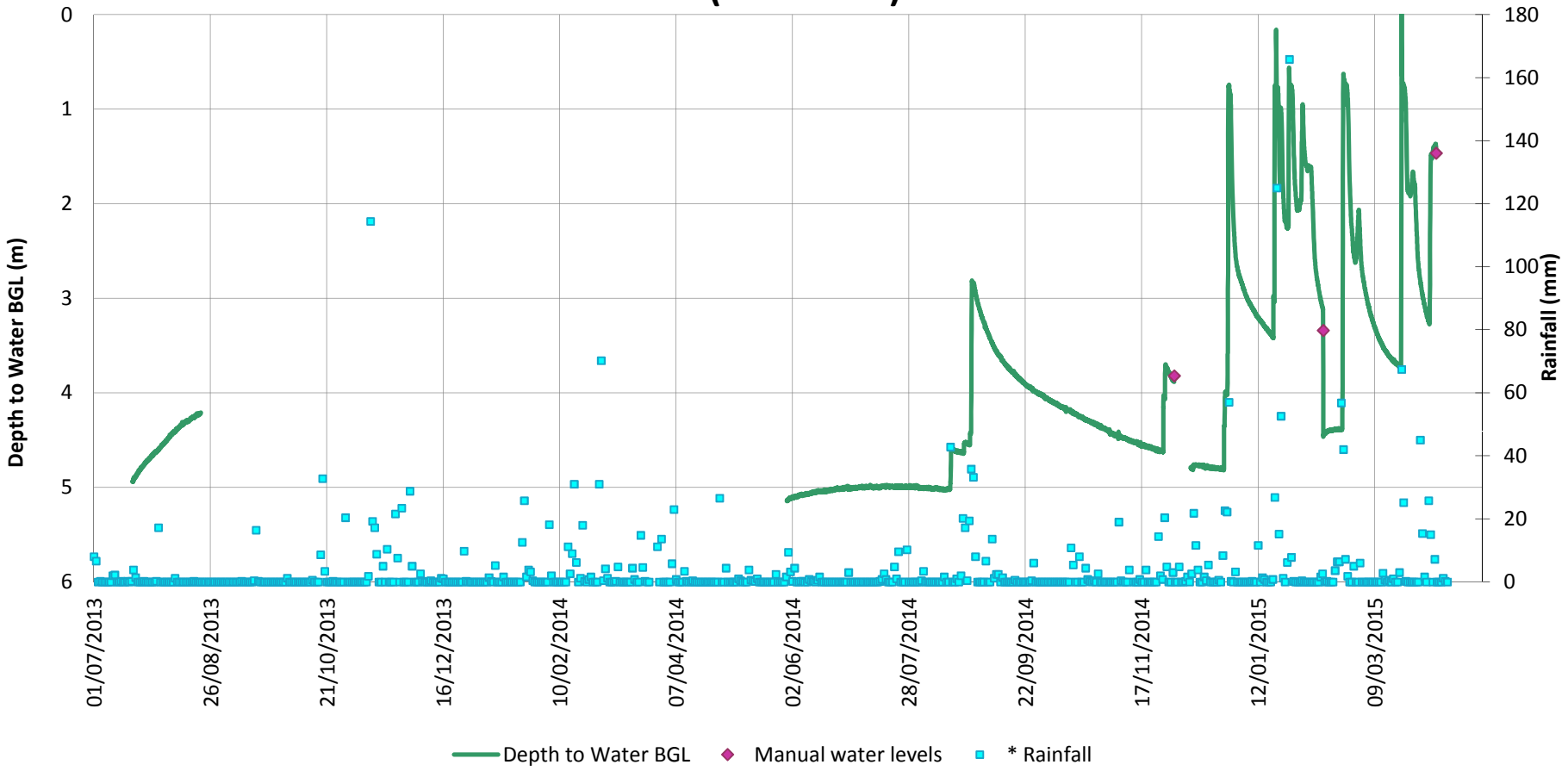
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N10262199	
			BH ID	C-BH3103	
Date	14/04/2015		Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-16

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW21 (C-BH3105) Water Level BGL



