

# **Foxground and Berry Bypass** Periodic and Pre-Operational Construction Compliance Status Report

Report 7  
1 October 2017 – 31 March 2018



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## Appendices

Appendix A	Project Approval Compliance Table
Appendix B	Surface Water Quality Monitoring Reports
Appendix C	Air Quality Monitoring Results
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**Details of Revision and Amendment:**

**Document Control**

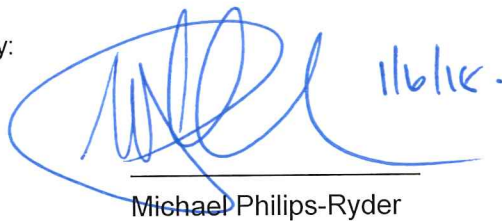
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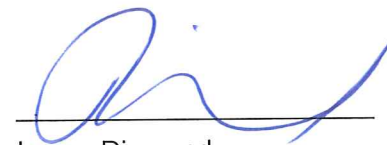
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6	Department of Planning & Environment	31/05/2018	Michael Young

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Michael Philips-Ryder  
Project Director



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## Amendment

Each new revision to the report will be distributed to all registered copyholders with an instruction that the superseded copy be destroyed or marked as superseded.

The revision number is included at the end of the document number, which is noted on each page. When amendments occur, the document or relevant section will be reissued with the revision number updated accordingly.

The Project Manager or Environmental Manager will approve amendments by initial in the Approval column below.

The following provides a record of amendments made to this document:

Revision	Date	Description	Page	Prepared by	Approved
0	4/05/2018	Draft submitted for approval to RMS & ER	All	James Diamond	James Diamond
1	8/05/2018	Updated with ER & RMS comments	All	James Diamond	James Diamond
2	31/05/2018	Final submitted		James Diamond	James Diamond

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## Abbreviations

CEMP	Construction Environmental Management Plan
CPESC	Certified professional in erosion and sediment control
CTP	Compliance Tracking Program
EMS	Environmental Management System
EPA	Environment Protection Authority
EP&A Act	Environmental Planning and Assessment Act 1979
EPL	Environment Protection Licence
ER	Environmental Representative
DP&E	Department of Planning and Environment MCoA
NBN	National Broadband Network
NSW	New South Wales
POEO Act	Protection of the Environment Operations Act 1997
OoW	Office of Water
PPR	Preferred Project Report
SEPP	State Environmental Planning Policy
SoC	Statement of Commitments
SWTC	Scope of Work and Technical Criteria
TMP	Traffic Management Plan
RBL	Rating Background Level
ROL	Road Occupancy Licence
NCR	Non-conformance report

## 1 Introduction

The Foxground and Berry bypass will provide a four-lane divided highway (two lanes in each direction) with median separation for 11.6 kilometres of the Princes Highway between Toolijooa Road near Foxground and Schofields Lane south of Berry. The project crosses both Kiama and Shoalhaven local government areas.

Key concept design features include:

- Approximately 12.4 kilometres of new highway, including bypasses of the Foxground bends and the Berry township
- Interchanges at Toolijooa Road, Austral Park Road, Tindalls Lane and the northern and southern interchanges for Berry
- Junction arrangements at Schofields Lane and Gembrook Lane which enable both northbound and southbound access to the highway
- A cutting about 25 metres deep at Toolijooa Ridge, bypassing the Foxground bends
- Six lanes through the cutting at Toolijooa Ridge for a distance of 1.5 kilometres, providing two lanes and a climbing lane in each direction
- Three bridge crossings at Broughton Creek and a bridge at Berry
- An upgrade and extension of Austral Park Road
- A new roundabout at the junction of Woodhill Mountain Road and the existing Princes Highway
- A diversion of Town Creek into Bundewallah Creek
- Proposed local road closure at North Street
- Victoria Street to remain open with a two-way connection between Queen and Victoria streets and a southbound on-ramp south of Victoria Street
- New property accesses and access roads (left-in/left-out only for direct property access to the upgraded highway) and
- Wildlife crossings (rope bridges and underpasses) to maintain existing wildlife corridors.
- Benefits associated with the Project include:
  - Improving road safety on the Princes Highway and local road network
  - Reducing total crashes on the Princes Highway in the project area by an estimated 64 per cent
  - Improving road safety through less interaction between traffic and pedestrians in the town of Berry
  - Improving the efficiency of the Princes Highway between Toolijooa Road and Schofields Lane
  - Reducing travel time by an estimated seven (7) minutes
  - Supporting regional and local economic development
  - Improving flood immunity and
  - Improving wildlife crossings.

The project is being delivered through a 'design and construct' contract process. Fulton Hogan was appointed by RMS on 11 July 2014 to deliver the project.

Further details on the project background can be sourced from the project website at (<http://www.rms.nsw.gov.au/projects/south-coast/foxground-berry-bypass/index.html>)

## 1.1 Project environmental assessment and approval

The Foxground and Berry bypass, Princes Highway upgrade was approved by the NSW Minister for Planning and Infrastructure on 22 July 2013. The project has been assessed as a transitional project under Part 3A of the Environmental Planning and Assessment Act 1979 (EP&A Act). The Minister's conditions of approval have been provided to Roads and Maritime Services to guide the detailed design, construction and operation of the project.

To facilitate the assessment and determination of the Project, an Environmental Assessment was developed and issued in November 2012. This assessment (and associated specialist studies) detailed the key environmental aspects of the project and recommended management and mitigation measures to mitigate environmental risks during construction and operation of the infrastructure. The Foxground and Berry bypass environmental assessment was exhibited for 34 days from Wednesday 14 November 2012 to Monday 17 December 2012 and a total of 254 submissions were received during the exhibition period.

A Submissions and Preferred Project Report (PPR) was developed and placed on public exhibition in response to the submissions received during the Environmental Assessment consultation period. This report responded to the main issues raised during the consultation period, described amendments made to the project design since the exhibition of the Environmental Assessment, and provided additional assessment of relevant environmental issues raised in the submissions and amendments made in the public consultation phase.

Both the Environmental Assessment and Submissions and Preferred Project Report were assessed by the NSW Department of Planning and Infrastructure.

In addition to the above approval, Fulton Hogan have also acquired an Environment Protection Licence (EPL) under the Protection of the Environment Operations Act 1997 (POEO Act) to facilitate construction activities. The EPL was issued 29 August 2014.

The Project Construction Environmental Management Plan (CEMP) and sub-plans were approved by the Department of Planning and Environment on 19 September 2014.

The Department of Planning and Environment approved the following project documents on 27 October: the Biodiversity Offset Strategy; the Ecological Monitoring Program; the Water Quality Monitoring Program; the Urban Design and Landscape Plan; and the Community Consultation Strategy.

Following the above approvals, RMS formally advised the Department of Planning and Environment that construction would commence on 28 October 2014 and the CEMP has been implemented since this date.

On 28 January 2015, the Department of Planning and Environment approved the modification of Condition C13. This modification removed the section which prohibited an increase to blasting limits application where a non-aboriginal heritage item existed.

On 9 March 2015, the Department of Planning and Environment approved increased blasting limits for the Toolijooa ridge earthworks cuts. A further approval to increase blasting limits at cut 3 and cut 4 on the FBB project was also approved.

Condition C4(e) of the project approval was modified by DP&E on 31 July 2015 to enable out-of-hours work as approved through the project Environmental Protection Licence. This modification was requested to streamline the out-of-hours works approval process without reducing the level of consideration required for out-of-hours work. Further, Condition C6 which previously detailed the Out of Hours work request process was removed as it was no longer required due to the modification to C4(e). The change was supported by NSW EPA, Kiama Municipal Council and Shoalhaven City Council.

One major consistency assessment has been completed on the project to date where the abutment B at Broughton Creek crossing 3 was designed to sit 34 metres closer to the creek in comparison to the concept design. This increase in construction footprint and scope also includes re-routing of an ephemeral drainage line into Broughton Creek. This consistency assessment was approved by RMS and the Project ER on 14 December 2015.

Condition C15 of the project approval was modified by DP&E on the 3 July 2017 to enable works within specified heritage sites after seeking written approval from the Secretary. In light of this approval from the Secretary was given on 3 July 2017 to work within heritage site G2B H25 to construct a residents driveway.

On 29 September 2017, the Department of Planning and Environment approved a modification to conditions C15 and C16 to align with the original project approval.

## 1.2 Purpose of this report

The purpose of this report is to provide a summary of the outcomes and actions obtained through the implementation of the project Compliance Tracking Program required under the Minister's Condition of Approval (MCoA) B29.

This compliance tracking report provides a review of compliance for the six month period between 1 October 2017 and 31 March 2018. A pre-operational compliance review was completed one month prior to operation of the project as required by Minister's Condition of Approval B29(c). Foxground and Berry Bypass Construction Compliance Report 6 (1 May 2017 – September 2017) fulfilled that requirement with commencement of the operational highway occurring on 31 October 2017.

Minister's Condition of Approval (MCoA) B29 states:

*"The Proponent shall develop and implement a Compliance Tracking Program to track compliance with the requirements of this approval. The Program shall be submitted to the Director General for approval prior to the commencement of construction and shall be applied during construction and for a minimum of one year following commencement of operation. The program shall include, but not necessarily be limited to:*

- (a) provisions for the notification of the Director General of the commencement of works prior to the commencement of construction and prior to the commencement of operation of the project (including prior to each stage, where works are being staged);*
- (b) provisions for periodic review of project compliance with the requirements of this approval and the documents listed under Condition A1, including the Statement of Commitments;*
- (c) provisions for periodic reporting of compliance status against the requirements of this approval and the documents listed under Condition A1, including the Statement of Commitments, to the Director General including at least one month prior to the commencement of construction and operation of the project and at other intervals during the construction and operation, as identified in the Program;*



- 
- (d) a program for independent environmental auditing in accordance with /SO 19011:2003 - Guidelines for Quality and/ or Environmental Management Systems Auditing;*
  - (e) mechanisms for reporting and recording incidents and actions taken in response to those incidents;*
  - (f) provisions for reporting environmental incidents to the Director General during construction and operation; and*
  - (g) procedures for rectifying any non-compliance identified.”*

During the reporting period the Foxground and Berry Bypass has been compliant to the conditions of approval. Appendix A of this report contains detailed information on the status and compliance of each specific condition for the Foxground and Berry Bypass.

## 2 Construction activities during reporting period

Project works are proceeding in accordance with the construction program. During the reporting period about 20% of the days were wet days. The total rainfall received on the project was significantly lower than the long term average. During this dry period production was at a high with environmental focus on closing out areas with permanent landscaping and dust mitigation measures.

To date the project is tracking at an overall 98% completion rate with minor outstanding works consisting of landscaping, property works, local roads and the decommissioning and rehabilitation of the remaining site compounds. The remaining work along the main alignment consists of repairing minor quality defects. The alignment in its final configuration commenced operation on the 31 October 2017.

### 2.1 Demolition and property adjustment

Demolition works are complete.

Property adjustments works have been completed and any unresolved matters have been taken up by RMS.

### 2.2 Utilities adjustments & diversions

FBB continued to construct utilities and service adjustments. The general construction progress for services is:

- Electrical services relocations – 100% complete
- Telecommunications – 100% complete
- Sewer and water – 100% complete
- Street lighting – 100% complete

### 2.3 Fencing

Boundary fencing is mostly complete on the project. The exceptions are tie-in fencing to new property access points and fencing that is yet to be agreed under private property works.

### 2.4 Traffic

On 31 October 2017 the project saw the alignment in its full configuration and with an operational speed of 100km/h. The operational set-up ensured that major traffic was kept out of Berry which has made the township a safer place for visitors. As the signal lane bypass of Berry had occurred earlier in June 2017, the switch to full configuration was conducted during standard work hours with no issues.

The remaining minor construction works are planned to avoid the need for traffic control. This is to ensure that delays are minimised to public motorists. Within the reporting period the project operated at its operational speed due to the completion of all works, however the occasional speed reduction occurred in small work areas associated with maintenance and defects.

Each traffic control setup is arranged to adhere to the Traffic at Work Site's Manual. To date the project has had 332 Traffic Control Plans (TCP's) designed and approved for use on site. These are regularly updated to ensure that they are relevant to the work occurring on site.

Traffic control was used at a number of locations on the Princes Highway and adjoining side roads where speed reductions and detours through local roads were utilised for both worker and public safety.

## 2.5 Drainage

All Drainage works have now been completed on the project.

## 2.6 Structures

The project includes the construction of 12 new bridges which cross creeks, floodplains, local roads and side roads. All 12 bridges have been completed.

There are six structural culverts on the project which provide connectivity for vehicles and wildlife under the new highway. All culverts have been completed.



**Figure 2-1: Fauna underpass complete with fauna furniture**

## 2.7 Roadworks

Works are complete on design earthworks and roadwork. Important milestones throughout the reporting period included:

- Opening of the Berry Bypass; diverting all highway traffic around the township of Berry.
- Decommissioning of Toolijooa, Gate 19, Gate 2 and part of the Austral Park compounds, leaving part of Austral Park and the Woodhill Mountain Road compounds the last of the construction footprint remaining.
- Completion of the final wearing coarse pavement.

## 2.8 Landscaping

The project has made good progress on landscaping works in the reporting period. It is a key project goal to have established landscaping at the time of the project opening to traffic. With dry and windy conditions for the majority of the reporting period, focus on consistent watering of landscaped areas has helped the high survival rates through these tough conditions.

The general update of progress is:

- Topsoil - 100% completed
- Hydro mulch - 100% completed
- Planting - 100% completed

The full time landscaping crews have planted some important areas around Queen Street and in other areas close to domestic residences, bridge abutments and general rural plantings.

The key focus now that all landscaping works are complete is the maintain the the permanent landscaping via weed removal and general maintenance along the project.



**Figure 2-4: Landscape maintenance of the garden beds south of the southern Berry interchange**

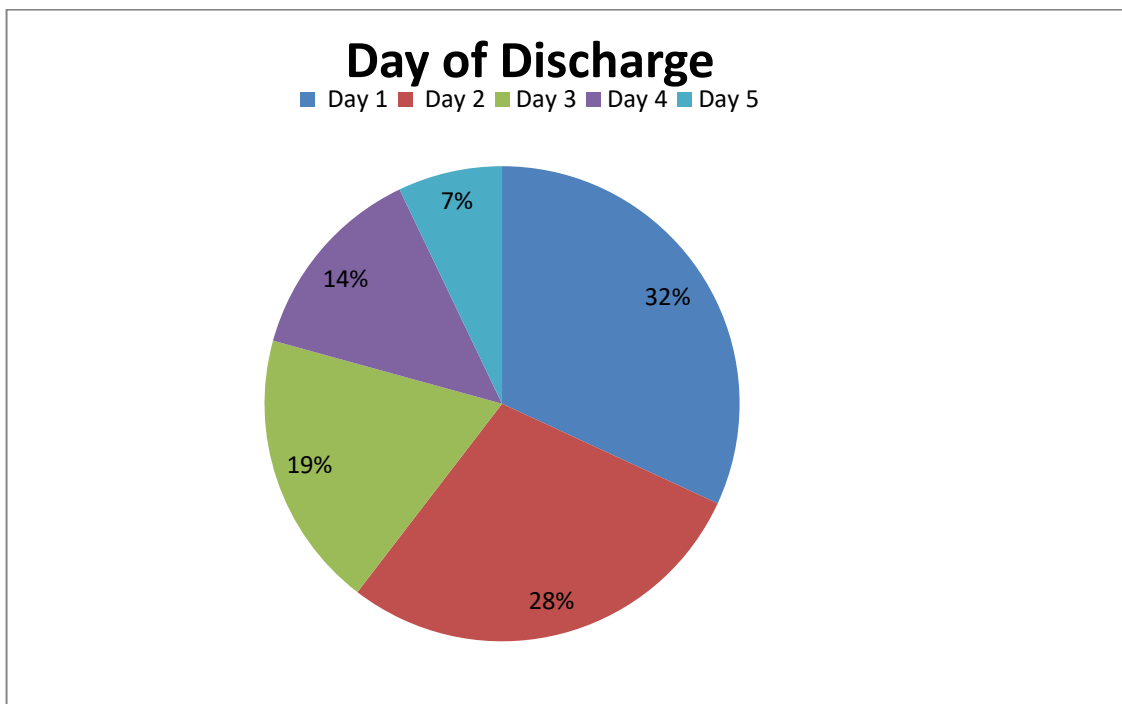
## 2.9 Sediment basins

The number of sediment basins on the project reflects construction progress. The risk footprint is continually decreasing as the works progress and areas are stabilised.

At the start of the reporting period there were 7 sediment basins in disturbed catchments. At the end of the reporting period there was 1 sediment basin within disturbed catchments. 6 catchments were rehabilitated within the reporting period. This is a positive indication that the project is continuing to reduce the environmental risk footprint as construction progresses.

Since the start of construction until the end of this reporting period there has been an 97% reduction in the number sediment basins. This generally means that about 99% of the overall disturbed footprint of the project has now been rehabilitated.

With regard to sediment basin management, the project continues to work diligently at treating and discharging stored site water back into the environment as efficiently as possible. The table below illustrates the timeframe that sediment basins have been discharged.



**Figure 2-5: Sediment basin discharges in the five day period after rainfall**

## 2.10 Noise mound construction

Construction of the Berry noise mound (North Street) was prioritised in the construction program. The early construction of the noise mound reduces the potential acoustic and visual impacts of construction on both the residents of North Street and the wider community.

There are three earth mounds in the project design which provide visual screening and noise attenuation. The progress of those noise and visual mounds is as follows:

- North street noise mound: 100% complete.
- Miller farm: the earth mound is 100% complete.
- Huntingdale Park: the earth mound is 100% complete.

## 2.11 Temporary works

The project requires temporary works to allow for safe and efficient construction of the Foxground and Berry bypass. In the reporting period this included the use of temporary side roads, services diversions, driveway accesses, light vehicle tracks and temporary bridges.

During the reporting period the project made important progress in rehabilitating areas of temporary works in accordance with updated landscape plans. Temporary works areas that have been rehabilitated include:

- Rehabilitation of Toolijooa, Gate 19, Gate 2 and part of Austral Park processing yards

The project is continuing the rehabilitation of all ancillary sites left on the project.