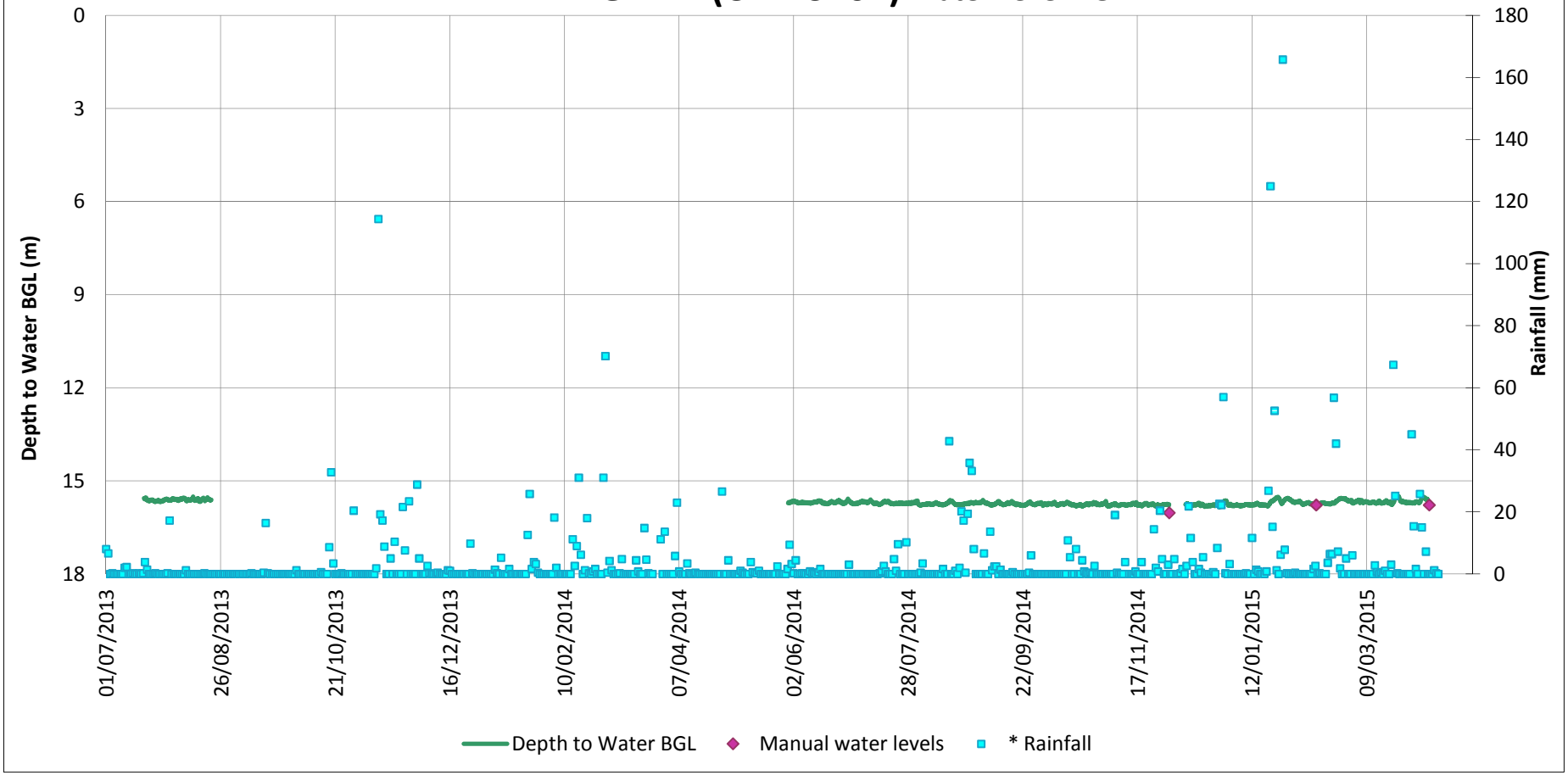
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10280416	
			BH ID	C-BH3105	
Date	14/04/2015		Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-17

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW22 (C-BH3107) Water Level BGL