**Figure 2-6: Rehabilitation of Toolijooa ancillary facility complete**

### 3 Environmental management system overview

#### 3.1 Environmental Management System certification

The overall Environmental Management System (EMS) for the Project is described within the Construction Environmental Management Plan (CEMP) and relevant sub plans. The EMS for the Project has been prepared to comply with the requirements of AS/NZS ISO 14001 Environmental Management Systems.

The Fulton Hogan EMS is periodically audited by external auditors to ensure compliance with ISO 14001. The Fulton Hogan EMS was audited in February 2018 by an external auditor which resulted in the recertification of the system.

#### 3.2 Environmental management framework

The framework of the environmental management documents has been designed to comply with the requirements of ISO 14001 and to be consistent with the Guidelines for the Preparation of an EMP (DP&I 2004).

The CEMP comprises relevant sections from Fulton Hogan's Corporate Management System as well as a number of supporting documents (i.e. issue specific environmental sub plans) providing more detailed environmental management specifications.

#### 3.3 Construction Environmental Management Plan

The CEMP is the key management tool in relation to environmental performance during the design and construction phases. The CEMP outlines Fulton Hogan's approach to minimising and managing environmental risks associated with the construction phase of the project. The CEMP is a dynamic document that is reviewed and amended to incorporate additional requirements as required, including changes to the project team, organisational structure and responsibilities or as improvements to procedures and methodologies develop.

The CEMP has been prepared in accordance with a number of guidelines including:

- Guideline for the Preparation of Environmental Management Plans (DP&I, 2004);
- RMS Specification G36 – Environmental Protection (Management Systems);
- ISO 14001:2004 – Environmental Managements Systems; and
- ISO 19011:2003 – Guidelines for Quality and/or Environmental Management Systems Auditing.
- NSW Minister for Planning Conditions of Approval (MCoA);
- EA and PPR Statement of Commitments; and
- Environment Protection License (EPL) requirements.

The CEMP was approved by the Department of Planning and Environment in accordance with MCoA B35 on 6 June 2014.

Detailed environmental management sub plans have been prepared on key environmental elements identified for the Project through the environmental assessment and approval process. They document the aspects, impacts, safeguards and monitoring requirements for each key environmental element, nominate who is responsible for implementing controls and note the frequency/timing of implementation.

The CEMP and sub-plans have been recently reviewed and endorsed by the Project ER, dates of revision for the plans are detailed in table 3-1.

Plan Name	DP&E Approval Date	Consistent with MCOA	Latest revision date
Construction Environmental Management Plan	06 June 2014	Yes	Rev H September 2017
Flora and Fauna Management Sub Plan	27 May 2014	Yes	Rev G May 2017
Heritage Management Sub Plan	13 May 2014	Yes	Rev F September 2017
Noise and Vibration Management Sub Plan	06 June 2014	Yes	Rev G September 2017
Soil and Water Quality Management Sub Plan	06 June 2014	Yes	Rev F September 2017
Air Quality Management Sub Plan	26 April 2014	Yes	Rev G September 2017
Construction Waste and Energy Management Sub Plan	29 April 2014	Yes	Rev H September 2017

**Table 3-1: CEMP and sub plans consistency with MCoA and ER review dates**

### 3.4 Compliance auditing

Regular auditing of the management system is completed during construction. Auditing includes:

- Internal compliance audits undertaken by Fulton Hogan
- External compliance audits undertaken by the Environmental Representative and RMS appointed auditors.

The intent of these audits is to identify opportunities for improvement and any system non-conformances during the course of construction so appropriate corrective actions can be implemented in a timely manner.

One internal audit undertaken by the Fulton Hogan occurred in the reporting period in February 2018, this audit focussed on G36 requirements for the completion of the project. The audit found one observation of concern which has been addressed and deemed closed.

The project CPESC, Strategic Environmental and Engineering Consulting (SEEC) is also engaged to regularly conduct audits of site documentation and implementation of progressive erosion and sediment control plans in order to ensure high levels of site controls are maintained.



## 4 Environmental Performance

The project continued to implement and maintain a high standard of environmental controls during the reporting period. Controls were planned and executed to industry best practice standards.

The project's environmental performance is reviewed and measured by regional RMS, FBB ER, NSW EPA, NSW Department of Primary Industries - Fisheries and NSW Office of Water.

Regional RMS environmental staff reviewed the project 13 times in the reporting period. Those inspections gave the project numerous 'green' and no 'amber or red' ratings. According to the RMS assessment standards the green rating indicates the 'site demonstrates good environmental management with no action required to avoid environmental harm'.

Fulton Hogan held the last of the six monthly environmental review group meeting (ERG) on in September 2017.

### 4.1 Effectiveness of environmental controls

Effectiveness of environmental controls is evaluated by industry trained environmental engineers and scientists. Controls are planned prior to ground disturbance and installed before works start.

Environmental controls have been designed and installed in accordance with industry best environmental practice. External specialist consultants are engaged periodically to provide specialist reviews and audit the effectiveness of installed controls. In addition to this, all controls are inspected weekly as a minimum, during and after rainfall events.

Site controls are reviewed and reinforced in advance of predicted heavy rainfall events. Prior to long weekends and shutdown periods extra controls are installed to make sure they are suitable for the time that workers are offsite.

Maintenance of controls occurs regularly during construction. Maintenance ensures controls are functioning properly and are fit for purpose.

In the reporting period, all erosion and sediment controls performed well during adverse weather. This minimised potential impacts on receiving catchments and adjacent sensitive receivers.

### 4.2 Environmental initiatives

The Foxground and Berry bypass construction team has adopted a 'Beyond Compliance' approach to the project. The aspirational goal for the project team is to leave a community legacy built on 360 degrees of excellence. This philosophy promotes a positive culture of excellence whereby the project aims to exceed the contract and legal requirements to create a legacy that all associated with the project will be proud of.

The 'Beyond Compliance' strategy has led to the development of goals for each construction zone to achieve during the project.

During the reporting period the project achieved one of the stage two goals, including:

- Conduct a site trial of alternative flocculants with support from RMS and EPA
- ecotoxicology testing on treated sediment basin water has passed
- Assess the effectiveness of the flocculent

- Assess the effectiveness of the flocculent in a passive treatment system

This trial is complete with finalisation of the data and the report has been sent to EPA.



**Figure 4-1: From left to right: Samples taken from batch basin vs HES Basin after rain event**



**Figure 4-2: HES Basin looking from the fore-bay across the spreader bar and down to the decanting system after rain event**

## Environmental monitoring

The Foxground and Berry bypass is undertaking a range of environmental monitoring to review the environmental effects of the project. The results of these monitoring activities are used to establish trends and drive improvements.

These results of the monitoring programs are described in this section.

### 4.3 Water quality

In accordance with approval condition B16 the project has developed a Water Quality Monitoring Program has been developed and was approved 27 October 2014.

The approved '*Water Quality Monitoring. Surface Water Monitoring Plan*' (June 2014) sets out the requirements for surface water quality monitoring. As the project became operational at the end of October 2017 surface water quality monitoring moved into the operational phase of monitoring except for 2 monitoring sites which would monitoring any potential impacts from the Woodhill Mountain Road Compound. This process was agreed to by Fulton Hogan, RMS and the project ER.

In the reporting period Fulton Hogan undertook 6 surface water monitoring events triggered on the project, these were:

- November 2017 event 26. Report contained in Appendix B of this report.
- December 2017 event 27. Report contained in Appendix B of this report
- January 2018 event 28. Report contained in Appendix B of this report
- February 2018 event 29. Report contained in Appendix B of this report
- February 2018 event 30. Report contained in Appendix B of this report
- March 2018 event 31. Report contained in Appendix B of this report

In the reporting period RMS undertook 3 surface water monitoring events triggered on the project, these were:

- February 2018. Report contained in Appendix B of this report
- February 2018. Report contained in Appendix B of this report
- March 2018. Report contained in Appendix B of this report

### 4.4 Flora and fauna

In accordance with approval condition B9 the project has developed an Ecological Monitoring Program approved on 27 October 2014.

As part of the monitoring program, aquatic monitoring was undertaken in the reporting period with 2 session in spring 2017.

The last of Nest box monitoring by Fulton Hogan was undertaken in Novemeber 2017.

The Grey-headed Flying Fox (GHFF) camp situated at Broughton Mill Creek remained in that location until late August 2017 when observations saw the camp naturally migrated

away from the area, however the camp have returned to the area along Broughton Mill Creek.

Works are complete on the installation of fauna underpasses and aerial fauna crossings for arboreal mammals. Fauna fencing along the alignment is complete.



**Figure 4-3: Rope bridge complete**

#### 4.5 Heritage

There were no unexpected finds on the project in the reporting period

#### 4.6 Air quality

Ambient air quality monitoring was undertaken in accordance with the Construction Air Quality Management Sub-plan. All results for the period had an average below the 4g/m<sup>2</sup> dust level. A review of the monthly air quality data showed that the project had no influence on the surrounding environment and inturn air quality monitoring ceased in February 2018 with the consultation between EPA, ER, RMS and Fulton Hogan.

Appendix D of this report shows the air quality monitoring results for the reporting period.

#### 4.7 Noise and vibration

Attended noise monitoring was undertaken during normal construction hours monthly. The recorded levels were consistent with the anticipated levels as described in Appendix A of the approved Noise and Vibration Management Plan. Records of noise monitoring within the reporting period can be found on the project website <http://www.fultonhogan.com/news-resources/management-plans-reporting/foxground-berry-bypass-nsw/>. Due to the low noise nature of work carried out during the reporting

period, Fulton Hogan deemed that noise monitoring would only result in readings of external influences and operational noise from the highway, therefore monitoring ceased in December 2017 with the consultation between EPA, ER, RMS and Fulton Hogan.

## 5 Community complaints

In accordance with MCoA B31, a complaint management system has been established on the project to document community consultation including enquiries or complaints during construction. The project information line, email address, postal address and website are now being monitored and managed by Roads and Maritime Services.

The telephone number, postal address and email address was published in newspapers circulating the local area before construction started and at project completion. The details are included on all project material published to the community and they are also available on the project website in accordance with MCoA B31.



**Figure 5.1 - Advert from South Coast Register – Friday 10 November 2017**

The project will continue to respond to and manage complaints made by stakeholders in accordance with AS-ISO 10002-2006 Complaints Handling. This system will be in place until eight weeks after the date of construction completion.

### 5.1 Number and types of complaints

During the reporting period two complaints were received. These complaints were both in relation to operational noise. RMS is currently reviewing the draft Operational Noise Report and will contact complainants once completed.

### 5.2 Community engagement initiatives

Consultation with nearby residents about the remaining construction activities and property adjustments occurred between 1 October 2017 and 31 March 2018. During the reporting period the Berry bypass was officially opened to traffic.

Four notification letters were distributed to nearby residents and the community about work on the North Street cul de sac, Willow Spings Road and final asphaltting work north of Berry.

Fulton Hogan did a final presentation to the Berry Forum in October 2017 with positive feedback from the community received about the early completion of the project.

## 6 Other compliance matters

### 6.1 Compliance Management

During the reporting period there were:

- No environmental non-conformances
- No overpressure non-conformances
- No overall non-conformances for the project against the conditions of approval and statement of commitments.

### 6.2 Internal and external environmental inspections

The project completes many inspections to assess environmental performance and identify improvements.

Those inspections have resulted in environmental management improvements across the project. The improvements included new erosion and sediment control installations, improved site mitigations and general site improvements.

Table 6-2 summarises the inspections completed on the project. The inspections completed are consistent with the requirements of the project documents.

Inspection type	Attendees	Number of inspections
Weekly	Fulton Hogan staff; engineers, environmental, foreman, leading hands, labourers, superintendents, management	17
Wet weather	Fulton Hogan staff; engineers, environmental, foreman, leading hands, labourers, superintendents, management	14
Environmental Representative	Toby Hobbs Fulton Hogan staff; environmental staff, engineers, foreman and superintendents	13
Regional RMS	Michelle Toms RMS project staff Toby Hobbs Fulton Hogan staff; environmental staff, engineers, foreman and superintendents	13
NSW EPA	Michael Heinze, Julian Thompson <b>Fulton Hogan staff; environmental staff, engineers, foreman and superintendents</b>	Nil
NSW DPI (Fisheries)	Allan Lugg, Jillian Reynolds <b>Fulton Hogan staff; environmental staff, engineers, foreman and superintendents</b>	Nil
NSW DPI (Crown Land and Water)	David Zerafa Fulton Hogan staff; environmental staff, engineers, foreman and superintendents	Nil

**Table 6-2: Inspections**



## **Appendix A Project Approval Compliance Table**

FBB Compliance Tracking Table - 31st March 2018

MCoA – Ministers Conditions of Approval Section 75J of the Environmental Planning and Assessment Act 1979						
Ref	Condition Requirement	Phase	Responsibility	Compliance status	Compliance notes	Close out
<b>PART A - ADMINISTRATIVE CONDITIONS</b>						
<b>Terms of Approval</b>						
A1	The Proponent shall carry out the project generally in accordance with the: (a) Major Project Application MP10_0240; (b) Princes Highway upgrade – Foxground and Berry bypass - Environmental Assessment (Volumes 1-2), prepared by AECOM Australia Pty Ltd for Roads and Maritime Services and dated November 2012; (c) Princes Highway upgrade – Foxground and Berry bypass – Submissions Report, prepared by AECOM Australia Pty Ltd for Roads and Maritime Services and dated May 2013, including the revised Statement of Commitments contained therein; and (d) conditions of this approval.	Pre-construction, construction, and operation	RMS/Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev G), September 2017 Section 1.2 Tracked and reported bi-annually in the Compliance Tracking Reports.	Ongoing
A2	In the event of an inconsistency between: (a) the conditions of this approval and any document listed from condition A1(a) to A1(c) inclusive, the conditions of this approval shall prevail to the extent of the inconsistency; and (b) any document listed from condition A1(a) to A1(c) inclusive, and any other document listed from condition A1(a) to A1(c) inclusive, the most recent document shall prevail to the extent of the inconsistency.	Pre-construction, construction, and operation	RMS/Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev G), September 2017. Section 1.2 Tracked and reported bi-annually in the Compliance Tracking Reports.	Ongoing
A3	The Proponent shall comply with any reasonable requirement(s) of the Secretary of the NSW Department of Planning & Environment (DP&E) arising from the Department's assessment of: (a) any reports, plans or correspondence that are submitted in accordance with this approval; and (b) the implementation of any actions or measures contained within these reports, plans or correspondence.	Pre-construction, construction, and operation	RMS/Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev G), September 2017. Section 1.2 Tracked and reported bi-annually in the Compliance Tracking Reports.	Ongoing
A4	Subject to confidentiality, the Proponent shall make all documents required under this approval available for public inspection on request.	Pre-construction, construction, and operation	RMS/Fulton Hogan	Compliant	Community Consultation Strategy, January 2017	Ongoing
A5	The Proponent shall notify the Secretary of the NSW Department of Planning & Environment (DP&E) and other relevant government agencies of any incident with actual or potential significant off-site environmental impacts on people or the biophysical environment as soon as practicable and within 24 hours after the occurrence of the incident. The Proponent shall provide full written details of the incident to the Secretary of the NSW Department of Planning & Environment (DP&E) within seven days of the date on which the incident occurred. Note: Where an incident also requires reporting to the OEH and/or EPA the incident report prepared for the purposes of notifying the OEH and/or EPA would meet this requirement	Pre-construction, construction, and operation	RMS/Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev G), September 2017. Section 1.2	Ongoing
A6	The Proponent shall meet the requirements of the Secretary of the NSW Department of Planning & Environment (DP&E) or relevant government agency (as determined by the Secretary of the NSW Department of Planning & Environment (DP&E)) to address the cause or impact of any incident, as it relates to this approval, reported in accordance with condition A5, within such period as the Secretary of the NSW Department of Planning & Environment (DP&E) may require.	Pre-construction, construction, and operation	RMS/Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev G), September 2017. Section 1.2	Ongoing
<b>Limits of Approval</b>						
A7	This approval shall lapse ten years after the date on which it is granted, unless construction works the subject of this project approval are physically commenced on or before that date.	Pre-construction, construction	RMS/Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev G), Section 1.2	Ongoing
<b>Statutory Requirements</b>						
A8	The Proponent shall ensure that all necessary licences, permits and approvals required for the development of the project are obtained and maintained as required throughout the life of the project. No condition of this approval removes the obligation for the Proponent to obtain, renew or comply with such necessary licences, permits or approvals except as provided under section 75U of the Act. This shall include relevant certification requirements in accordance with section 109R of the Act.	Pre-construction, construction, and operation	RMS/Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev G), Section 1.2	Ongoing
<b>Staging</b>						

**MCoA – Ministers Conditions of Approval Section 75J of the Environmental Planning and Assessment Act 1979**

Ref	Condition Requirement	Phase	Responsibility	Compliance status	Compliance notes	Close out
A9	<p>The Proponent may elect to construct and/ or operate the project in stages. Where staging is proposed, the Proponent shall submit a Staging Report to the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) prior to the commencement of the first proposed stage. The Staging Report shall provide details of:</p> <ul style="list-style-type: none"> <li>(a) how the project would be staged including general details of work activities associated with each stage and the general timing of when each stage would commence; and</li> <li>(b) details of the relevant conditions of approval, which would apply to each stage and how these shall be complied with across and between the stages of the project.</li> <li>(c) Where staging of the project is proposed, these conditions of approval are only required to be complied with at the relevant time and to the extent that they are relevant to the specific stage(s).</li> </ul> <p>The Proponent shall ensure that an updated Staging Report (or advice that no changes to staging are proposed) is submitted to the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) prior to the commencement of each stage, identifying any changes to the proposed staging or applicable conditions.</p> <p>The Proponent shall ensure that all plans, sub-plans and other management documents required by the conditions of this approval and relevant to each stage (as identified in the Staging Report) are submitted to the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) no later than one month prior to the commencement of the relevant stages, unless an alternative timeframe is agreed to by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E).</p>	Pre-construction, construction	RMS/Fulton Hogan	Compliant	<p>NA.</p> <p>No changes to staging are proposed from that already approved by DP&amp;E as part of the <i>Toolijooa Road Fill Works Stage of the Foxground and Berry bypass Project</i>.</p>	Complete
<b>PART B - PRIOR TO CONSTRUCTION</b>						
<b>Design</b>						
B1	<p>The proponent shall, in consultation with the relevant council/s, investigate the need for:</p> <ul style="list-style-type: none"> <li>(a) potential future on and off ramps at Woodhill Mountain Road; and</li> <li>(b) a potential future left turn lane onto the new highway from Toolijooa Road.</li> </ul> <p>The investigation shall be undertaken to the satisfaction of Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E), and include consideration of the relevant environmental impacts (noise, flooding, heritage, biodiversity, traffic etc.) and consider any alternative options.</p>	Pre-construction	RMS	Compliant	<p>RMS consulted with both Kiama Municipal Council and Shoalhaven City Council regarding the future off ramps and left turn lane. A letter regarding B1 was sent to DP&amp;E on 30th September 2014. DP&amp;E advised of their satisfaction in addressing B1 in a letter dated 27th October 2014.</p>	Complete
B2	<p>The bridge piers at the Connollys Creek / Bundewallah Creek / Broughton Mill Creek crossing shall be located and designed in such a way to minimise visual impacts to Berry and the bridge piers at Broughton Creek crossing 3 are located and designed in such a way to minimise visual impacts to RMB 353 Princes Highway, Broughton Village. Evidence of how visual impacts have been minimised shall be provided to the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) prior to the commencement of works that would influence the design of the bridge in this location.</p>	Pre-construction	RMS/Fulton Hogan	Compliant	<p>Compliance has been met through the development of the detailed Urban Design and Landscaping Plan 12 September 2014</p> <p>Evidence of how visual impacts have been minimised was provided to DP&amp;E on 30th September 2014.</p>	Complete
<b>Biodiversity - Mitigation Measures - Fauna and Waterways</b>						
B3	<p>The Proponent shall design (and implement) the fauna crossings identified in Table 5.1 of Volume 2 Appendix F of the document listed under condition A1(b), at the locations and in accordance with the minimum design principles identified in Table 5.1, unless otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E)</p>	Pre-construction	RMS/Fulton Hogan	Compliant	<p>Princes Highway Foxground and Berry Bypass Fauna Crossings Report 20 November 2015</p> <p>As at March 2018, all fauna crossing have been completed generally in accordance with the Fauna Crossing Report</p>	Complete
B4	<p>Investigations into the design of fauna crossings identified in Table 5.1 of Appendix F of the document listed under condition A1(b) during detailed design shall be undertaken with the input of a suitably qualified and experienced ecologist and in consultation with OEH and DPI (Fishing and Aquaculture).</p>	Pre-construction	RMS/Fulton Hogan	Compliant	<p>Princes Highway Foxground and Berry Bypass Fauna Crossings Report 20 November 2015</p>	Complete
B5	<p>The Proponent shall prepare a report on the final design of fauna and/or waterway crossings identified in Table 5.1 of Appendix F of the document listed under condition A1(b), where the location of the crossing has changed and/or the crossing does not meet the minimum design principles identified in Table 5.1. The report shall be submitted to the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) prior to the commencement of construction of the relevant crossing, and shall demonstrate how the new location and/ or design would result in acceptable biodiversity outcomes. The report shall clearly identify how the fauna and/or waterway crossing will work in conjunction with complementary fauna exclusion fencing measures to be implemented for the project. The report shall be accompanied by evidence of consultation with OEH and DPI (Fishing and Aquaculture) in relation to the suitability of any changes to the location and/or crossing design.</p>	Pre-construction	RMS/Fulton Hogan	Compliant	<p>Princes Highway Foxground and Berry Bypass Fauna Crossings Report 20 November 2015</p>	Complete
B6	<p>The Proponent shall, in consultation with OEH and DPI (Fishing and Aquaculture), ensure that all waterway crossings are designed and constructed consistent with the principles of the Guidelines for Controlled Activities Watercourse Crossings (Department of Water and Energy, February 2008), Policy and Guidelines for Fish Friendly Waterway Crossings (NSW Fisheries, February 2004) and Policy and Guidelines for Design and Construction of Bridges, Roads, Causeways, Culverts and Similar Structures (NSW Fisheries 1999). Where multiple cell culverts are proposed for creek crossings, at least one cell shall be provided for fish passage, with an invert or bed level that mimics creek flows.</p>	Pre-construction	RMS/Fulton Hogan	Compliant	<p>Flora and Fauna Management Sub Plan (Rev G)</p> <p>The project used three temporary bridges and one temporary culvert to provide access across the three 'Class 1' waterways on the project.</p> <p>All temporary creek crossings have now been removed and embankments have been rehabilitated.</p>	Complete
<b>Biodiversity Offsets</b>						
B7	<p>The Proponent shall, in consultation with the OEH and DPI (Fishing and Aquaculture), develop a <b>Biodiversity Offset Strategy</b> that identifies the available options for offsetting the biodiversity impacts of the project in perpetuity, with consideration to the</p>	Pre-construction	RMS	Compliant	<p>Biodiversity Offset Strategy approved by DP&amp;E 27 October 2014</p>	Complete

**MCoA – Ministers Conditions of Approval Section 75J of the Environmental Planning and Assessment Act 1979**

Ref	Condition Requirement	Phase	Responsibility	Compliance status	Compliance notes	Close out
	<p>Principles for the use of biodiversity offsets in NSW (OEH website <a href="http://www.environment.nsw.gov.au/biocertification/offsets.htm">http://www.environment.nsw.gov.au/biocertification/offsets.htm</a> dated 17 June 2011). Unless otherwise agreed to by the OEH and DPI (Fishing and Aquaculture), offsets shall be provided on a like-for-like basis and at a minimum ratio of 4:1 for areas of high conservation value (including EEC, salt marsh, and poorly conserved vegetation communities identified as being more than 75% cleared in the catchment management area) and 2:1 for the remainder of native vegetation areas (including threatened species habitat, mangroves, seagrass, and non-EEC riparian vegetation). The Strategy shall include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> <li>(a) the aims and objectives of the biodiversity offset strategy;</li> <li>(b) confirmation of the vegetation type/ habitat (in hectares) to be cleared and their condition, and the size of offsets required (in hectares);</li> <li>(c) details of the type of available offset measures that have been identified to compensate for the loss of threatened species and vulnerable and endangered ecological communities and/ or their habitats, and native vegetation (including mangroves, seagrasses, salt marsh and riparian vegetation). The measures shall achieve a neutral or net beneficial outcome for all the biodiversity values likely to be impacted directly or indirectly during both the construction and operation of the project;</li> <li>(d) the decision-making framework that would be used to select the final suite of offset measures to achieve the aims and objectives of the Strategy, including the ranking of offset measures;</li> <li>(e) a process for addressing and incorporating offset measures arising from changes in biodiversity impacts (where these changes are generally consistent with the biodiversity impacts identified for the project in the documents listed under condition A1), including: <ul style="list-style-type: none"> <li>(i) changes to the footprint due to detailed design;</li> <li>(ii) changes to predicted impacts as a result of changes to mitigation measures;</li> <li>(iii) the identification of additional species/ habitat through pre-clearance surveys and construction;</li> <li>(iv) addressing outcomes of the ecological monitoring program; and</li> <li>(v) additional impacts associated with the establishment of ancillary facilities; and</li> </ul> </li> <li>(f) options for the securing and management of biodiversity offsets in perpetuity.</li> </ul> <p>The Biodiversity Offset Strategy shall be submitted to the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) for approval no later than 6 weeks prior to the commencement of construction that would result in the disturbance of native vegetation, unless otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E).</p>					
B8	<p>Within two years of the date of approval of the Biodiversity Offset Strategy, unless otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E), the Proponent shall prepare and submit a <b>Biodiversity Offset Package</b> for the approval of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E). The Package shall be developed in consultation with the OEH and DPI (Fishing and Aquaculture), and shall include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> <li>(a) details of the final suite of the biodiversity offset measures to be implemented for the project demonstrating how it achieves the requirements of the Biodiversity Offset Strategy (including specified offset ratios);</li> <li>(b) the final selected means of securing the biodiversity values of the Package in perpetuity, including ongoing management, maintenance and monitoring requirements; and</li> <li>(c) timing and responsibilities for the implementation of the provisions of the Package over time.</li> </ul> <p>The requirements of the Package shall be implemented by the responsible parties according to the timeframes set out in the Package, unless otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E).</p>	Construction and operation	RMS	Compliant	<p>The Biodiversity Offset Package was approved by DPE on the 3rd May 2017. A timeframe for implementation isn't identified in the BOP, however RMS are currently negotiating BioBanking agreements</p> <p>BioBanking agreements for two Roads and Maritime owned properties were lodged with OEH in the reporting period. All four BioBanking agreements are now lodged with OEH.</p>	Ongoing
<b>Ecological Monitoring</b>						
B9	<p>The Proponent shall develop an <b>Ecological Monitoring Program</b> to monitor the effectiveness of the biodiversity mitigation measures implemented as part of the project. The program shall be developed by a suitably qualified and experienced ecologist in consultation with the OEH and DPI (Fishing and Aquaculture) and shall include but not necessarily be limited to:</p> <ul style="list-style-type: none"> <li>(a) an adaptive monitoring program to assess the effectiveness of the mitigation measures identified in conditions B3 and B36(b) and allow amendment to the measures if necessary. The monitoring program shall nominate performance parameters and criteria against which effectiveness will be measured and include operational road kill surveys to assess the effectiveness of fauna crossings and exclusion fencing implemented as part of the project;</li> <li>(b) mechanisms for developing additional monitoring protocols to assess the effectiveness of any additional mitigation measures implemented to address additional impacts in the case of design amendments or unexpected threatened species finds during construction (where these additional impacts are generally consistent with the biodiversity impacts identified for the project in the documents listed under condition A1);</li> <li>(c) monitoring shall be undertaken during construction (for construction-related impacts) and from opening of the project to traffic (for operation/ ongoing impacts) until such time as the effectiveness of mitigation measures can be demonstrated to have been achieved over a minimum of three successive monitoring periods after opening of the project to traffic, unless otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E). The monitoring period may be reduced with the agreement of the Secretary of the NSW Department of Planning &amp; Environment</li> </ul>	Pre-construction	RMS/Fulton Hogan	Compliant	<p>Ecological Monitoring Program approved 27 October 2014</p> <p>Ecological monitoring is ongoing. Monitoring dates within the current reporting period were:</p> <ul style="list-style-type: none"> <li>- Aquatic monitoring: 16th November 2017</li> <li>- Nest box monitoring: 6th November 2017</li> <li>- Weed Monitoring: 26th September</li> </ul> <p>Reports are provided in Appendix D of this report.</p>	Ongoing

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Ref	Condition Requirement	Phase	Responsibility	Compliance status	Compliance notes	Close out
	<p>(DP&amp;E) in consultation with the OEH and DPI (Fishing and Aquaculture), depending on the outcomes of the monitoring;</p> <p>(d) provision for the assessment of the data to identify changes to habitat usage and whether this can be directly attributed to the project;</p> <p>(e) details of contingency measures that would be implemented in the event of changes to habitat usage patterns directly attributable to the construction or operation of the project; and</p> <p>(f) provision for annual reporting of monitoring results to the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) and the OEH and DPI (Fishing and Aquaculture), or as otherwise agreed by those agencies.</p> <p>The Program shall be submitted to the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) for approval no later than 6 weeks prior to the commencement of construction that would result in the disturbance of native vegetation (unless otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E)).</p>					
<b>Hydrology and Flooding</b>						
B10	The Proponent shall ensure, where feasible and reasonable, that the project is designed to not exceed the afflux and other flooding criteria within the vicinity of the project as identified or predicted in the documents listed under condition A1. New or duplicated drainage structures shall be designed to minimise changes to afflux and flooding to waterways that traverse the project alignment to the greatest extent practicable.	Pre-construction	RMS/Fulton Hogan	Compliant	Detailed Design - Flooding Report	Complete
B11	<p>The Proponent shall develop a <b>Hydrological Mitigation Report</b> for properties in the Broughton Creek, Town Creek, Bundewallah Creek and Shoalhaven floodplain areas where flood impacts are predicted to increase as a result of the project. The Report shall be based on detailed floor level survey and associated assessment of potentially flood affected properties in those areas. The Report shall:</p> <p>(a) identify properties in those areas likely to have an increased flooding impact and detail the predicted increased flooding impact;</p> <p>(b) identify mitigation measures to be implemented where increased flooding is predicted to adversely affect access, property or infrastructure;</p> <p>(c) identify measures to be implemented to minimise scour and dissipate energy at locations where flood velocities are predicted to increase as a result of the project and cause localised soil erosion and/or pasture damage;</p> <p>(d) be developed in consultation with the relevant council, NSW State Emergency Service and directly-affected property owners; and</p> <p>(e) identify operational and maintenance responsibilities for items (a) to (c) inclusive.</p> <p>The Proponent shall not commence construction of the project on or within those areas likely to alter flood conditions until such time as works identified in the hydrological mitigation report have been completed, unless otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E).</p>	Pre-construction	RMS/Fulton Hogan	Compliant	<p>Hydrological Mitigation Report</p> <p>Detailed Design - Flooding Report</p> <p>Repeated attempts to gain agreement with the landowner have not been successful to date. Roads and Maritime are continuing efforts to resolve this issue.</p>	Ongoing
B12	Based on the mitigation measures identified in condition B11, the Proponent shall prepare a final schedule of feasible and reasonable flood mitigation measures proposed at each directly-affected property in consultation with the property owner. The schedule shall be provided to the relevant property owner(s) prior to the implementation/ construction of the mitigation works, unless otherwise agreed by the Secretary of the NSW Department of Planning & Environment (DP&E). A copy of each schedule of flood mitigation measures shall be provided to the Department and the relevant council prior to the implementation/ construction of the mitigation measures on the property.	Pre-construction	RMS/Fulton Hogan	Compliant	Hydrological Mitigation Report (by RMS)	Complete
B13	In the event that the Proponent and the relevant property owner cannot agree on feasible and reasonable flood mitigation measures to be applied to a property within one month of the first consultation on the measures (as required under condition B10), the Proponent shall employ a suitably qualified and experienced independent hydrological engineer, who has been approved by the Secretary of the NSW Department of Planning & Environment (DP&E), for the purposes of this condition prior to the commencement of construction in the Broughton Creek, Town Creek, Bundewallah Creek and Shoalhaven floodplain areas affected by increased afflux from the project to advise and assist affected property owners in negotiating feasible and reasonable mitigation measures.	Pre-construction	RMS	Compliant	Mark Babister from WMA Engineers appointed and approved by DP&E	Complete
B14	The Proponent shall provide assistance to the relevant council and/ or NSW State Emergency Service, to assist in the preparation of any new or necessary update(s) to the relevant plans and documents in relation to flooding, to reflect changes in flooding levels, flows and characteristics as a result of the project.	Pre-construction	RMS/Fulton Hogan	Compliant	RMS have consulted local council and they have advised that no assistance is required	Complete
<b>Sedimentation, Erosion and Water</b>						
B15	Prior to the commencement of construction, unless otherwise agreed by the Secretary of the NSW Department of Planning & Environment (DP&E), the Proponent shall in consultation with the EPA and NOW, undertake <b>groundwater modelling</b> on the concept design for the project, subject to the modelling being revised should the detailed design have a significantly different impact on groundwater than the concept design. The modelling shall be undertaken by a suitably qualified and experienced groundwater expert and assess the construction and operational impacts of the proposal on the groundwater resources, groundwater quality, groundwater hydrology and groundwater dependent ecosystems and provide details of contingency and management measures in the groundwater management strategy required under condition B36(d).	Pre-construction	RMS/Fulton Hogan	Compliant	<p>Detailed Design - Geotechnical Design &amp; Interpretative Report</p> <p>RMS undertook groundwater modelling on the RMS Concept Design for the project. Since the detailed design will not have a significantly different impact on groundwater than the RMS Concept Design, no further groundwater modelling is required.</p>	Complete