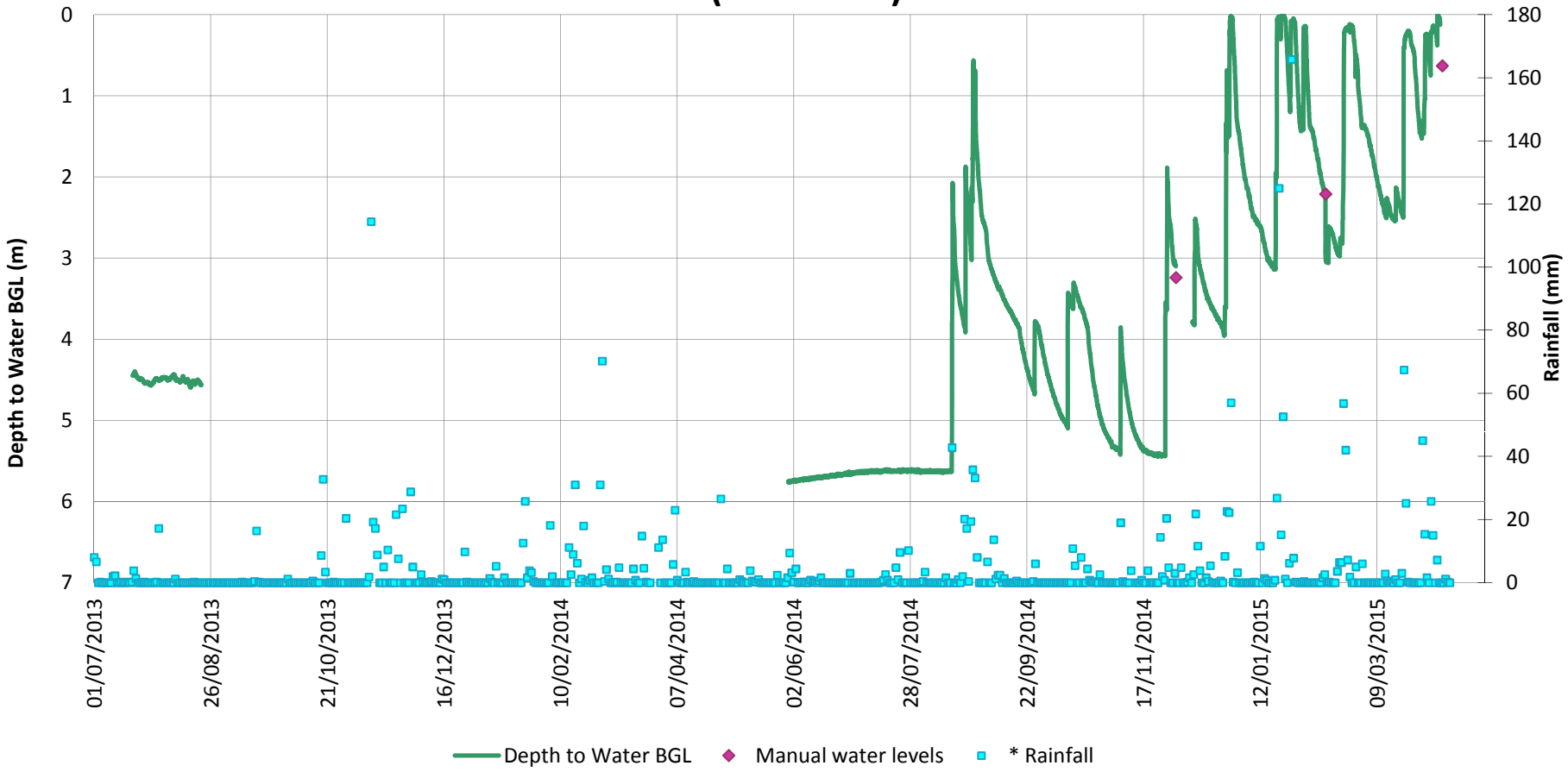


Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10280407	
Date	14/04/2015		BH ID	C-BH3107	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-18

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW23 (C-BH3106) Water Level BGL



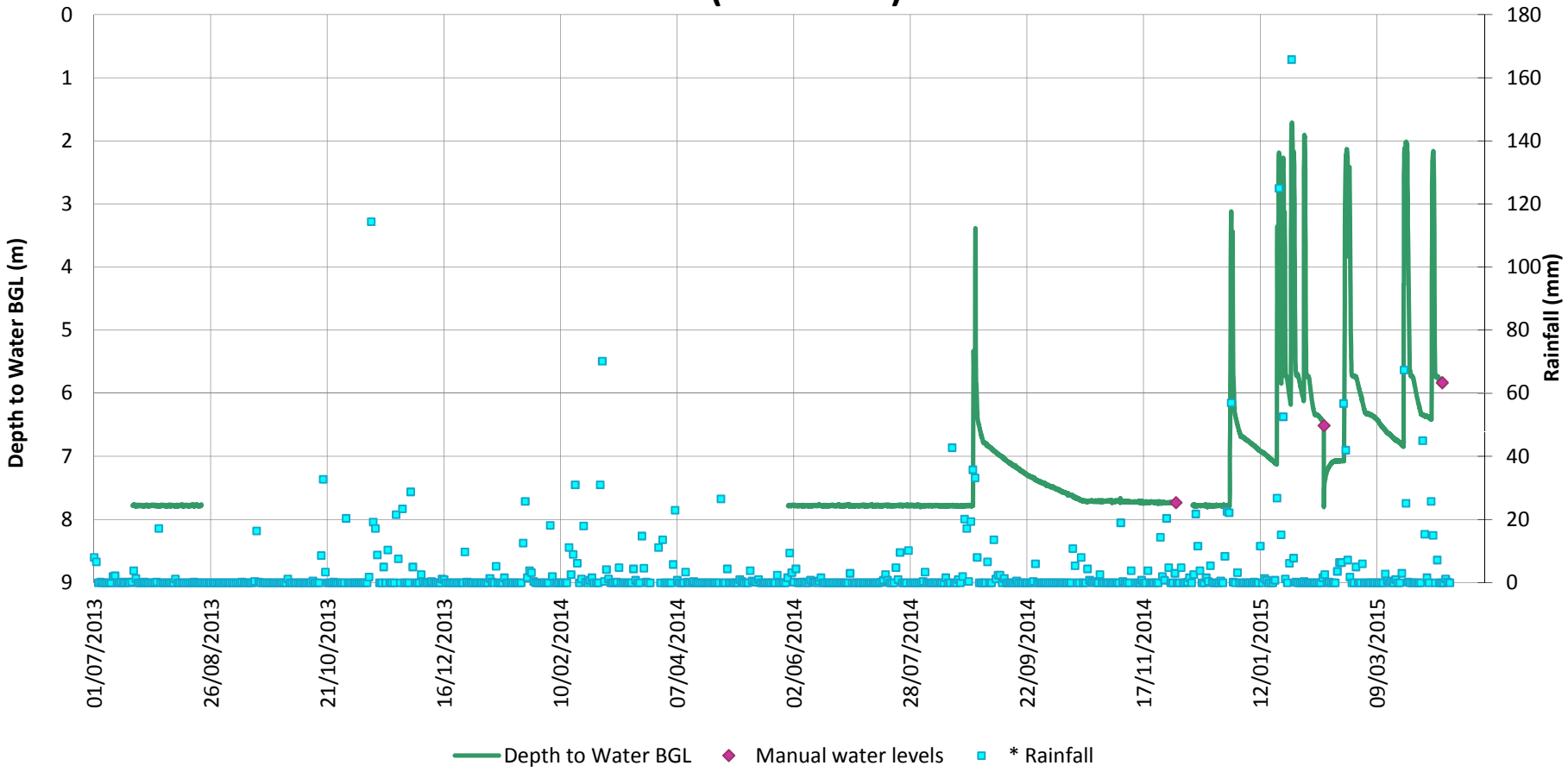
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262202	
Date	14/04/2015		BH ID	C-BH3106	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-19