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Ref	Condition Requirement	Phase	Responsibility	Compliance status	Compliance notes	Close out
B16	<p>The Proponent shall prepare and implement a <b>Water Quality Monitoring Program</b> to monitor the impacts of the project on surface and groundwater quality and resources and wetlands, during construction and operation. The Program shall be developed in consultation with the OEH, EPA, DPI (Fishing and Aquaculture) and NOW and shall include but not necessarily be limited to:</p> <p>(a) identification of surface and groundwater quality monitoring locations (including watercourses, water bodies and SEPP14 wetlands) which are representative of the potential extent of impacts from the project;</p> <p>(b) the results of the groundwater modelling undertaken under condition B15;</p> <p>(c) identification of works and activities during construction and operation of the project, including emergencies and spill events, that have the potential to impact on surface water quality of potentially affected waterways;</p> <p>(d) development and presentation of parameters and standards against which any changes to water quality will be assessed, having regard to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 (Australian and New Zealand Environment Conservation Council, 2000);</p> <p>(e) representative background monitoring of surface and groundwater quality parameters for a minimum of twelve months (considering seasonality) prior to the commencement of construction, to establish baseline water conditions, unless otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E);</p> <p>(f) a minimum monitoring period of three years following the completion of construction or until the affected waterways and/ or groundwater resources are certified by an independent expert as being rehabilitated to an acceptable condition. The monitoring shall also confirm the establishment of operational water control measures (such as sedimentation basins and vegetation swales);</p> <p>(g) contingency and ameliorative measures in the event that adverse impacts to water quality are identified; and</p> <p>(h) reporting of the monitoring results to the Department, OEH, EPA and NOW.</p> <p>The Program shall be submitted to the Director-General for approval 6 months prior to the commencement of construction of the project, or as otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E). A copy of the Program shall be submitted to the OEH, EPA, DPI (Fishing and Aquaculture) and NOW prior to its implementation.</p>	Pre-construction	RMS/Fulton Hogan	Compliant	<p>Construction Soil and Water Quality Management Plan (Rev E) Appendix B - Water Quality Monitoring Program</p> <p>As the project became operational at the end of October 2017 surface water quality monitoring moved into the operational phase of monitoring except for 2 monitoring sites which would monitor any potential impacts from the Woodhill Mountain Road Compound. This process was agreed to by Fulton Hogan, RMS and the project ER.</p> <p>Fulton Hogan undertook Surface water quality monitoring on the following dates:</p> <ul style="list-style-type: none"> <li>- 7th November 2017 – Minor Event</li> <li>- 6th December 2017 – Minor Event</li> <li>- 15th January 2018 – Minor Event</li> <li>- 13th February 2018 – Minor Event</li> <li>- 27th February 2018 – Major Event</li> <li>- 21st March 2018 – Minor Event</li> </ul> <p>RMS undertook Surface water quality monitoring on the following dates:</p> <ul style="list-style-type: none"> <li>- 14th February 2018 - Minor Event (operational)</li> <li>- 26th February 2018 - Major Event (operational)</li> <li>- 22nd March 2018 - Minor Event (operational)</li> </ul> <p>Results are provided in Appendix B of this report.</p>	Ongoing
<b>Heritage Impacts - Built and Landscape Heritage</b>						
B17	<p>Prior to pre-construction and construction impacts affecting 'Glen Devon' Federation Cottage (H11) and skid mounted work-site shed (H60), the Proponent shall carry out further historical research and investigate the options for relocation of these heritage items, in consultation with the department and the Heritage Council of NSW, to the satisfaction of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E).</p> <p>Additionally, for H11, the proponent shall:</p> <p>(a) undertake archaeological investigations in accordance with condition B20; and</p> <p>(b) provide for the preparation and implementation of a heritage interpretation plan.</p>	Prior to Pre-construction	RMS	Compliant	<p>Glen Devon Cultural Heritage Assessment was submitted to DP&amp;E on 16th July 2014 and was approved by DP&amp;E in a letter dated 10th September 2014.</p> <p>DP&amp;E was advised of the relocation outcome of Glen Devon in a letter dated 9th July 2015.</p> <p>The Glen Devon Heritage Interpretation Plan was submitted to DP&amp;E on 9th July 2015.</p>	Complete
B18	<p>Prior to the commencement of preconstruction and construction works in proximity to the following items G2B H11, H13, H15, H16, H17, H19, H21, H22, H23, H30, H45, H47, H53, H54, H55, H56, H62, H63, and the Southern Illawarra Coastal Plain and Hinterland Cultural Landscape (SICPH CL), and G2B A13, A14, A39, TRACL and MFT12 the Proponent shall complete all archival recordings, including photographic recording. In addition detailed historical research shall be undertaken for the following items G2B H60 H61, H63, the SICPH CL and G2B A39.</p> <p>This work shall be undertaken by an experienced heritage consultant, in accordance with the guidelines issued by the Heritage Council of NSW. The areas containing these items shall be clearly identified and/or fenced until the completion of the archival recordings. Within 6 months of completing the above work, the Proponent shall submit a report containing the archival recordings and the historical research, where required, to the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E), the Heritage Council of NSW, the local Council and the local Historical Society.</p>	Prior to Pre-construction	RMS	Compliant	<p>Archival recording and detailed historic research complete. Reports were sent to the DP&amp;E independently of this Compliance Tracking Report.</p> <p>Reports relating to Non-Aboriginal heritage were submitted to DP&amp;E on 10th July 2015</p> <p>Reports relating to Aboriginal heritage were submitted to DP&amp;E on 22nd October 2015</p> <p>Reports were sent to the Heritage Council of NSW, the local Councils, and the local Historical Society during this reporting period.</p>	Complete
B19	<p>Prior to pre-construction and construction impacts affecting G2B H15, H19, H21, H22, H23, H30 and H55 the Proponent shall carry out further historical and physical archaeological investigations in relation to these road alignments, in consultation with the department and the Heritage Council of NSW, to the satisfaction of the Director-General. These investigations must:</p> <p>(a) undertake archaeological investigations in accordance with condition B22;</p> <p>(b) provide for the detailed analysis of any heritage items discovered during the investigations;</p> <p>(c) include management options for these heritage items (including options for relocation and display); and</p> <p>(d) if the findings of the investigations are significant, provide for the preparation and implementation of a heritage interpretation plan.</p>	Prior to Pre-construction	RMS	Compliant	<p>Historic and physical archaeological investigations complete.</p> <p>Report submitted to the DP&amp;E on 10th July 2015.</p>	Complete
<b>Archaeology (Aboriginal and non-Aboriginal)</b>						
B20	<p>Prior to the commencement of pre-construction and construction activities affecting Aboriginal site G2B PAD 1 the Proponent shall:</p>	Prior to Pre-construction	RMS	Compliant	<p>Archaeological investigations complete.</p>	Complete

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	<p>(a) undertake archaeological investigation of this site using a methodology generally consistent with testing undertaken for the Environmental Assessment, and prepared in consultation with the OEH (Aboriginal heritage) and the Aboriginal stakeholders; and</p> <p>(b) report on the results of the archaeological investigation, including recommendations (such as for further archaeological work), in consultation with the OEH and to the satisfaction of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E), and shall include, but not necessarily be limited to:</p> <p>(i) consideration of measures to avoid or minimise disturbance to Aboriginal objects where objects of moderate to high significance are found to be present;</p> <p>(ii) where impacts cannot be avoided, recommendations for any further investigations under condition B21; and</p> <p>(iii) management and mitigation measures to ensure there are no additional impacts due to pre-construction and construction activities.</p>				Report submitted to the DP&E on 22nd October 2015.	
B21	<p>Prior to the commencement of pre-construction and construction activities affecting sites G2B A16, A18, A24, A29, A30, A31, A32, A33, A36, and G2B PAD1 the proponent shall:</p> <p>(a) develop a detailed salvage strategy, prepared in consultation with the OEH (Aboriginal heritage) and the Aboriginal stakeholders. The investigation program shall be prepared to the satisfaction of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E); and</p> <p>(b) undertake any further archaeological excavation works recommended by the results of the Aboriginal archaeological investigation program.</p> <p>Within twelve months of completing the above work, unless otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E), the Proponent shall submit a report containing the findings of the excavations, including artefact analysis and Aboriginal Site Impacts Recording Forms (ASIR), and the identification of final storage location for all Aboriginal objects recovered (testing and salvage), prepared in consultation with the Aboriginal stakeholders, the OEH (Aboriginal heritage) and to the satisfaction of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E).</p> <p>Note: where archaeological testing has occurred as part of the Environmental Assessment and the results are included in the documents listed in condition A1(b) the sites tested must still form part of the final report prepared under condition B21(b).</p>	Prior to Pre-construction	RMS	Compliant	<p>Archaeological salvage works have been completed on behalf of RMS by the nominated project archaeologist Kelleher Nightingale Consulting, in accordance with the approved methodology.</p> <p>The salvage report was finalised and sent to DP&amp;E during this reporting period</p>	Complete
B22	<p>Prior to the commencement of pre-construction and construction activities affecting non-Aboriginal sites H11, H14, H19, H23, H28, H30, H48, H49, H53, and H55, the Proponent shall:</p> <p>(a) Undertake an Historic archaeological investigation program in accordance with the Heritage Council's Archaeological Assessments Guideline (1996) using a methodology prepared, in consultation with the OEH (Heritage Branch), and to the satisfaction of the Director-General. This work should be undertaken by an archaeological heritage consultant approved by the Director-General. The nomination for the Excavation Director shall demonstrate ability to comply with the Heritage Council's Criteria for the Assessment of Excavation Directors (July 2011).</p> <p>(b) Report on the results of the non-Aboriginal archaeological investigation program, including recommendations (such as for further archaeological work), in consultation with the Heritage Branch, OEH and to the satisfaction of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E), and shall include, but not necessarily be limited to:</p> <p>(i) consideration of measures to avoid or minimise disturbance to archaeology, where archaeology of non-Aboriginal archaeological significance is found to be present;</p> <p>(ii) where impacts cannot be avoided, recommendations for any further investigations for archaeology of historical archaeological significance; and</p> <p>(iii) management and mitigation measures to ensure there are no additional impacts due to pre-construction and construction activities.</p> <p>(c) Undertake any further archaeological excavation works recommended by the results of the non-Aboriginal archaeological investigation program.</p> <p>Within 12 months of completing the above work, unless otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E), the Proponent shall submit a report containing the findings of the excavations, including artefact analysis, and the identification of a final repository for finds, prepared in consultation with the OEH (Heritage branch) and to the satisfaction of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E).</p> <p>Note: where archaeological testing has occurred as part of the environmental assessment and the results are included in the documents listed in condition A1(b) the sites tested must still form part of the methodology and final report prepared for the non-Aboriginal archaeological investigation program.</p>	Prior to Pre-construction	RMS	Compliant	<p>Investigation and reporting is complete.</p> <p>Report submitted to the DP&amp;E on 10th July 2015.</p>	Complete
<b>Urban Design and Landscaping</b>						
B23	<p>The Proponent shall prepare and implement an <b>Urban Design and Landscape Plan</b> for the project. The Plan shall be prepared in consultation with the relevant council and shall present an integrated urban design for the project. The Plan shall include, but not necessarily be limited to:</p> <p>(a) a principal goal of achieving the urban design objectives outlined in Section 2.2 Volume 2 Appendix I of the document referred to in Condition A1(b);</p> <p>(b) location of existing vegetation and proposed landscaping (including use of indigenous and endemic species where</p>	Pre-construction	RMS	Compliant	<p>Urban Design and Landscape Plan approved by DP&amp;E 27 October 2017.</p> <p>Works to rehabilitate the project footprint in accordance with the UDLP are complete. Significant progressive stabilisation was achieved throughout the phases of construction. Decommissioning and rehabilitation of 4 ancillary sites has been completed with 2 sites remaining.</p>	Ongoing

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	<p>possible) and design features;</p> <p>(c) graphics such as sections, perspective views and sketches for key elements of the project (including, but not limited to built elements such as retaining walls, cuttings, embankments, bridges, and noise barriers);</p> <p>(d) a description of locations along the project corridor directly or indirectly impacted by the construction of the project (e.g. temporary ancillary facilities, access tracks, watercourse crossings, etc.) and details of the strategies to progressively rehabilitate regenerate and/ or revegetate the locations with the objective of promoting biodiversity outcomes and visual integration. Details of species to be replanted/ revegetated shall be provided, including their appropriateness to the area and considering existing vegetation and habitat for threatened species;</p> <p>(e) an assessment of the visual screening effects of existing vegetation and the proposed landscaping. Where residences and businesses have been identified as likely to experience high visual impact as a result of the project and high residual impacts are likely to remain, the Proponent shall in consultation with affected receptors, identify opportunities for providing at-receptor landscaping to further screen views of the project. Where agreed to with the landowner, these measures shall be implemented during the construction of the project;</p> <p>(f) take into account appropriate roadside plantings and landscaping in the vicinity of heritage items and ensure no additional heritage impacts;</p> <p>(g) specific details on the landscape treatments for the North Street corridor, Town Creek diversion and Town Park.</p> <p>(h) strategies for progressive landscaping of other environmental controls such as erosion and sedimentation controls, drainage and noise mitigation;</p> <p>(i) location and design treatments for any associated footpaths and cyclist elements, and other features such as seating, lighting (in accordance with AS 4282-1997 Control of the Obtrusive Effect of Outdoor Lighting), fencing, and signs;</p> <p>(j) evidence of consultation with the relevant council and community on the proposed urban design and landscape measures prior to its finalisation; and</p> <p>(k) monitoring and maintenance procedures for the vegetated built elements, rehabilitated vegetation and landscaping (including weed control) including performance indicators, responsibilities, timing and duration and contingencies where rehabilitation of vegetation and landscaping measures fail.</p> <p>The Plan shall be submitted for the approval of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) prior to the commencement of construction, unless otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E). The Plan may be submitted in stages to suit the staged construction program of the project.</p>					
<b>Signage Policy</b>						
B24	The Proponent shall prepare a <b>signage policy</b> which addresses the bypassed towns of Foxground and Berry, in consultation with the relevant council.	Operation	RMS/Fulton Hogan	Compliant	Foxground and Berry Bypass Signage Policy dated 20th September 2013	Complete
B25	The signage policy shall be consistent with the Guide: Signposting (RTA July 2007), Tourist Signposting guide (RMS and Destination NSW 2012) and provide information on the range of services available within Berry including advice on any parks that could be used as a rest area (and directional signage to these parks) and that that the route through the towns may be taken as an alternative to the highway.	Operation	RMS/Fulton Hogan	Compliant	Foxground and Berry Bypass Signage Policy dated 20th September 2013	Complete
<b>Property and Landuse</b>						
B26	The Proponent shall ensure that the project is designed to minimise land take impacts to surrounding properties (including agricultural properties) as far as feasible and reasonable, in consultation with the affected landowners. Where the viability of existing agricultural operations are identified to be impacted by the land requirements of the project, the Proponent shall as part of detailed design employ a suitably qualified and experienced independent agricultural specialist (that is approved by the Secretary of the NSW Department of Planning & Environment (DP&E) for the purpose of this condition), to assist in identifying alternative farming opportunities for the relevant properties.	Pre-construction	RMS	Compliant	During the project development no impacts were identified to the viability of existing agricultural operations. As such, engaging an independent agricultural specialist was not required.	Complete
B27	The proponent shall discuss Crown Land transfer options with DPI (Crown Lands) and Shoalhaven Council, for Crown land located along the length of the project between Tannery Road and the northern interchange, with a view to reaching a mutually acceptable outcome for all parties. Evidence of consultation shall be provided to the Secretary of the NSW Department of Planning & Environment (DP&E) prior to the commencement of construction, with an agreed outcome to be reached, and submitted to the Secretary of the NSW Department of Planning & Environment (DP&E), prior to the operation of the upgraded highway. In the event that a mutually acceptable agreement cannot be reached, the Secretary of the NSW Department of Planning & Environment (DP&E) must be advised in writing, to determine whether mediation may be required.	Pre-construction and construction		Compliant	Evidence of consultation was sent to DP&E on 26th September 2014. An outcome was provided to DP&E on 18th October 2017.	Complete
B28	The proponent shall, in consultation with Shoalhaven City Council, prepare a strategy for the use of the Council land adjacent the project at North Street (presently occupied by the Berry Riding Club) investigating options to minimise impacts on the riding club both during construction and operation of the project. The final option(s) shall be determined by the proponent prior to the commencement of construction of works in the vicinity of the riding club, in consultation with Shoalhaven City Council and to the satisfaction of the Secretary of the NSW Department of Planning & Environment (DP&E).	Pre-construction		Compliant	The strategy for the land between North Street and the Berry bypass has been progressed by Roads and Maritime and Shoalhaven City Council to the point where Council has exhibited a draft Berry District Park Masterplan. The Shoalhaven City Council sought community comment on the draft masterplan. Roads and Maritime, in consultation with Shoalhaven City Council, has ensured that the Foxground and Berry Bypass Project has allowed sufficient land opportunity between North Street and the Berry	Complete



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					Bypass to meet the needs identified in the masterplan. Roads and Maritime propose no further involvement in the masterplan development and a copy of the Council draft plan is available at the following link: <a href="http://shoalhaven.nsw.gov.au/My-Council/Current-Projects/Berry-District-Park">http://shoalhaven.nsw.gov.au/My-Council/Current-Projects/Berry-District-Park</a> Roads and Maritime received confirmation from DPE on 29th November 2017 that the requirements of Condition B28 have been met.	
<b>Compliance Tracking</b>						
B29	<p>The Proponent shall develop and implement a <b>Compliance Tracking Program</b> to track compliance with the requirements of this approval. The Program shall be submitted to the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) for approval prior to the commencement of construction and relate to both the construction and operational phases of the project, and include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> <li>(a) provisions for the notification of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) of the commencement of works prior to the commencement of construction and prior to the commencement of operation of the project (including prior to each stage, where works are being staged);</li> <li>(b) provisions for periodic review of project compliance with the requirements of this approval and the documents listed under condition A1, including the Statement of Commitments;</li> <li>(c) provisions for periodic reporting of compliance status against the requirements of this approval and the documents listed under condition A1, including the Statement of Commitments, to the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) including at least one month prior to the commencement of construction and operation of the project and at other intervals during the construction and operation, as identified in the Program;</li> <li>(d) a program for independent environmental auditing in accordance with ISO 19011:2003 - Guidelines for Quality and/ or Environmental Management Systems Auditing;</li> <li>(e) mechanisms for reporting and recording incidents and actions taken in response to those incidents;</li> <li>(f) provisions for reporting environmental incidents to the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) during construction and operation; and</li> <li>(g) procedures for rectifying any non-compliance identified during environmental auditing, review of compliance or incident management.</li> </ul>	Pre-construction, Construction, Operation	RMS/Fulton Hogan	Compliant	Compliance Tracking Program , Revision B 5 September 2014 Construction Environmental Management Plan (Rev G), Section 8.3 Notification prior to the commencement of operation was sent to the Secretary on 3rd October 2017	Ongoing
<b>Community Information and Involvement - Provision of Electronic Information</b>						
B30	<p>Prior to the commencement of construction, the Proponent shall establish and maintain a new <b>website</b>, or dedicated pages within an existing website, for the provision of electronic information associated with the project. The Proponent shall, subject to confidentiality, publish and maintain up-to-date information on the website or dedicated pages including, but not necessarily limited to:</p> <ul style="list-style-type: none"> <li>(a) information on the current implementation status of the project;</li> <li>(b) a copy of the documents referred to under condition A1 of this approval, and any documentation supporting modifications to this approval that may be granted from time to time;</li> <li>(c) a copy of this approval and any future modification to this approval;</li> <li>(d) a copy of each relevant environmental approval, licence or permit required and obtained in relation to the project;</li> <li>(e) a copy of each current strategy, plan, program or other document required under this approval; and</li> <li>(f) the outcomes of compliance tracking in accordance with the requirements of condition B29.</li> </ul>	Pre-construction	RMS/Fulton Hogan	Compliant	Community Communication Strategy, (Rev 3) Section 7.2 Website: <a href="http://www.rms.nsw.gov.au/projects/south-coast/foxground-berry-bypass/index.html">http://www.rms.nsw.gov.au/projects/south-coast/foxground-berry-bypass/index.html</a> Periodic revisions and amendments of relevant documentation will be made as required.	Ongoing
<b>Complaints and Enquiries Procedure</b>						
B31	<p>Prior to the commencement of construction, the Proponent shall ensure that the following are available for community complaints and enquiries during the construction period:</p> <ul style="list-style-type: none"> <li>(a) a telephone number on which complaints and enquiries about construction and operation activities may be registered;</li> <li>(b) a postal address to which written complaints and enquiries may be sent; and</li> <li>(c) an email address to which electronic complaints and enquiries may be transmitted.</li> </ul> <p>The telephone number, the postal address and the email address shall be published in a newspaper circulating in the local area prior to the commencement of construction and prior to the commencement of project operation. The above details shall also be provided on the website (or dedicated pages) required by this approval.</p>	Construction	RMS/Fulton Hogan	Compliant	Community Communication Strategy, (Rev 3) sections 7.2 and 8.2	Ongoing
B32	<p>The Proponent shall prepare and implement a <b>Construction Complaints Management System</b> consistent with AS 4269 Complaints Handling prior to the commencement of construction activities and must maintain the System for the duration of construction activities.</p> <p>Information on all complaints received, including the means by which they were addressed and whether resolution was reached and whether mediation was required or used, shall be maintained by the Proponent and included in a complaints register. The information contained within the System shall be made available to the Secretary of the NSW Department of Planning &amp;</p>	Pre-construction, Construction	RMS/Fulton Hogan	Compliant	Community Communication Strategy, (Rev 3) Sections 8.1 and 8.2	Ongoing

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	Environment (DP&E) on request.					
<b>Community Involvement</b>						
B33	<p>The Proponent shall prepare and implement a <b>Community Communication Strategy</b> for the project. This Strategy shall be designed to provide mechanisms to facilitate communication between the Proponent, the Contractor, the Environmental Representative, the relevant council and the local community (broader and local stakeholders) on the construction and environmental management of the project. The Strategy shall include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> <li>(a) identification of stakeholders to be consulted as part of the Strategy, including affected and adjoining landowners;</li> <li>(b) procedures and mechanisms for the regular distribution of information to stakeholders on the progress of the project and matters associated with environmental management;</li> <li>(c) procedures and mechanisms through which stakeholders can discuss or provide feedback to the Proponent and/ or Environmental Representative in relation to the environmental management and delivery of the project;</li> <li>(d) procedures and mechanisms through which the Proponent can respond to enquiries or feedback from stakeholders in relation to the environmental management and delivery of the project; and</li> <li>(e) procedures and mechanisms that would be implemented to resolve issues/ disputes that may arise between parties on the matters relating to environmental management and the delivery of the project. This may include the use of an appropriately qualified and experienced independent mediator.</li> </ul> <p>Key issues that should be addressed in the Community Communication Strategy should include (but not necessarily be limited to):</p> <ul style="list-style-type: none"> <li>(i) traffic management (including property access, pedestrian access);</li> <li>(ii) landscaping/urban design matters;</li> <li>(iii) construction activities; and</li> <li>(iv) noise and vibration mitigation and management.</li> </ul> <p>The Proponent shall maintain and implement the Strategy throughout construction of the project. The Strategy shall be approved by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) prior to the commencement of construction, or as otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E).</p>	Pre-construction	RMS/Fulton Hogan	Compliant	<ul style="list-style-type: none"> <li>a) Community Communication Strategy, 27 October 2015 Section 5.2</li> <li>b) Community Communication Strategy, 27 October 2015 Section 7.2 and Appendix E</li> <li>c) Community Communication Strategy, 27 October 2015 Section 8.2</li> <li>d) Community Communication Strategy, 27 October 2015 Section 8.2</li> <li>e) Community Communication Strategy, 27 October 2015 Sections 4.1 and 8.2.</li> </ul> <p>Community Communication Strategy Appendix C</p> <ul style="list-style-type: none"> <li>i) Community Communication Strategy, 27 October 2015 Sections 4.1, 7.2 and 13.</li> <li>ii) Community Communication Strategy Sections 3.4, 7.2 and 7.5.</li> <li>iii) Community Communication Strategy Sections 3.4, 7.2 and 7.5.</li> <li>iv) Community Communication Strategy Sections 3.4, 7.2 and 7.5.</li> </ul>	Ongoing
<b>Environmental Management - Environmental Representative</b>						
B34	<p>Prior to the commencement of construction of the project, or as otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E), the Proponent shall nominate for the approval of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) a suitably qualified and experienced <b>Environment Representative(s)</b> that is independent of the design (including preparation of documentation referred to in condition A1), and construction personnel. The Proponent shall employ the Environmental Representative(s) for the duration of construction, or as otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E). The Environment Representative(s) shall:</p> <ul style="list-style-type: none"> <li>(a) be the principal point of advice in relation to the environmental performance of the project;</li> <li>(b) be consulted in responding to the community concerning the environmental performance of the project where the resolution of points of conflict between the Proponent and the community is required;</li> <li>(c) monitor the implementation of environmental management plans and monitoring programs required under this approval;</li> <li>(d) monitor the outcome of environmental management plans and advise the Proponent upon the achievement of project environmental outcomes;</li> <li>(e) have responsibility for considering and advising the Proponent on matters specified in the conditions of this approval, and other licences and approvals related to the environmental performance and impacts of the project;</li> <li>(f) ensure that environmental auditing is undertaken in accordance with the requirements of condition B29 and the project's Environmental Management System(s);</li> <li>(g) be given the authority to approve/ reject minor amendments to the Construction Environment Management Plan. What constitutes a "minor" amendment shall be clearly explained in the Construction Environment Management Plan required under condition B35; and</li> <li>(h) be given the authority and independence to require reasonable steps be taken to avoid or minimise unintended or adverse environmental impacts, and failing the effectiveness of such steps, to direct that relevant actions be ceased immediately should an adverse impact on the environment be likely to occur.</li> </ul>	Pre-construction, construction	RMS/Fulton Hogan	Compliant	Vantage Environmental (Toby Hobbs) has been appointed by RMS as the Environmental Representative on the Foxground and Berry Bypass.	Complete
<b>Construction Environmental Management Plan</b>						
B35	<p>The Proponent shall prepare and (following approval) implement a <b>Construction Environmental Management Plan</b> for the project. The Plan shall outline the environmental management practices and procedures that are to be followed during construction, and shall be prepared in consultation with the relevant agencies and in accordance with the Guideline for the Preparation of Environmental Management Plans (Department of Infrastructure, Planning and Natural Resources, 2004). The Plan shall include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> <li>(a) a description of activities to be undertaken during construction of the project or stages of construction, as relevant;</li> <li>(b) statutory and other obligations that the Proponent is required to fulfil during construction including approvals,</li> </ul>	Preconstruction	RMS/Fulton Hogan	Compliant	<p>Construction Environmental Management Plan (Rev H)</p> <p>A periodic review was undertaken of the CEMP and sub plans in September 2017 and endorsed by the ER on 25th September 2017.</p>	Ongoing

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	<p>consultations and agreements required from agencies and key legislation and policies. Evidence of consultation with relevant agencies shall be included identifying how issues raised by these agencies have been addressed in the Plan;</p> <p>(c) a description of the roles and responsibilities for relevant employees involved in the construction of the project including relevant training and induction provisions for ensuring that employees, including contractors and sub-contractors are aware of their environmental and compliance obligations under these conditions of approval;</p> <p>(d) identification of ancillary facility site locations, including an assessment against the location criteria outlined in condition C32;</p> <p>(e) an environmental risk analysis to identify the key environmental performance issues associated with the construction phase and details of how environmental performance would be monitored and managed to meet acceptable outcomes including what actions will be taken to address identified potential adverse environmental impacts (including any impacts arising from the staging of the construction of the project and/ or concurrent construction works with adjacent Princes Highway Upgrade projects, as relevant). In particular, the following environmental performance issues shall be addressed in the Plan:</p> <ul style="list-style-type: none"> <li>(i) measures to monitor and manage dust emissions including dust from stockpiles, blasting, traffic on unsealed public roads and materials tracking from construction sites onto public roads;</li> <li>(ii) measures to minimise hydrology impacts, including measures to stabilise bed and bank structures as required,</li> <li>(iii) measures to monitor and manage impacts associated with the construction and operation of ancillary facilities,</li> <li>(iv) measures for the handling, treatment and management of contaminated materials,</li> <li>(v) measures to monitor and manage waste generated during construction including but not necessarily limited to: general procedures for waste classification, handling, reuse, and disposal; use of secondary waste material in construction wherever feasible and reasonable; procedures for dealing with green waste including timber and mulch from clearing activities; and measures for reducing demand on water resources (including the potential for reuse of treated water from sediment control basins);</li> <li>(vi) measures to monitor and manage spoil, fill and materials stockpile sites including details of how spoil, fill or material would be handled, stockpiled, reused and disposed and a stockpile management protocol detailing locational criteria that would guide the placement of stockpiles and management measures that would be implemented to avoid/ minimise amenity impacts to surrounding residents and environmental risks (including to surrounding water courses). Stockpile sites that affect heritage, threatened species, populations or endangered ecological communities require the approval of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E), in consultation with the OEH;</li> <li>(vii) measures to monitor and manage hazard and risks including emergency management; and</li> <li>(viii) the issues identified in condition B36;</li> </ul> <p>(f) details of community involvement and complaints handling procedures during construction, consistent with the requirements of conditions B30 to B33;</p> <p>(g) details of compliance and incident management consistent with the requirements of condition B29; and</p> <p>(h) procedures for the periodic review and update of the Construction Environmental Management Plan and sub-plans required under condition B35 and B36 respectively, as necessary (including where minor changes can be approved by the Environmental Representative).</p> <p>The Plan shall be submitted for the approval of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) no later than one month prior to the commencement of construction, or within such period otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E). Construction works shall not commence until written approval has been received from the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E).</p>					
B36	<p>As part of the Construction Environment Management Plan for the project required under condition B35, the Proponent shall prepare and implement the following sub plan(s):</p> <p>(a) a <b>Construction Traffic Management Sub-plan</b>, prepared in accordance with the Roads and Maritime Service's QA Specification G10 – Control of Traffic and Traffic Control at Work Sites Manual (2003) to manage disruptions to traffic movements as a result of construction traffic associated with the project. The sub-plan shall be developed in consultation with the relevant council and shall include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> <li>(i) identification of construction traffic routes and quantification of construction traffic volumes (including heavy vehicle/ spoil haulage) on these routes;</li> <li>(ii) details of vehicle movements for construction sites and site compounds including parking, dedicated vehicle turning areas, and ingress and egress points;</li> <li>(iii) details of potential impacts to traffic on the existing highway, the 'Sandtrack', and associated local roads, including, intersection level of service and potential disruptions to pedestrians, public transport, parking, cyclists and property access</li> <li>(iv) details of temporary and interim traffic arrangements to address potential impacts;</li> </ul>	Preconstruction	RMS/Fulton Hogan	Compliant	<ul style="list-style-type: none"> <li>(a) Construction Traffic Management Plan (Rev 3) and Appendices</li> <li>(b) Flora and Fauna Management Sub Plan (Rev G) and Appendices.</li> <li>(c) Noise and Vibration Management Sub Plan (Rev G) and Appendices</li> <li>(d) Soil and Water Quality Management Sub Plan (Rev F) and Appendices</li> <li>(e) Heritage Management Sub Plan (Rev F) and Appendices</li> </ul>	Ongoing

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	<p>(v) details of evidence based mitigation measures to address potential impacts on the 'Sandtrack';</p> <p>(vi) a response procedure for dealing with traffic incidents; and</p> <p>(vii) mechanism for the monitoring, review and amendment of this sub-plan.</p> <p>(b) <b>a Construction Flora and Fauna Management Sub-plan</b> to detail how construction impacts on ecology will be minimised and managed. The sub-plan shall be developed in consultation with the OEH and DPI (Fishing and Aquaculture) and shall include, but not necessarily be limited to:</p> <p>(i) details of pre-construction surveys undertaken by a suitably qualified and experienced ecologist to verify the construction boundaries/ footprint of the project based on detailed design and to confirm the vegetation to be cleared as part of the project (including tree hollows, threatened flora and fauna species and riparian vegetation);</p> <p>(ii) updated sensitive area/ vegetation maps based on (i) above and previous survey work;</p> <p>(iii) details of general work practices and mitigation measures to be implemented during construction to minimise impacts on native fauna and native vegetation (particularly threatened species and EECs) not proposed to be cleared as part of the project, including, but not necessarily limited to: fencing of sensitive areas, a protocol for the removal and relocation of fauna during clearing, engagement of a suitably qualified and experienced ecologist to identify locations where they would be present and to oversee clearing activities and facilitate fauna rescues and re-location, clearing timing with consideration to breeding periods, measures for maintaining existing habitat features (such as bush rock and tree branches etc), seed harvesting and appropriate topsoil management, construction worker education, weed management (including controls to prevent the introduction or spread of <i>Phytophthora cinnamomi</i>), erosion and sediment control and progressive re-vegetation;</p> <p>(iv) specific procedures to deal with EEC/ threatened species anticipated to be encountered within the project corridor including re-location, translocation and/or management and protection measures;</p> <p>(v) a procedure for dealing with unexpected EEC/threatened species identified during construction including cessation of work and notification of the OEH, determination of appropriate mitigation measures in consultation with the OEH (including relevant re-location measures) and update of ecological monitoring and/ or biodiversity offset requirements consistent with conditions B7 and B8; and</p> <p>(vi) mechanism for the monitoring, review and amendment of this sub-plan;</p> <p>(c) <b>a Construction Noise and Vibration Management Sub-plan</b> to detail how construction noise and vibration impacts will be minimised and managed. The sub-plan shall be developed in consultation with the EPA and include, but not necessarily be limited to:</p> <p>(i) identification of nearest sensitive receptors and relevant construction noise and vibration goals applicable to the project;</p> <p>(ii) identification of key noise and/or vibration generating construction activities (based on representative construction scenarios, including at ancillary facilities) that have the potential to impact on surrounding sensitive receivers including expected noise/ vibration levels;</p> <p>(iii) identification of feasible and reasonable measures proposed to be implemented to minimise construction noise and vibration impacts (including construction traffic noise impacts);</p> <p>(iv) procedures for dealing with out-of-hour works in accordance with condition C4 and C6, including procedures for notifying the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) concerning complaints received in relation to the extended hours approved under condition C4(e);</p> <p>(v) procedures and mitigation measures to ensure relevant vibration and blasting criteria are achieved, including a suitable blast program, applicable buffer distances for vibration intensive works, use of low-vibration generating equipment/ vibration dampeners or alternative construction methodology, and pre- and post-construction dilapidation surveys of sensitive structures where blasting and/ or vibration is likely to result in damage to buildings and structures (including surveys being undertaken immediately following a monitored exceedance of the criteria);</p> <p>(vi) procedures for notifying sensitive receivers of construction activities that are likely to affect their noise and vibration amenity, as well as procedures for dealing with and responding to noise complaints; and</p> <p>(vii) a program for construction noise and vibration monitoring clearly indicating monitoring frequency, location, how the results of this monitoring would be recorded and, procedures to be followed where significant exceedances of relevant noise and vibration goals are detected;</p> <p>(d) <b>a Construction Soil and Water Quality Management Sub-plan</b> to manage surface and groundwater impacts during construction of the project. The sub-plan shall be developed in consultation with the OEH, EPA, DPI (Fishing and Aquaculture) and NOW and include, but not necessarily be limited to:</p> <p>(i) identification of potential sources of erosion and sedimentation, and water pollution (including those resulting</p>					

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	<p>from maintenance activities);</p> <ul style="list-style-type: none"> <li>(ii) details of how construction activities would be managed and mitigated to minimise erosion and sedimentation consistent with condition C20;</li> <li>(iii) where construction activities have the potential to impact on waterways or wetlands (through direct disturbance such as construction of waterway crossings or works in close proximity to waterways or wetlands), site specific mitigation measures to be implemented to minimise water quality, riparian and stream hydrology impacts as far as practicable, including measures to stabilise bed and/ or bank structures where feasible and reasonable, and to rehabilitate affected riparian vegetation to existing or better condition. The timing of rehabilitation of the waterways shall be identified in the sub-plan;</li> <li>(iv) a contingency plan, consistent with the Acid Sulphate Soils Manual, to deal with the unexpected discovery of actual or potential acid sulphate soils, including procedures for the investigation, handling, treatment and management of such soils and water seepage;</li> <li>(v) a tannin leachate management protocol to manage the stockpiling of mulch and use of cleared vegetation and mulch filters for erosion and sediment control;</li> <li>(vi) construction water quality monitoring requirements consistent with condition B16; and</li> <li>(vii) a groundwater management strategy, including (but not necessarily limited to):               <ul style="list-style-type: none"> <li>i. description and identification of groundwater resources (including depths of the water table and water quality) potentially affected by the project based on baseline groundwater monitoring undertaken in accordance with condition B15;</li> <li>ii. identification of surrounding licensed bores, dams or other water supplies and groundwater dependant ecosystems and potential groundwater risks associated with the construction of the project on these groundwater users and ecosystems;</li> <li>iii. measures to manage identified impacts on water table, flow regimes and quality and to groundwater users and ecosystems;</li> <li>iv. groundwater inflow control, handling, treatment and disposal methods; and</li> <li>v. a detailed monitoring plan to identify monitoring methods, locations, frequency, duration and analysis requirements; and</li> </ul> </li> </ul> <p>(e) a <b>Construction Heritage Management Sub-plan</b> to detail how construction impacts on Aboriginal and non-Aboriginal heritage will be avoided, minimised and managed. The sub-plan shall be prepared by an appropriately qualified heritage consultant(s) and be developed in consultation with the Heritage Council of NSW, the OEH (Aboriginal heritage), and registered Aboriginal stakeholders (for Aboriginal heritage), and include, but not necessarily be limited to:</p> <ul style="list-style-type: none"> <li>(i) In relation to Aboriginal Heritage:           <ul style="list-style-type: none"> <li>i. details of management measures and strategies for protection, salvage, and/or conservation of sites and items that will be directly or indirectly impacted during construction (including further archaeological investigations, salvage measures and/ or measures to protect unaffected sites during construction works in the vicinity);</li> <li>ii. procedures for dealing with previously unidentified Aboriginal objects (excluding human remains) including cessation of works in the vicinity, assessment of the significance of the item(s) and determination of appropriate mitigation measures including when works can re-commence by a suitably qualified archaeologist in consultation with the department, OEH and registered Aboriginal stakeholders and assessment of the consistency of any new Aboriginal heritage impacts against the approved impacts of the project, and notification to the OEH, in accordance with section 89A of the National Parks and Wildlife Act 1974, and the department;</li> <li>iii. procedures for dealing with human remains, including cessation of works in the vicinity and notification of the department, NSW Police Force, OEH and registered Aboriginal stakeholders and not recommencing any works in the area unless authorised by the department and/ or the NSW Police Force); and</li> <li>iv. induction processes (identification, protection) for construction personnel (including procedures for keeping records of inductions) and procedures for ongoing Aboriginal consultation and involvement; and</li> </ul> </li> <li>(ii) In relation to non-Aboriginal Heritage:           <ul style="list-style-type: none"> <li>i. details of management measures and strategies for protection, excavation, archival recording and/or conservation of heritage items that will be directly or indirectly impacted during construction (including measures to protect unaffected items during construction works in the vicinity);</li> <li>ii. procedures for dealing with previously unidentified items of heritage significance, including cessation of works in the vicinity, assessment of the significance of the item(s) and determination of appropriate mitigation measures including when works can re-commence by a suitably qualified and experienced archaeologist in consultation with the department and the Heritage Council of NSW</li> </ul> </li> </ul>					