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW24 (C-BH3108) Water Level BGL



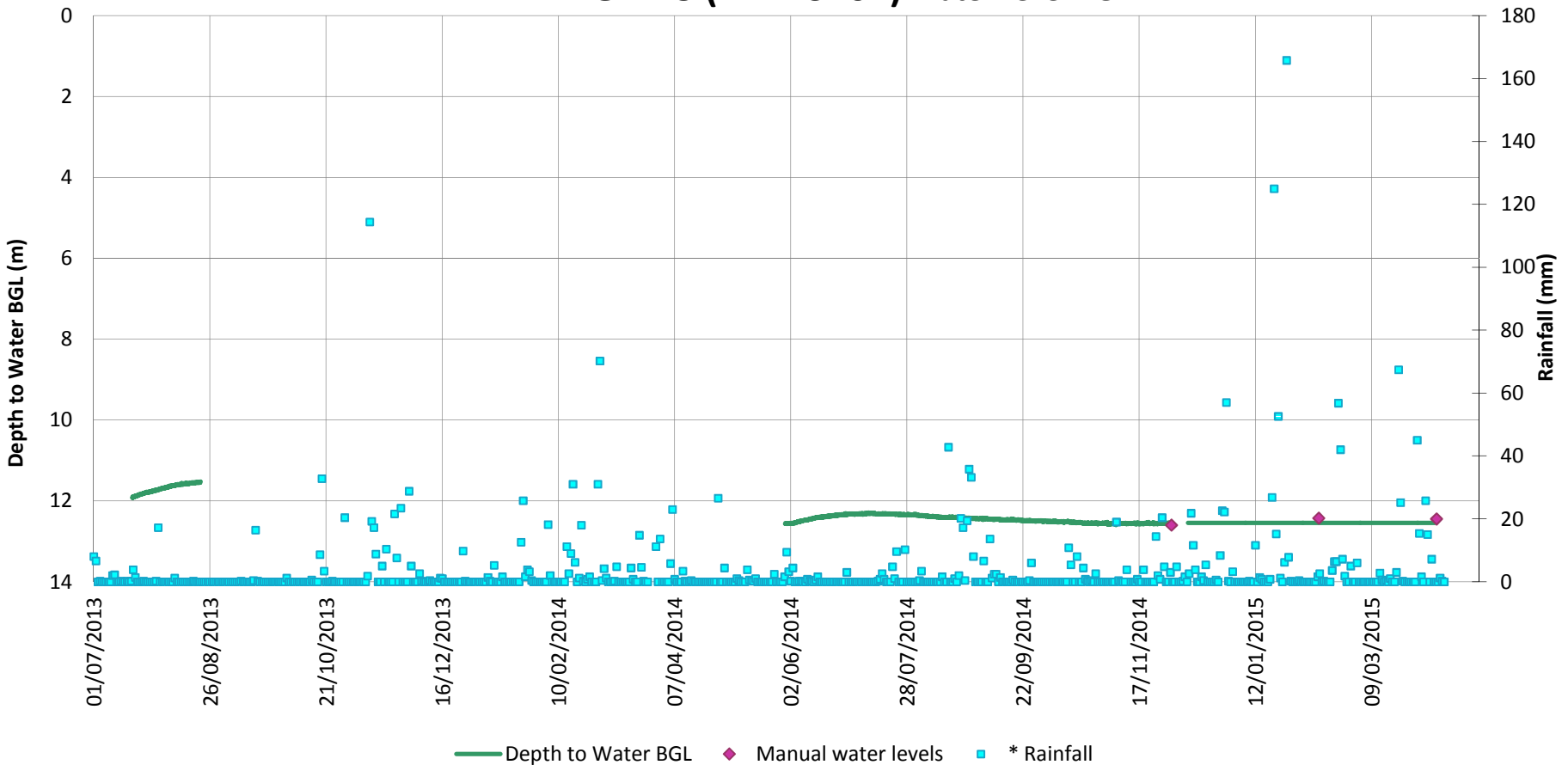
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262197	
			BH ID	C-BH3108	
Date	14/04/2015		Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-20

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW25 (D-BH3101) Water Level BGL