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	<p>and assessment of the consistency of any new non-Aboriginal heritage impacts against the approved impacts of the project and notification of the Heritage Council of NSW, in accordance with Section 146 of the NSW Heritage Act 1977, and the department;</p> <p>iii. procedures for dealing with human remains, including cessation of works in the vicinity and notification of the department, NSW Police Force, the Heritage Council of NSW and not recommending any works in the area unless authorised by the department, and/ or the NSW Police Force); and</p> <p>iv. heritage induction processes (identification, protection) for construction personnel (including procedures for keeping records of inductions).</p>					
<b>PART C - DURING CONSTRUCTION</b>						
<b>Biodiversity</b>						
C1	The Proponent shall employ feasible and reasonable measures to minimise the clearing of native vegetation during the construction of the project.	Construction	Fulton Hogan	Compliant	Flora and Fauna Management Sub Plan (Rev G) and Appendices: contains provisions for minimising clearing. Clearing of native vegetation was minimised during the construction phase of the project.	Completed
<b>Air Quality Impacts</b>						
C2	The Proponent shall employ feasible and reasonable measures (including cessation of relevant works, as appropriate) to ensure that the project is constructed in a manner that minimises dust generation, including wind-blown dust, traffic-generated dust, dust from stockpiles and material tracking from construction and ancillary facility sites onto public roads.	Construction	Fulton Hogan	Compliant	Air Quality Management Sub Plan (Rev G), September 2017 Measures to minimise dust including multiple types of soil binding agents were used during the construction phase of the project.	Completed
<b>Noise and Vibration Impacts - Construction Hours</b>						
C3	<p>The Proponent shall only undertake construction activities associated with the project during the following standard construction hours:</p> <p>(a) For the area south of Tindalls Lane (including Berry township)</p> <p>(i) 7:00am to 6:00pm Mondays to Fridays, inclusive; and</p> <p>(ii) 8:00am to 1:00pm Saturdays; and</p> <p>(iii) at no time on Sundays or public holidays.</p>	Construction	Fulton Hogan	Compliant	Noise and Vibration Management Sub Plan (Rev G), September 2017	Ongoing
C4	<p>Works outside of the standard construction hours identified in condition C3 may be undertaken in the following circumstances:</p> <p>(a) works that generate noise that is:</p> <p>(i) LAeq (15 minute) noise levels no more than 5dB(A) above rating background level at any residence in accordance with the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009): and</p> <p>(ii) LAeq (15 minute) noise levels no more than the noise management levels specified in Table 3 of the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009) at other sensitive receivers; or</p> <p>(b) where a negotiated agreement has been reached with affected receivers, where the prescribed noise levels cannot be achieved; or</p> <p>(c) for the delivery of materials required outside these hours by the NSW Police Force or other authorities for safety reasons; or</p> <p>(d) for the area between Toolijooa Road and Tindalls Lane, encompassing Toolijooa cut, Broughton Creek floodplain and major bridge works (outside of Berry township) low noise impact activities and works as follows:</p> <p>(i) between 6:00am and 7:00am Monday to Friday; and</p> <p>(ii) between 6:00pm and 7:00pm Monday to Friday; and</p> <p>(iii) 1:00pm and 5:00pm on Saturdays; and</p> <p>(iv) at no time after 6pm on a day preceding a public holiday long weekend; and</p> <p>(e) where it is required in an emergency to avoid injury or the loss of life, property and/or to prevent environmental harm; or</p> <p>(f) works approved through an EPL, including for works identified in an out of hours procedure.</p>	Construction	Fulton Hogan	Compliant	Noise and Vibration Management Sub Plan (Rev G) Appendix E Additional approved out of hour's works have been completed and are compliant to the requirements of the individual supplementary approval. Condition C4 was modified by DP&E 31 July 2015 to allow for the NSW EPA to consider and approve Out of Hours Work (OOHW) in accordance with the Project Environmental Protection Licence (EPL)	Ongoing
C5	<p>Except as expressly permitted by an Environment Protection Licence issued for the project, high noise impact activities and works shall only be undertaken:</p> <p>(a) between the hours of 8:00am to 6:00pm Mondays to Fridays;</p> <p>(b) between the hours of 8:00am to 1:00pm Saturdays; and</p> <p>(c) in continuous blocks not exceeding three hours each with a minimum respite from those activities and works of not less than one hour between each block.</p> <p>For the purposes of this condition 'continuous' includes any period during which there is less than a one hour respite between ceasing and recommencing any of the work the subject of this condition.</p>	Construction	Fulton Hogan	Compliant	Noise and Vibration Management Sub Plan (Rev G), September 2017, Chapter 7	Ongoing
C6	<del>Construction activities (Out of Hours work) may be allowed to occur outside the construction hours specified in condition C3 with the prior written approval of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E). Requests for Out of</del>	Construction	Fulton Hogan	N/A	Condition C6 deleted by DP&E in accordance with the Modification	N/A

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	<p>Hours approval will be considered for construction activities which cannot be undertaken during the construction hours specified in condition C3 for technical or other justifiable reasons and will be considered on a case by case or activity specific basis. Request for Out of Hours work must be accompanied by:</p> <p>(a) details of the nature and need for activities to be conducted during the varied construction hours;</p> <p>(b) written evidence to the EPA and the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) that activities undertaken during the varied construction hours are justified, appropriate consultation with potentially affected receivers and notification of the relevant Council has been undertaken, issues raised have been addressed, and all feasible and reasonable mitigation measures have been put in place; and</p> <p>(c) evidence of consultation with the EPA on the proposed variation in standard construction hours.</p> <p>Despite the above, Out of Hours work may also occur in accordance with an approved Construction Environment Management Plan or Construction Noise and Vibration Management Sub-plan for this project, where that plan provides a process for considering the above on a case by case or activity specific basis by the Proponent, including factors (a) to (c) above.</p>				of 31 July 2015	
C7	<p>Blasting associated with the project shall only be undertaken during the following hours:</p> <p>(a) 9:00am to 5:00pm, Mondays to Fridays, inclusive;</p> <p>(b) 9:00am to 1:00pm on Saturdays; and</p> <p>(c) at no time on Sundays or public holidays.</p> <p>This condition does not apply in the event of a direction from the NSW Police Force or other relevant authority for safety or emergency reasons to avoid loss of life, property loss and/or to prevent environmental harm.</p>	Construction	Fulton Hogan	Compliant	Noise and Vibration Management Sub Plan (Rev G), September 2017, Appendix D. Blasting was completed in July 2016. No further blasting is proposed.	Complete
<b>Construction Noise and Vibration Goals</b>						
C8	The Proponent shall implement feasible and reasonable noise mitigation measures with the aim of achieving the construction noise management levels detailed in the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009) during construction activities. Any activities that could exceed the construction noise management levels shall be identified and managed in accordance with the Construction Noise and Vibration Management Sub-plan required under condition B36.	Construction	Fulton Hogan	Compliant	Noise and Vibration Management Sub Plan (Rev G) Section 4.1 and Chapter 7 No exceedances were observed in the reporting period. Noise is reported monthly in EPL reports and publically available on the Fulton Hogan website. <a href="http://www.fultonhogan.com/news-resources/management-plans-reporting/foxground-berry-bypass-nsw/">(http://www.fultonhogan.com/news-resources/management-plans-reporting/foxground-berry-bypass-nsw/)</a> The project is now in operational phase	Complete
C9	The Proponent shall implement all feasible and reasonable mitigation measures with the aim of achieving the following construction vibration goals:	Construction	Fulton Hogan	Compliant	Noise and Vibration Management Sub Plan (Rev G), September 2017, Section 4.2 and Chapter 7 No further vibration activities will be undertaken	Complete
C10	The Proponent shall ensure that airblast overpressure generated by blasting associated with the project does not exceed the criteria specified in Table 1 when measured at the most affected residence or other sensitive receiver.	Construction	Fulton Hogan	Compliant	Noise and Vibration Management Sub Plan (Rev G) Section 4.2, Chapter 7 and Appendix D Blasting is complete.	Complete
	<b>Table 1 - Airblast overpressure criteria:</b>					
	<table border="1"> <thead> <tr> <th>Airblast overpressure (dB(Lin Peak))</th> <th>Allowable exceedance</th> </tr> </thead> <tbody> <tr> <td>125</td> <td>5% of total number of blasts over a 12 month period</td> </tr> <tr> <td>135</td> <td>0%</td> </tr> </tbody> </table>					
Airblast overpressure (dB(Lin Peak))	Allowable exceedance					
125	5% of total number of blasts over a 12 month period					
135	0%					

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C11	<p>The Proponent shall ensure that ground vibration generated by blasting associated with the project does not exceed the criteria specified in Table 2 when measured at the most affected residence or other sensitive receiver.</p> <p><b>Table 2 – Peak particle velocity criteria</b></p> <table border="1"> <thead> <tr> <th>Receiver</th> <th>Peak particle velocity (mm/s)</th> <th>Allowable exceedance</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Residence on privately owned land</td> <td>5</td> <td>5% of total number of blasts over a 12 month period</td> </tr> <tr> <td>10</td> <td>0%</td> </tr> <tr> <td>Non-Aboriginal Heritage Item</td> <td>3</td> <td>0%</td> </tr> </tbody> </table>	Receiver	Peak particle velocity (mm/s)	Allowable exceedance	Residence on privately owned land	5	5% of total number of blasts over a 12 month period	10	0%	Non-Aboriginal Heritage Item	3	0%	Construction	Fulton Hogan	Compliant	<p>Noise and Vibration Management Sub Plan (Rev G) Section 4.3, Chapter 7 and Appendix D</p> <p>Blasting was completed in this reporting period and no further blasting is required</p>	Complete
Receiver	Peak particle velocity (mm/s)	Allowable exceedance															
Residence on privately owned land	5	5% of total number of blasts over a 12 month period															
	10	0%															
Non-Aboriginal Heritage Item	3	0%															
C12	To ensure that the criteria specified in conditions C10 and C11 are satisfied at the most affected residence or other sensitive receiver, blasting trials shall be undertaken prior to the commencement of the project's blasting program, with results from the trial blasts used to determine site specific blast design to satisfy the relevant criteria.	Construction	Fulton Hogan	Compliant	<p>Noise and Vibration Management Sub Plan (Rev G) Section 4.3, Chapter 7 and Appendix D</p> <p>Blasting was completed in this reporting period and no further blasting is required</p>	Complete											
C13	<p>C13. The blasting criteria identified in conditions C10 and/or C11 may be exceeded where the Proponent has written approval from the Director General. In obtaining the Director General's approval for any such exceedance the Proponent shall submit to the Director General:</p> <p>(a) a written agreement from the EPA and the relevant landowner to exceed the criteria;</p> <p>(b) details of the proposed blasting program and justification for the proposed increase to blasting criteria including alternatives considered (where relevant);</p> <p>(c) an assessment of the environmental impacts of the increased blast limits on the surrounding environment and most affected residences or other sensitive receivers including, but not limited to noise, vibration and air quality and any risk to surrounding utilities, services or other structures;</p> <p>(d) in relation to any identified non-Aboriginal heritage items in the vicinity of blasting works, an assessment of heritage impacts;</p> <p>(e) details of the blast management, mitigation and monitoring procedures to be implemented;</p> <p>(f) details of consultation undertaken (including clear identification of proposed blast limits and potential property impacts) and agreement reached with the relevant landowners and EPA (including a copy of the agreement in relation to increased blasting limits).</p> <p>Unless otherwise agreed by the Director General, the following exclusions apply to the application of this condition:</p> <p>(a) any agreements reached may be terminated by the landowner at any time should concerns about the increased blasting limits be unresolved; and</p> <p>(b) the blasting limit agreed to under any agreement can at no time exceed a maximum Peak Particle Velocity vibration level of 25 mm/s or maximum Airblast Overpressure level of 125 dBL.</p>	Construction	Fulton Hogan	Compliant	<p>Noise and Vibration Management Sub Plan (Rev G) Section 4.3, Chapter 7 and Appendix D</p> <p>Modification to C13 was approved on 28th January 2015</p> <p>Blasting was completed in this reporting period and no further blasting is required</p>	Complete											
<b>Operational Noise Mitigation Review</b>																	
C14	<p>Unless otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E), within 6 months of commencing construction, the Proponent shall, in consultation with the EPA, prepare and submit for the approval of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E), a review of the operational noise mitigation measures proposed to be implemented for the project. The review shall:</p> <p>(a) confirm the operational noise predictions of the project based on detailed design. This operational noise assessment shall be based on an appropriately calibrated noise model (which has incorporated additional noise monitoring, where necessary for calibration purposes);</p> <p>(b) review the suitability of the operational noise mitigation measures identified in the documents listed under condition A1 to achieve the criteria outlined in the <i>Road Noise Policy</i> (DECCW, 2011), based on the operational noise performance of the project predicted under (a) above; and</p> <p>(c) where necessary, investigate additional feasible and reasonable noise mitigation measures to achieve the criteria outlined in the <i>Road Noise Policy</i> (DECCW, 2011).</p>	Construction	RMS/Fulton Hogan	Compliant	Operational Noise Management Design Report Rev 3 dated 16 March 2015. Approved by DP&E on 12th June 2015	Complete											

**Heritage Impacts**



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C15	This approval does not allow the Proponent to destroy, modify or otherwise physically affect human remains as part of the project.	Construction	RMS/Fulton Hogan	Compliant	Heritage Management Sub Plan (Rev F), September 2017, Chapter 5 and Appendix A Modification of C15 was approved on 29th September 2017	Ongoing
C16	The Proponent shall not destroy, modify or otherwise physically affect Aboriginal sites A3, A20, A37 – A39, and MFT 13-23 and non-Aboriginal sites H25, H26, H51, H52, H58, and H59.	Construction	RMS/Fulton Hogan	Compliant	Heritage Management Sub Plan (Rev F), September 2017, Chapter 5 Modification of C16 was approved on 29th September 2017	Ongoing
C17	Identified impacts to heritage (both Aboriginal and non-Aboriginal), shall be minimised to the greatest extent practicable through both detailed design and construction, particularly with regard to Aboriginal sites A13, A14, A18 and TRACL, and historic sites H13, H20, H54, H62, H63 and the Southern Illawarra Coastal Plain and Hinterland Cultural Landscape. Where impacts are unavoidable, works shall be undertaken in accordance with the actions to manage heritage construction impacts required by condition B36(e) and under the guidance of an appropriately qualified heritage specialist.	Construction	RMS/Fulton Hogan	Compliant	Heritage Management Sub Plan (Rev F), September 2017, Chapter 5 Detailed design of the Foxground and Berry Bypass Urban Design and Landscaping Plan 20 November 2015	Ongoing
C18	The proponent shall not destroy, modify or otherwise physically affect any heritage items outside the approved project footprint, unless otherwise agreed by the Secretary of the NSW Department of Planning & Environment (DP&E) in accordance with Condition C32 of this project approval.	Construction	RMS/Fulton Hogan	Compliant	CEMP Section 3.7 and Appendix A5 Heritage Management Sub Plan (Rev F), September 2017, Chapter 5	Ongoing
C19	The measures to protect Aboriginal or historic heritage sites near or adjacent to the project during construction shall be detailed in the Heritage Management Sub-plan required under condition B36(e).	Construction	RMS/Fulton Hogan	Compliant	Heritage Management Sub Plan (Rev F), September 2017, Chapter 5	Ongoing
<b>Sedimentation, Erosion and Water</b>						
C20	Soil and water management measures consistent with <i>Managing Urban Stormwater - Soils and Construction Volumes 1 and 2, 4th Edition</i> (Landcom, 2004) and <i>Managing Urban Stormwater Soils And Construction Vols 2A and 2D Main Road Construction</i> (Department of Environment and Climate Change, 2008) shall be employed during the construction of the project for erosion and sediment control.	Construction	RMS/Fulton Hogan	Compliant	Soil and Water Quality Management Sub Plan (Rev F), September 2017, Section 2.2 and Chapter 5	Ongoing
C21	Where available, and of appropriate chemical and biological quality, the Proponent shall use stormwater, recycled water or other water sources in preference to potable water for construction activities, including concrete mixing and dust control.	Construction	RMS/Fulton Hogan	Compliant	Soil and Water Quality Management Sub Plan (Rev F), September 2017, Chapter 5	Ongoing
C22	All surface water and groundwater must be adequately treated prior to entering the stormwater system to protect the receiving water source quality.	Construction	RMS/Fulton Hogan	Compliant	Soil and Water Quality Management Sub Plan (Rev F), September 2017, Chapter 5	Ongoing
<b>Property and Landuse</b>						
C23	The Proponent shall construct the project in a manner that minimises impacts to private properties and other public or private structures (such as dams, fences, utilities, services etc.) along the project corridor. In the event that construction of the project results in direct or indirect damage to such property or structure, the Proponent shall arrange and fund repair of the damage to a standard comparable to that in existence prior to the damage occurring, unless otherwise agreed by the relevant property or utility owner.	Construction	RMS/Fulton Hogan	Compliant	Community Communication Strategy Appendices C and E. Noise and Vibration Management Sub Plan (Rev G), September 2017, Chapter 7 Dilapidation Reports have been completed	Ongoing
C24	Access to private property shall be maintained during construction unless otherwise agreed with the property owner in advance. A landowner's access that is physically affected by the Project shall be reinstated to meet at least equivalent standard and/or relevant road safety standards, in consultation with the property owner.	Construction	RMS/Fulton Hogan	Compliant	Community Communication Strategy Sections 3.4 and 7.2	Ongoing
C25	Any damage caused to property as a result of the project shall be rectified or the property owner compensated, within a reasonable timeframe, with the costs borne by the Proponent. This condition is not intended to limit any claims that the property owner may have against the Proponent.	Construction	RMS/Fulton Hogan	Compliant	Community Communication Strategy Section 7.2	Ongoing
C26	The Proponent shall, in consultation with relevant property owners, construct the project in a manner that minimises intrusion and disruption to agricultural operations/ activities in surrounding properties (e.g. stock access, access to farm dams etc.), unless otherwise agreed by the relevant property owner.	Construction	RMS/Fulton Hogan	Compliant	Community Communication Strategy Section 7.2	Ongoing
<b>Traffic Impacts</b>						
C27	The roads likely to be used by the project's heavy construction vehicles shall be identified in the Construction Traffic Management Sub-plan required under condition B36(a). (a) Road dilapidation reports shall be prepared for local roads likely to be used by the project's construction traffic, and a copy of the report(s) shall be provided to the relevant council, prior to use by the project's heavy construction vehicles. Any damage resulting from the use of the identified local roads by the project's heavy construction vehicles, aside from that resulting from normal wear and tear, shall be repaired at the cost of the Proponent, unless otherwise agreed by the relevant council. (b) A road dilapidation report shall be prepared for the 'Sandtrack' and a copy of the report shall be provided to the relevant council, prior to commencement of construction. Should monitoring in accordance with Condition B36(a) reveal higher	Pre-construction	RMS/Fulton Hogan	Compliant	Construction Traffic Management Plan (Rev 3) Section 2 A road dilapidation report for the 'Sandtrack' prior to operation was sent to Shoalhaven and Kiama councils, and submitted to DPE on 30th October 2017. The report outlined that the 'Sandtrack' did not receive higher than anticipated traffic volumes and therefore consultation with council is not required.	Complete