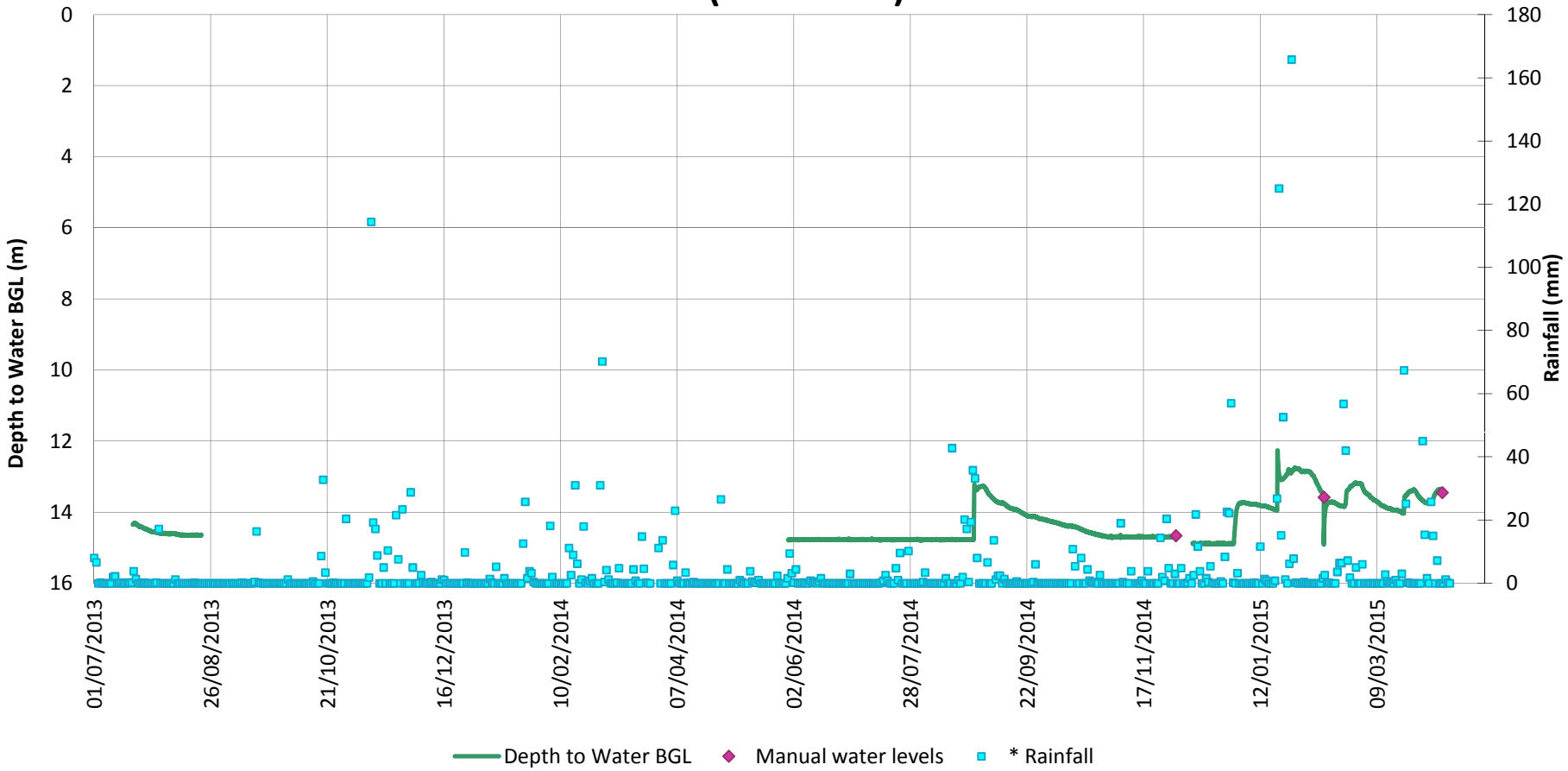


Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262203	
Date	14/04/2015		BH ID	D-BH3101	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-21

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW26 (D-BH3106) Water Level BGL



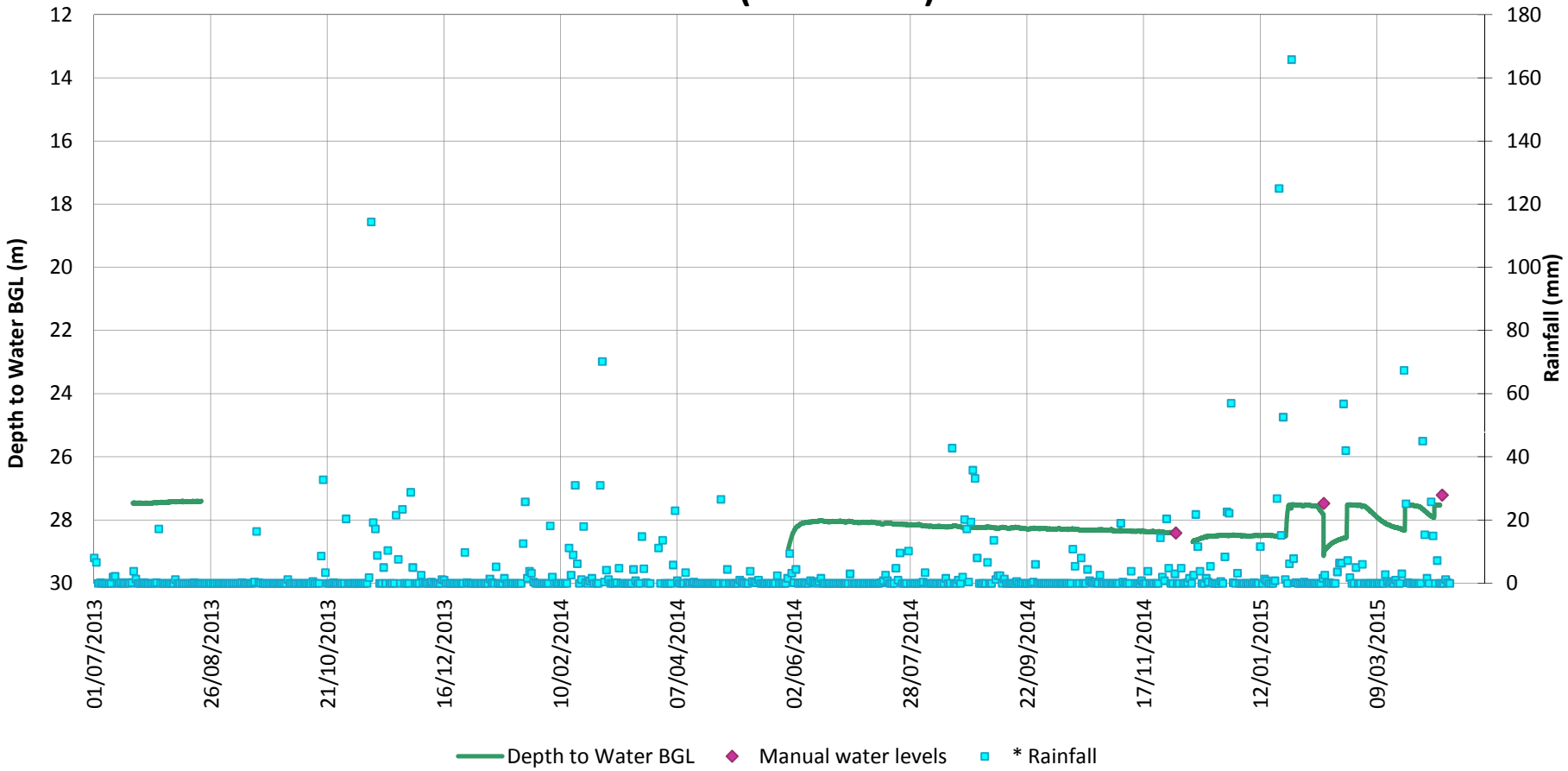
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262194	
Date	14/04/2015		BH ID	D-BH3106	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-22

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW27 (D-BH3102) Water Level BGL



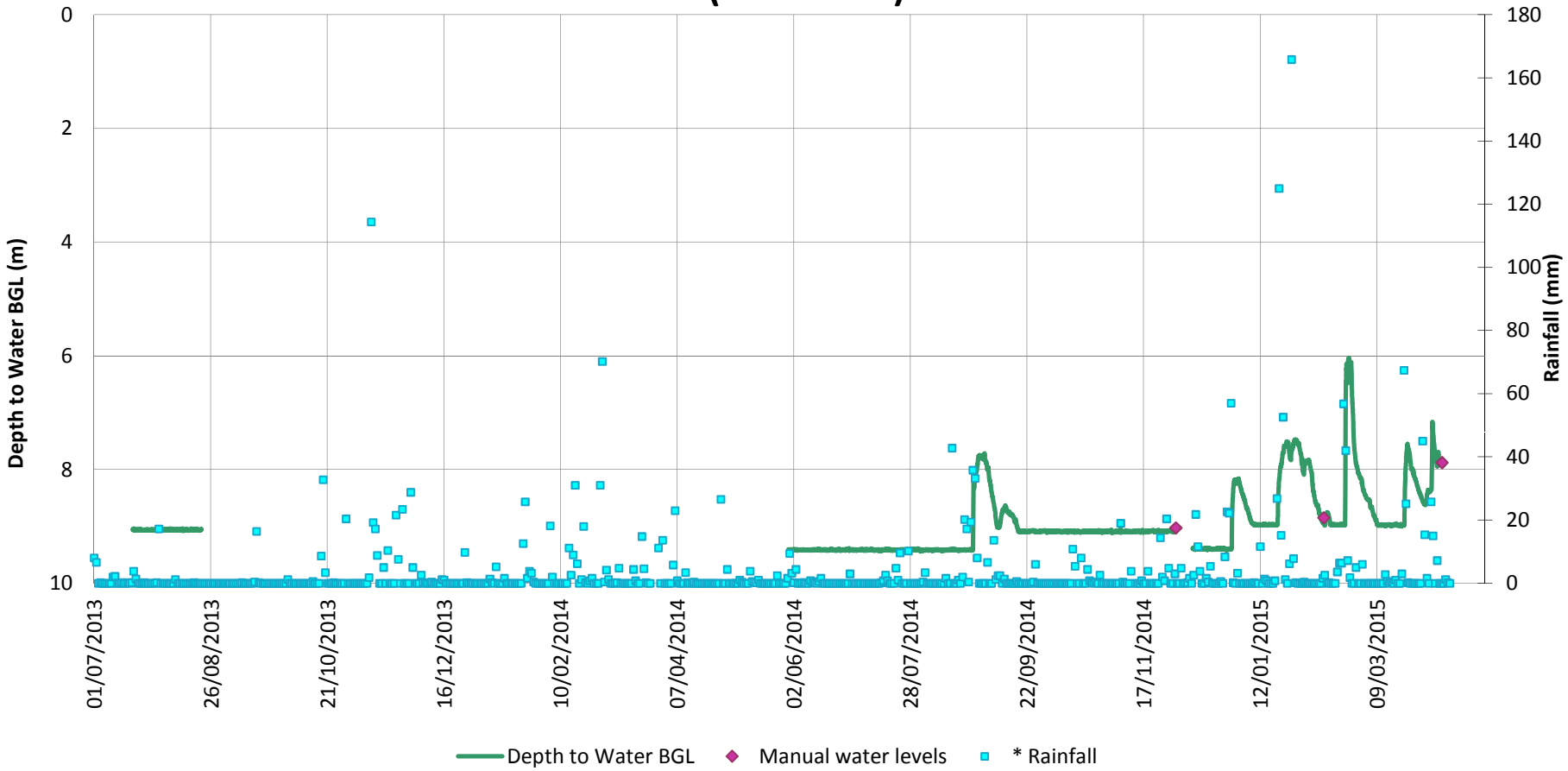
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262200	
			BH ID	D-BH3102	
Date	14/04/2015		Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-23