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	than anticipated volumes of traffic (as defined in the document referred to in Condition A1(b)) resulting in a higher rate of deterioration in the condition of local road infrastructure, consultation with the relevant Council shall be undertaken to determine mitigation measures in accordance with condition B36(a). A report shall be prepared and submitted to the Secretary of the NSW Department of Planning & Environment (DP&E) at 12 months and 24 months after commencement of construction, and prior to operation, unless otherwise agreed by the Secretary of the NSW Department of Planning & Environment (DP&E).					
<b>Waste Management</b>						
C28	The Proponent shall not cause, permit or allow waste generated outside the site to be received at the site for storage, treatment, processing, reprocessing, or disposal on the site, except as expressly permitted by a licence under the Protection of the Environment Operations Act 1997, if such a licence is required in relation to that waste.	Construction	RMS/Fulton Hogan	Compliant	Waste and Energy Management Sub Plan (Rev H), Chapters 4 and 5	Ongoing
C29	The Proponent shall maximise the reuse and/or recycling of waste materials generated on site as far as practicable, to minimise the need for treatment or disposal of those materials off site.	Construction	RMS/Fulton Hogan	Compliant	Waste and Energy Management Sub Plan (Rev H), Chapters 4 and 5	Ongoing
C30	The Proponent shall ensure that liquid and/or non-liquid waste generated on the site is assessed and classified in accordance with Waste Classification Guidelines (Department of Environment and Climate Change, 2008) and where removed from the site is directed to a waste management facility lawfully permitted to accept the materials.	Construction	RMS/Fulton Hogan	Compliant	Waste and Energy Management Sub Plan (Rev H), Chapters 4 and 5	Ongoing
<b>Hazards and Risks</b>						
C31	The Proponent shall store and handle dangerous goods, as defined by the Australian Dangerous Goods Code, strictly in accordance with: <ul style="list-style-type: none"> <li>(a) relevant Australian Standards;</li> <li>(b) for liquids, a minimum bund volume requirement of 110% of the volume of the largest single stored volume within the bund; and</li> <li>(c) the Environment Protection Manual for Authorised Officers: Bunding and Spill Management, Technical Bulletin (Environment Protection Authority, 1997).</li> </ul> In the event of an inconsistency between the requirements listed from (a) to (c) above, the most stringent requirement shall prevail to the extent of the inconsistency.	Pre-construction, Construction	RMS/Fulton Hogan	Compliant	Project Work Health and Safety Management Plan Section 8.4 Soil and Water Quality Management Sub Plan (Rev F), September 2017, Section 5.11	Ongoing
<b>Ancillary Facilities</b>						
C32	Unless otherwise approved by the Secretary of the NSW Department of Planning & Environment (DP&E) in accordance with this condition, the sites for ancillary facilities (except stockpiles) associated with the construction of the project shall: <ul style="list-style-type: none"> <li>(a) be located more than 50 metres from a waterway;</li> <li>(b) have ready access to the road network or direct access to the construction corridor;</li> <li>(c) not require native vegetation clearing beyond that already required by the project;</li> <li>(d) be sited on relatively level land;</li> <li>(e) be separated from the nearest residences by at least 200 metres (or at least 300 metres for a temporary batching plant);</li> <li>(f) not unreasonably affect the land use of adjacent properties;</li> <li>(g) be above the 20 ARI flood level unless a contingency plan to manage flooding is prepared and implemented;</li> <li>(h) provide sufficient area for the storage of raw materials to minimise, to the greatest extent practical, the number of deliveries required outside standard construction hours; and</li> <li>(i) not impact on heritage items beyond those already impacted by project (including identified Aboriginal cultural value and archaeological sensitivity).</li> </ul>	Pre-construction and Construction	RMS/Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev H), Section 2.4 and Appendix A5 As the project risk footprint is reduced, the project team continue to rehabilitate areas formerly used as ancillary facilities Currently only 2 ancillary facilities remain in use	Ongoing
C33	Ancillary sites that do not meet the criteria set out under condition C32 of this approval shall be approved by the Secretary of the NSW Department of Planning & Environment (DP&E) prior to establishment. In obtaining this approval, the Proponent shall assess the ancillary facility against the criteria set out under condition C32 of this approval to demonstrate how the potential environmental impacts can be mitigated and managed to acceptable standards. Such assessment(s) can be submitted separately or as part of the Construction Environmental Management Plan required under B35 of this approval. The assessment shall include, but not necessarily be limited to: <ul style="list-style-type: none"> <li>(a) a description of the ancillary facility, its components and the surrounding environment;</li> <li>(b) details on the activities to be carried out at the facility, including the hours of use and the storage of dangerous and hazardous goods;</li> <li>(c) an assessment of the environmental impacts on the site and the surrounding environment, including, but not limited to noise, vibration, air quality, traffic access, flora and fauna, heritage and light spill;</li> <li>(d) details on the mitigation, monitoring and management procedures specific to the ancillary facility that would be implemented to minimise the environmental impacts or, where this is not possible, feasible and reasonable measures to offset these impacts and an assessment of the adequacy of the mitigation or offsetting measures. This shall include consideration of restrictions on the hours of use or exclusion of certain activities;</li> </ul>	Pre-construction and Construction	RMS/Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev H), Section 2.4 and Appendix A5 Operation and construction of sites D and H was approved 15 January 2015 subject to the implementation of Ancillary facilities assessment for proposed ancillary facilities at Broughton Creek (Site D) and Austral Park Road (Site H): Foxground and Berry Bypass, November 2014. No further ancillary facilities will be required	Complete

**MCoA – Ministers Conditions of Approval Section 75J of the Environmental Planning and Assessment Act 1979**

Ref	Condition Requirement	Phase	Responsibility	Compliance status	Compliance notes	Close out
	<p>(e) details on the timing for the completion of activities at the ancillary facility and how the site will be decommissioned (including any necessary rehabilitation); and</p> <p>(f) demonstrated overall consistency with the approved project.</p> <p>The Proponent shall demonstrate to the satisfaction of the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) that there will be no significant adverse impact from that facility's construction or operation.</p>					
C34	<p>The Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E)'s approval is not required for minor ancillary facilities (e.g. lunch sheds, office sheds, and portable toilet facilities, etc.) that do not comply with the criteria set out in condition C32 of this approval and which:</p> <p>(a) are located within an active construction zone within the approved project footprint; and</p> <p>(b) have been assessed by the Environmental Representative to have:</p> <p>(i) minimal amenity impacts to surrounding residences, with consideration to matters such as noise and vibration impacts, traffic and access impacts, dust and odour impacts, and visual (including light spill) impacts, and</p> <p>(ii) (minimal environmental impact in respect to waste management, and no impacts on flora and fauna, soil and water, and heritage beyond those approved for the project; and</p> <p>(c) have environmental and amenity impacts that can be managed through the implementation of environmental measures detailed in a Construction Environment Management Plan for the project.</p>	Construction	RMS/Fulton Hogan	Compliant	<p>Construction Environmental Management Plan (Rev H), Section 2.4 and Appendix A5</p> <p>No further minor ancillary facilities will be required</p>	Complete
<b>PART D - PRIOR TO OPERATIONS</b>						
<b>Operational Environmental Management System</b>						
D1	Prior to the commencement of operation, the Proponent shall incorporate the project into its existing environmental management systems.	Construction	RMS	Compliant	The new highway is being managed in accordance with RMS' existing operation systems.	Ongoing
<b>PART E - DURING OPERATIONS</b>						
<b>Operational Noise</b>						
E1	<p>Within 12 months of the commencement of operation of the project, or as otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E), the Proponent shall undertake operational noise monitoring to compare actual noise performance of the project against noise performance predicted in the review of noise mitigation measures required by condition C14, and prepare an <b>Operational Noise Report</b> to document this monitoring. The Report shall include, but not necessarily be limited to:</p> <p>(a) noise monitoring to assess compliance with the operational noise levels predicted in the review of operational noise mitigation measures required under condition C14 and documents specified under condition A1 of this approval;</p> <p>(b) a review of the operational noise levels in terms of criteria and noise goals established in the Environmental Criteria for Road Traffic Noise (EPA, 1999);</p> <p>(c) methodology, location and frequency of noise monitoring undertaken, including monitoring sites at which project noise levels are ascertained, with specific reference to locations indicative of impacts on sensitive receivers;</p> <p>(d) details of any complaints and enquiries received in relation to operational noise generated by the project between the date of commencement of operation and the date the report was prepared;</p> <p>(e) any required recalibrations of the noise model taking into consideration factors such as actual traffic numbers and proportions;</p> <p>(f) an assessment of the performance and effectiveness of applied noise mitigation measures together with a review and if necessary, reassessment of all feasible and reasonable mitigation measures; and</p> <p>(g) identification of additional feasible and reasonable measures to those identified in the review of noise mitigation measures required by condition C14, that would be implemented with the objective of meeting the criteria outlined in the Environmental Criteria for Road Traffic Noise (EPA, 1999), when these measures would be implemented and how their effectiveness would be measured and reported to the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) and the EPA.</p> <p>The Proponent shall provide the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E) and the EPA with a copy of the Operational Noise Report within 60 days of completing the operational noise monitoring referred to in (a) above or as otherwise agreed by the Secretary of the NSW Department of Planning &amp; Environment (DP&amp;E).</p>	Operation	RMS	Compliant	Operational Noise monitoring commenced in late March 2018. This information is currently being processed, with the Operational Noise Monitoring Report due for publication in mid-2018.	Ongoing

**Table 1: Revised statement of commitments (May 2013)**

SoC – Revised statement of commitments (May 2013)						
No.	Commitment Requirement	Phase	Responsibility	Compliance status	Compliance notes	Close out
<b>Environmental management</b>						
EM1	The head contractor for the project will have an Environmental Management System (EMS).	Pre-construction and construction	Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev H) and Sub-plans	Ongoing
EM2	Environmental management plans will be developed and implemented by suitably qualified and experienced personnel and will incorporate as a minimum the mitigation and management measures in the environmental assessment.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev H) and Sub-plans	Ongoing
EM3	Environmentally sensitive areas (such as native vegetation, river flat eucalypt forest and cultural heritage) within the construction site boundary will be marked on sensitive area maps, demarcated and signposted where necessary. Maps will be made available during all on-site inductions to construction personnel.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev H), Appendix A6	Ongoing
EM4	All construction personnel will receive training regarding environmental management.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev H), Chapter 5	Ongoing
<b>Community consultation</b>						
CC1	<p>The community will be kept informed with measures such as:</p> <ul style="list-style-type: none"> <li>- Letter box drops, media releases and community updates.</li> <li>- An internet site established and maintained for the duration of the project.</li> <li>- Variable message signs.</li> <li>- The project office.</li> <li>- Email to registered stakeholders.</li> <li>- Targeted consultation with affected individuals or groups.</li> </ul> <p>Information to be provided will include:</p> <ul style="list-style-type: none"> <li>- Changes to access and traffic conditions.</li> <li>- A detail of future works programs.</li> <li>- General construction progress.</li> </ul>	Pre-construction and construction	Fulton Hogan	Compliant	Community Communication Strategy (Rev 3), Section 7.2	Ongoing
CC2	<p>Communication management will include:</p> <ul style="list-style-type: none"> <li>- A 24 hour toll-free contact telephone number.</li> <li>- Directions on how to register a complaint or make an inquiry.</li> <li>- Acknowledgement of complaints within 24 hours.</li> <li>- A complaint recording and tracking system.</li> </ul>	Pre-construction and construction	RMS/Fulton Hogan	Compliant	Community Communication Strategy (Rev 3), Sections 8.1 and 8.2	Ongoing
<b>Traffic and transport</b>						
TT1	Construction vehicle movements and works programs will incorporate traffic control measures to minimise traffic and transport impacts on local roads and the existing highway.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Traffic Management Plan (Rev3), Chapter 3	Ongoing
TT2	Road safety on 'the Sandtrack' will be monitored during construction. Should additional road safety issues be identified appropriate road safety measures will be implemented where reasonable and feasible, in consultation with Kiama Municipal Council and Shoalhaven City Council.	Construction	RMS	Compliant	Construction Traffic Management Plan (Rev3), Chapter 2	Complete
TT3	Traffic levels and operational performance will be monitored during peak periods, at approximately 6 and 12 months following completion of the project.	Operation	RMS	Compliant	Traffic was monitored over the peak holiday period of Easter 2018. No delays or impacts were experienced on the network within the project area. General operational performance has indicated a travel time saving of between 5 to 10 minutes on pre-build travel times.	Ongoing
<b>Noise and vibration</b>						
NV1	Mitigation and management measures, such as noise barriers, pre-dilapidation surveys and monitoring, will be used to minimise construction noise and vibration at sensitive receivers.	Construction	Fulton Hogan	Compliant	Construction Noise and Vibration Management Sub-plan (Rev G), Chapter 7 and Section 8.3	Ongoing
NV2	If required due to ground conditions, impact piling ('driven piles') will be conducted during standard working hours.	Construction	Fulton Hogan	Compliant	There are no driven piles on the project.	Complete

SoC – Revised statement of commitments (May 2013)						
No.	Commitment Requirement	Phase	Responsibility	Compliance status	Compliance notes	Close out
NV3	Reasonable and feasible mitigation measures, such as noise barriers in the vicinity of North Street and Huntingdale Park Road and architectural treatments, will be developed and implemented to meet the noise criteria applicable to the project in consultation with the sensitive receiver.	Pre-construction	Fulton Hogan	Compliant	Noise barriers on North street have been constructed as a priority to limit potential noise effects on neighbouring residents. Post construction noise monitoring will identify the need for any additional reasonable and feasible treatments	Ongoing
NV4	Operational noise monitoring will be undertaken approximately one year after project opening, in accordance with RMS' Environmental Noise Management Manual (RTA, 2001). If monitoring indicates a clear trend that traffic noise levels exceed those predicted, further feasible and reasonable measures will be investigated in consultation with a qualified and experienced acoustic specialist and affected property owners.	Construction and Operation	Fulton Hogan	Compliant	Operational Noise monitoring commenced in late March 2018. This information is currently being processed, with the Operational Noise Monitoring Report due for publication in mid-2018.	Ongoing
NV5	The feasibility of constructing noise protection on the western side of Mark Radium Park will be investigated.	Pre-construction and construction	Fulton Hogan	Compliant	The Detailed Design Report: Operational Noise Management (Final design) (March 2015), Section 6.4 assessed the acoustic performance of a potential noise barrier at Mark Radium Park and found construction of a barrier was not reasonable or feasible.	Complete
<b>Biodiversity</b>						
BD1	Areas of vegetation identified to be retained will be managed as environmentally sensitive areas.	Pre-construction	Fulton Hogan	Compliant	Construction Flora and Fauna Management Sub-plan (Rev G), Chapter 5	Complete
BD2	Pre-clearing fauna surveys, clearing procedures, including staged clearing where there are hollow trees, and methods to control noxious and environmental weeds and pests will be developed and implemented prior to clearing activities, in consultation with a suitably qualified and experienced ecologist.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Flora and Fauna Management Sub-plan (Rev G), Chapter 5, Appendices A and F	Complete
BD3	Natural and artificial habitat features, such as bat roost and nest boxes, will be installed to replace hollow-bearing trees that are removed.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Flora and Fauna Management Sub-plan (Rev G), Chapter 5, Appendices A	Complete
BD4	A fauna monitoring program will be developed in consultation with OEH. This program will allow the assessment of the effectiveness of fauna mitigation measures including nest boxes, bat roost boxes, fauna underpasses, rope bridges and fauna fencing.	Pre-construction, construction and operation	RMS	Compliant	Construction Flora and Fauna Management Sub-plan (Rev G), Chapter 5, Appendix A Ecological Monitoring Program.	Complete
BD5	Soil that has been stripped, stockpiled and/or reinstated as part of the construction works will be appropriately managed to maintain available seed bank.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Flora and Fauna Management Sub-plan (Rev G), Chapter 5, Appendix A Construction Soil and Water Quality Management Sub-plan (Rev D), Appendix F	Complete
BD6	Fauna mitigation structures, such as fauna underpasses, fauna overpasses and fauna fencing will be provided where reasonable and feasible. These structures will be designed to assist the safe passage of fauna underneath or over the highway.	Pre-construction, construction and operation	Fulton Hogan	In progress	Fauna Crossings Report (CoA B5).	Complete
BD7	Vegetation will be retained, where practicable, under bridges, at temporary creek crossing sites, adjacent to ancillary sites and in the vicinity of rope bridges.	Pre-construction, construction and operation	Fulton Hogan	Compliant	Construction Flora and Fauna Management Sub-plan (Rev G), Chapter 5 and Appendix A. Landscape Drawings	Complete
BD8	Permanent and temporary waterway crossings will be designed and constructed in accordance with the fish classification of each waterway.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Flora and Fauna Management Sub-plan (Rev G), Chapter 5	Complete
BD9	A biodiversity offset package will be developed in consultation with the biodiversity offset strategy and in consultation with OEH and DTIRIS. The area of restoration or offsetting would be guided by a simulated assessment of the project impacts and potential offsets using the Bio Banking Assessment Methodology with a minimum of 2:1 for riparian vegetation.	Pre-construction and construction	RMS	Compliant	The Biodiversity Offset Package was approved by DPE on the 3rd May 2017. A timeframe for implementation isn't identified in the BOP, however RMS are currently negotiating BioBanking agreements. BioBanking agreements for two Roads and Maritime owned properties were lodged with OEH in the reporting period. All four BioBanking agreements are now lodged with OEH.	Ongoing
<b>Surface water and groundwater</b>						
SG1	Water quality measures such as water quality basins, swales or bioretention systems at sensitive receiving environments will be designed and installed to respond to the project water quality design criteria.	Pre-construction and construction	Fulton Hogan	Design compliant; installation in progress.	Construction Soil and Water Quality Management Sub-plan (Rev F), Chapter 5 Detailed Design – Drainage Report	Complete
SG2	A design and revegetation strategy for the Town Creek diversion will be developed during detailed design and will include measures to:	Pre-construction and construction	Fulton Hogan	Compliant	Detailed Design – Drainage Report Urban Design and Landscape Plan, March 2016	Complete