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW28 (D-BH3103) Water Level BGL



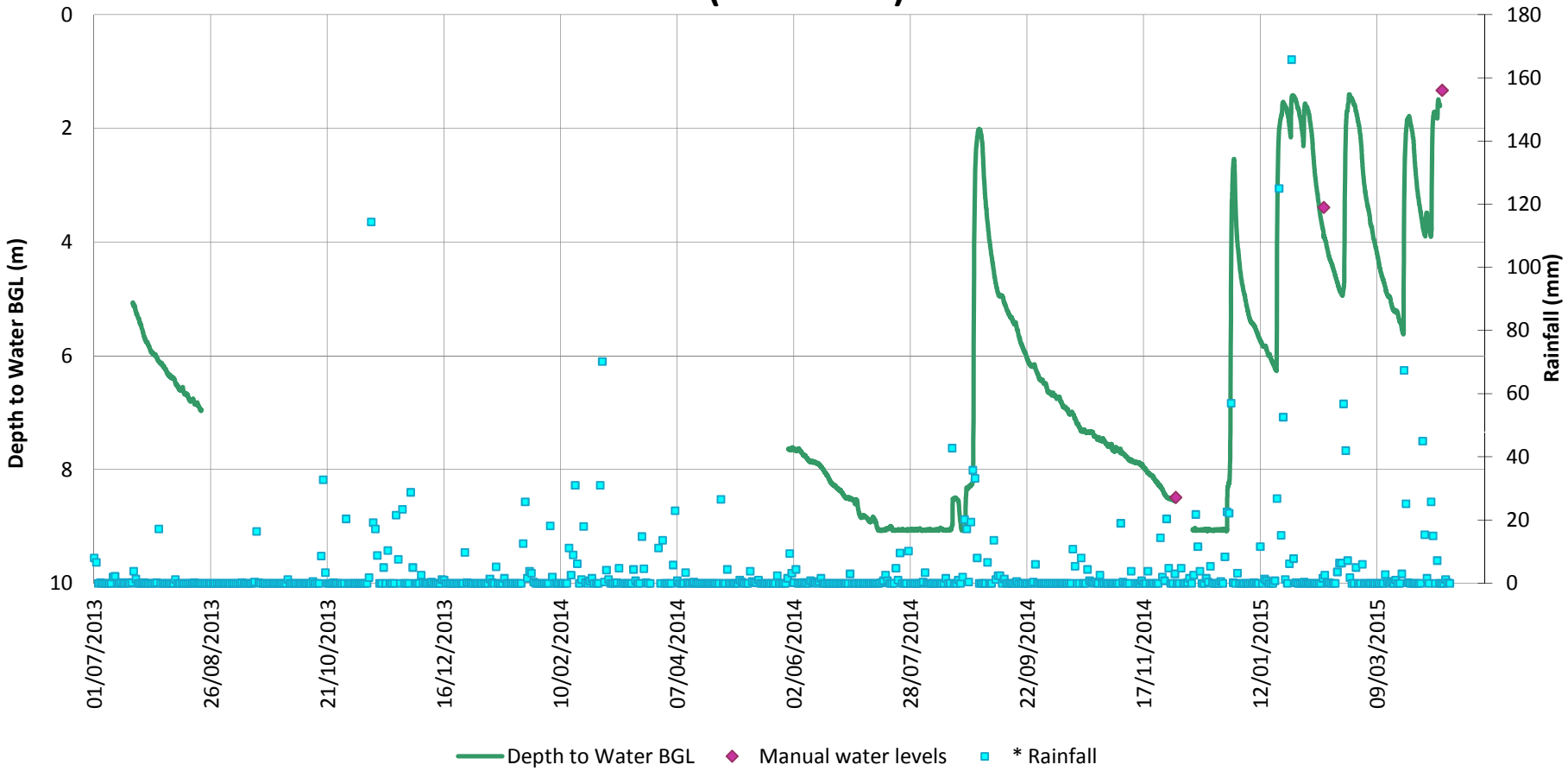
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262205	
Date	14/04/2015		BH ID	D-BH3103	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-24

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW29 (D-BH3104) Water Level BGL



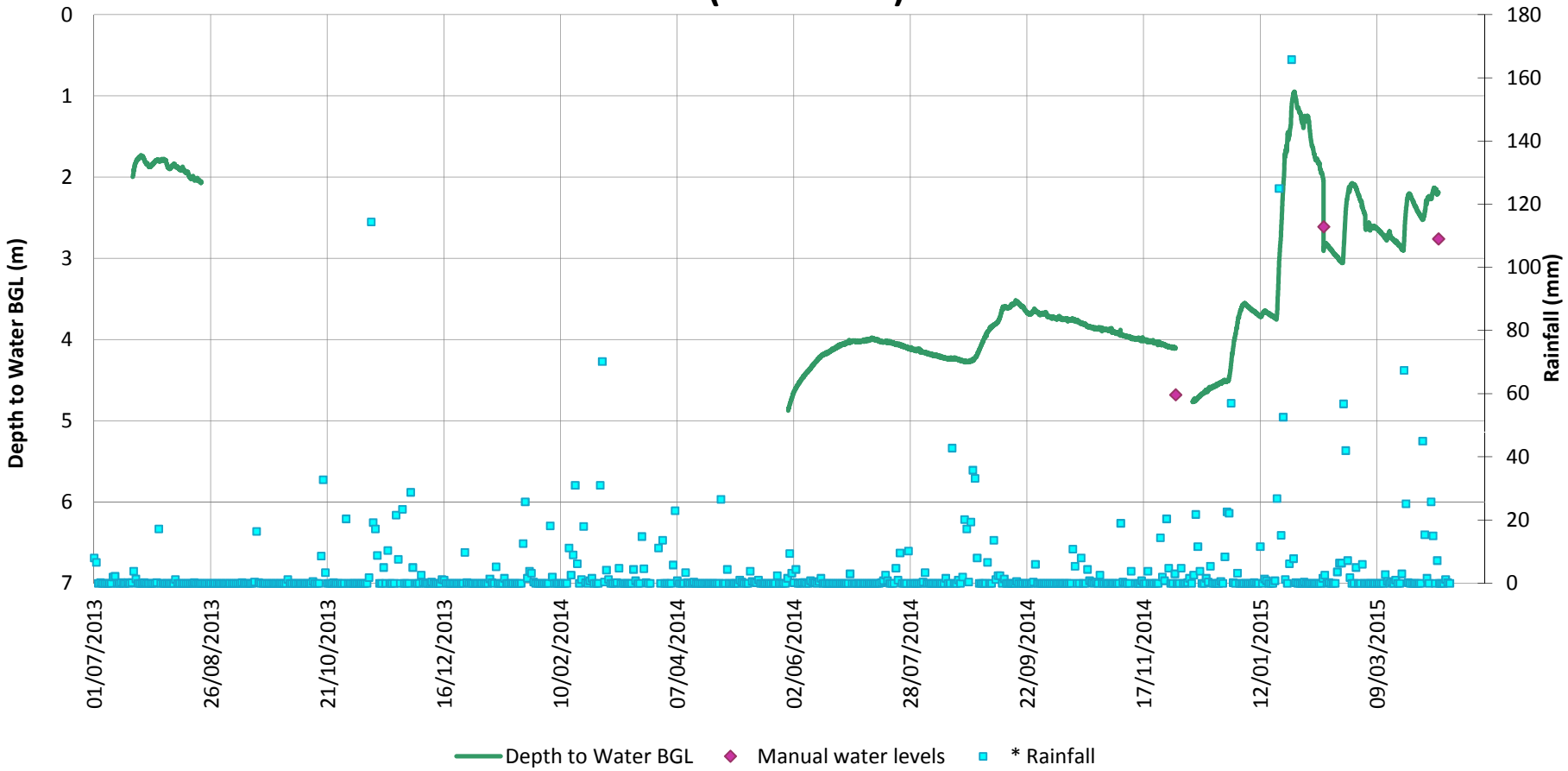
Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262201	
Date	14/04/2015		BH ID	D-BH3104	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-25

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

HW10 Pacific Hwy; Oxley Hwy to Kempsey

GW30 (D-BH3105) Water Level BGL



Drawn	KF	Transport Roads & Maritime Services	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262193	
Date	14/04/2015		BH ID	D-BH3105	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-26

Groundwater sample taken at time of manual water levels BGL = below ground level (existing)

* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)