SoC – Revised statement of commitments (May 2013)						
No.	Commitment Requirement	Phase	Responsibility	Compliance status	Compliance notes	Close out
	Maintain flushing efficiency. Mitigate erosion risk at the connection with Bundewallah Creek. The design of the diversion will be finalised in consultation with directly affected landowners. The Town Creek diversion will be stabilised to mitigate erosion risk prior to operation.					
SG3	Permanent losses to farm dam catchments and inflows will be identified during detailed design. Mitigation strategies will be developed in consultation with affected landowners and implemented where reasonable and feasible.	Pre-construction	RMS/ Fulton Hogan	Compliant	Detailed Design – Drainage Report	Complete
SG4	Drinking water drawn from Broughton Creek will be maintained through measures identified in commitment AQ1. In the event that water drawn from Broughton Creek does not meet existing drinking water quality standards, an appropriate source of potable water will be made available to affected residents, following consultation.	Construction	Fulton Hogan	Compliant	Construction Air Quality Management Sub-plan (Rev G), Chapter 5  Residents have been consulted directly during construction about upcoming and ongoing construction activities. Sensitive water receivers are managed through targeted site works and the implementation of specific erosion and sediment controls.	Complete
SG5	RMS will consult with landholders along the existing Town Creek alignment, below the proposed diversion, to confirm that there are no Basic Landholder Rights (under the Water Management Act 2000) to access water for domestic or stock purposes.	Pre-construction	RMS	Compliant	RMS consulted with landowners and confirmed no Basic Landholder Rights exist along the Town Creek alignment.	Complete
SG6	Waterway structures will be designed to maintain existing flow regimes, where practicable.	Pre-construction	Fulton Hogan	Compliant	Detailed Design – Drainage Report	Complete
SG7	Detailed design will seek to minimise increases in peak flood levels in the 1 in 100 year flood event.	Pre-construction	Fulton Hogan	Compliant	Detailed Design – Drainage Report	Complete
SG8	Changes to flood impacts on property will be identified as part of detailed design. Where increased flood impacts to structures, such as residences, are identified, mitigation measures will be proposed and implemented where reasonable and feasible.	Pre-construction and construction	Fulton Hogan	Compliant	Hydrological Mitigation Report  Detailed Design - Flooding Report  Repeated attempts to gain agreement with the landowner have not been successful to date. Roads and Maritime are continuing efforts to resolve this issue.	Ongoing
SG9	Impacts on stream channel structure diversion will be minimised during detailed design. Measures to be considered may include culvert sizing, energy dissipation measures, scour protection and other design features to control flow intensity and direction.	Pre-construction	Fulton Hogan	Compliant	Detailed Design – Drainage Report	Complete
SG10	Groundwater monitoring of water levels and water quality will be undertaken. Where levels and/or quality indicate that the project is potentially having an adverse impact, mitigation measures will be considered and implemented where reasonable and feasible.	Construction	Fulton Hogan	Compliant	Soil and Water Quality Management Sub Plan (Rev F), Appendix B	Ongoing
SG11	Water efficient work practices, such as water reuse and recycling for road construction and revegetation irrigation will be implemented, where feasible. In the event that surface water from watercourses or groundwater is required to supply water to the project, a site specific impact assessment will be carried out in consultation with the NSW Office of Water and potentially affected stakeholders.	Construction	Fulton Hogan	Compliant	Soil and Water Quality Management Sub Plan (Rev F), September 2017, Chapter 5	Complete
<b>Landscape character and visual amenity</b>						
VL1	The detailed design will be developed with reference to the minimum reference design requirements and the findings of the CM+ Urban Design Study for the following project components: All bridges within the project, with consideration of the Bridge Aesthetics Design Guidelines (RTA 2003). Embankments across Broughton Creek west of Toolijooa Ridge. Noise attenuation measures barriers along the length of the project.	Pre-construction	Fulton Hogan	Compliant	Urban Design and Landscape Plan, March 2016 Detailed Design - Structures Report	Complete
VL2	Councils and the local community will be engaged during detailed design to receive feedback on an urban and landscape design strategy for the project and the integration of existing pedestrian access and mobility plans for Berry.	Pre-construction	Fulton Hogan	Compliant	Completed during detailed design Detailed Design - Roads Report	Complete
VL3	To respect the rural and historic character of Foxground and Berry, noise barriers and bridges will be designed using forms, materials, colour and texture that are sensitive to the area, that complement the existing rural character and, where possible and desirable, that recede into the landscape. Planting and revegetation will be used to help blend the project into its setting and screen and visually soften built elements.	Pre-construction	Fulton Hogan	Compliant	Urban Design and Landscape Plan, March 2016 Native plant stock has been incorporated into the landscape plantings throughout the rural setting to integrate the project with the surrounding landscape character.	Complete
VL4	Landscaping treatments will include native plant species endemic to the local area and where practicable, locally sourced seed and propagated plant stock will be used to supplement the plant materials required for the project.	Pre-construction and construction	Fulton Hogan	Compliant	Urban Design and Landscape Plan, March 2016	Complete
VL5	A lighting strategy and design will be undertaken during detailed design to minimise the impacts of light spill. Detailed design will address mechanisms for reducing the impacts of headlight glare from vehicles travelling on the bridges at Berry and Broughton Creek	Pre-construction	Fulton Hogan	Compliant	Detailed Design - Signage, Linemarking & Road Furniture Report	Complete
<b>Aboriginal heritage</b>						

SoC – Revised statement of commitments (May 2013)						
No.	Commitment Requirement	Phase	Responsibility	Compliance status	Compliance notes	Close out
AH1	Aboriginal sites identified to be conserved will be managed as environmentally sensitive areas.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Heritage Management Sub-plan (Rev F), Chapter 5 Construction Environmental Management Plan (Rev H), Appendix A6	Complete
AH2	Disturbance to the natural soil profile of G2B A13 and G2B A14 will be avoided, where practicable.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Heritage Management Sub-plan (Rev F), Chapter 5 Alignment Report	Complete
AH3	Conduct a program of archaeological salvage at sites G2B A16, G2B A18, G2B A24, G2B A29, G2B A30, G2B A31, G2B A32, G2B A32, G2B A33, G2B A36, and G2B PAD1.	Construction	RMS	Compliant	Archaeological salvage works have been completed on behalf of RMS by the nominated project archaeologist, Kelleher Nightingale Consulting.	Complete
AH4	If any skeletal remains or unknown Aboriginal objects or places are encountered, works that would potentially impact the find will stop immediately. Works will not re-commence until appropriate clearance has been received.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Heritage Management Sub-plan (Rev F), Chapter 5 and Appendix A	Ongoing
AH5	All construction personnel will receive training in the management of Aboriginal cultural materials, including legal obligations, the application of protocols and the recognition of Aboriginal cultural materials.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Heritage Management Sub-plan (Rev F), Section 6.2	Complete
<b>Non-Aboriginal heritage</b>						
NA1	Mitigation (archival record, test/salvage excavation) will be completed for impacted heritage items.	Pre-construction and construction	RMS	Compliant	Archival recording and detailed historic research complete.	Complete
NA2	An archival recording of Glen Devon (G2B H11) and its grounds will be conducted prior to the commencement of construction	Pre-construction and construction	RMS	Compliant	Archival recording complete	Complete
NA3	Non-Aboriginal sites identified to be conserved will be managed as environmentally sensitive areas.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Heritage Management Sub-plan (Rev F), Chapter 5	Complete
NA4	If any unknown non-Aboriginal heritage items are encountered, all works that would potentially impact the find will stop immediately. Works will not recommence until appropriate clearance has been received.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Heritage Management Sub-plan (Rev F), Chapter 5 and Appendix A	Ongoing
NA5	An archival record will be prepared for any directly impacted heritage item. Copies will be kept in RMS' library and distributed to the Kiama library and Shoalhaven library (Nowra branch).	Pre-construction and construction (as relevant)	RMS	Compliant	Archival recording completed. Copies to be sent to Kiama and Shoalhaven libraries.	Complete
<b>Land use and property</b>						
P1	Negotiation for all property acquisitions will be in accordance with RMS' Land Acquisition Information Guide (RTA, 2011). Compensation assessment will be in accordance with the Land Acquisition (Just Terms Compensation) Act 1991.	Pre-construction	RMS	Compliant	Complete	Complete
P2	Property access will be maintained during construction. If temporary or alternative access is required, it will be provided in consultation with the affected landowner/s.	Construction.	Fulton Hogan	Compliant	Community Communication Strategy (Rev 3), Section 7.2	Complete
P3	Affected property owners will be consulted during detailed design regarding long term access requirements via underpasses.	Pre-construction and construction	Fulton Hogan	Compliant	Community Communication Strategy (Rev 3), Section 7.2	Complete
<b>Socio-economic</b>						
SE1	Negotiations for property acquisition will include consideration of property adjustments, where required, to maintain farm management practices.	Pre-construction	RMS	Compliant	Complete	Complete
SE2	Stock refuge will be maintained at Broughton Creek bridge 2 and will be determined during detailed design in consultation with landowners.	Pre-construction	RMS/ Fulton Hogan	Compliant	Community Communication Strategy (Rev 3), Section 7.2 Detailed Design – Alignment Report	Complete
SE3	Appropriate destination signage will be provided near to interchanges.	Operation	Fulton Hogan	N/A at this stage – relates to operation.	Construction Traffic Management Plan (Rev3), Sections 16.3.1 & 16.3.2 Detailed Design - Signage, Linemarking & Road Furniture Report	Complete
SE4	Consultation with Shoalhaven City Council will continue through detailed design and construction regarding assistance towards the development of strategies to address the continued economic viability of Berry.	Pre-construction and construction	RMS	Compliant	Ongoing via support of the Berry Strategic Plan via the Berry Forum, recognised by SCC as the official consultative community body – ref: <a href="http://berryforum.org.au/strategic-plan/">http://berryforum.org.au/strategic-plan/</a>	Complete
SE5	Access to recreational facilities will be maintained during construction and operation of the project, where practicable, including consideration of assistance to the relocation of the Berry equestrian centre during construction.	Pre-construction, construction and	RMS/ Fulton Hogan	Compliant	Community Communication Strategy (Rev 3), Section 7.2	Complete

SoC – Revised statement of commitments (May 2013)						
No.	Commitment Requirement	Phase	Responsibility	Compliance status	Compliance notes	Close out
		operation				
SE6	Access to local creeks, including access to the existing Broughton Creek bridge will be maintained during construction and operation to provide access for recreational fishers, where safe and practicable.	Pre-construction, construction and operation	Fulton Hogan	Compliant	Community Communication Strategy (Rev 3), Section 7.2 Detailed Design - Drainage Report	Complete
<b>Soil and water quality</b>						
SW1	Management measures will be designed, installed and maintained to minimise erosion and sedimentation from construction activities.	Pre-construction, construction and operation	Fulton Hogan	Compliant	Construction Soil and Water Quality Management Sub-plan (Rev F), Chapter 5	Ongoing
SW2	A soil conservation specialist will be engaged to provide advice on erosion and sedimentation control.	Pre-construction, construction and operation	Fulton Hogan	Compliant	Construction Soil and Water Quality Management Sub-plan (Rev F), Chapter 5 SEEC have been engaged as the nominated soil conservationist	Complete
SW3	Stabilisation of exposed areas will be undertaken progressively.	Pre-construction, construction and operation	Fulton Hogan	Compliant	Construction Soil and Water Quality Management Sub-plan (Rev F), Chapter 5	Ongoing
SW4	Monitoring of water quality upstream and downstream of the project site will be undertaken before and during construction.	Pre-construction, construction and operation	Fulton Hogan	Compliant	Construction Soil and Water Quality Management Sub-plan (Rev F), Appendix B As the project became operational at the end of October 2017 surface water quality monitoring moved into the operational phase of monitoring except for 2 monitoring sites which would monitor any potential impacts from the Woodhill Mountain Road Compound. This process was agreed to by Fulton Hogan, RMS and the project ER. Fulton Hogan undertook Surface water quality monitoring on the following dates: <ul style="list-style-type: none"> <li>- 7th November 2017 – Minor Event</li> <li>- 6th December 2017 – Minor Event</li> <li>- 15th January 2018 – Minor Event</li> <li>- 13th February 2018 – Minor Event</li> <li>- 27th February 2018 – Major Event</li> <li>- 21st March 2018 – Minor Event</li> </ul> RMS undertook Surface water quality monitoring on the following dates: <ul style="list-style-type: none"> <li>- 14th February 2018 - Minor Event (operational)</li> <li>- 26th February 2018 - Major Event (operational)</li> <li>- 22nd March 2018 - Minor Event (operational)</li> </ul> Results are provided in Appendix B of this report.	Ongoing
SW5	Areas of ASS to be avoided will be fenced and signposted as exclusion zones before and during any works in the vicinity.	Pre-construction, construction and operation	Fulton Hogan	Compliant	Construction Soil and Water Quality Management Sub-plan (Rev F), Appendix E	Complete
SW6	Exposed ASS will be neutralised and surface run-on will be minimised. Any acid runoff or acid material will be contained and treated.	Pre-construction, construction and operation	Fulton Hogan	Compliant	Construction Soil and Water Quality Management Sub-plan (Rev F), Appendix E	Complete
SW7	Targeted soil contamination investigations will be undertaken during detailed design, if required. A remedial action plan will be developed if contamination is found to pose unacceptable risks to the environment and human health.	Pre-construction, construction and operation	Fulton Hogan	Compliant	Construction Soil and Water Quality Management Sub-plan (Rev F), Appendix C Detailed Design - Geotechnical Report No contamination identified	Complete
<b>Air quality</b>						



SoC – Revised statement of commitments (May 2013)						
No.	Commitment Requirement	Phase	Responsibility	Compliance status	Compliance notes	Close out
AQ1	Standard dust and emission control measures will be implemented to manage construction air quality impacts at sensitive receivers.	Construction	Fulton Hogan	Compliant	Construction Air Quality Management Sub-plan (Rev G), Chapter 5	Complete
AQ2	Monitoring will be undertaken to assess the effectiveness of the air quality environmental management measures. Where required, additional feasible and reasonable environmental management measures will be used.	Construction	Fulton Hogan	Compliant	Construction Air Quality Management Sub-plan (Rev G), Section 6.3	Complete
<b>Hazards and risks</b>						
HR1	Spills will be contained immediately. Bunded areas within the construction site and ancillary facilities, or other areas where suitable containment measures are in place to prevent discharge into watercourses, will be used for storage of potentially hazardous and/or contaminating materials and activities.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Soil and Water Quality Management Sub-plan (Rev F), Chapter 5	Ongoing
HR2	Not used.	NA	NA	NA	NA	NA
HR3	Protection measures for the eastern gas pipeline and suitable construction methods when working in the vicinity of the pipeline will be implemented in consultation with Jemena (Eastern Gas Pipeline).	Pre-construction and construction	Fulton Hogan	Compliant	Detailed Design - Signage, Linemarking & Road Furniture Report	Complete
HR4	Permanent water quality basins, swales or other appropriate controls will be designed during the detailed design phase to protect waterways from spills.	Pre-construction and operation	Fulton Hogan	Compliant	Detailed Design – Drainage Report	Complete
<b>Waste and management</b>						
SM1	Not used.	NA	NA	NA	NA	NA
SM2	The waste minimisation hierarchy principles of avoid, reduce, reuse, recycle or dispose will apply to all aspects of the project.	Construction	Fulton Hogan	Compliant	Construction Waste and Energy Management Plan (Rev H), Chapters 4 and 5	Ongoing
<b>Greenhouse gas emissions</b>						
GG1	Energy efficient work practices will be implemented, including consideration of: Energy efficient design of site buildings. Design of site compounds and the batch plant to minimise unnecessary vehicle movement. Regular servicing of site plant and equipment. Training of construction personnel in energy efficient plant operation. The use of accredited GreenPower. Use of locally sourced materials where available and of suitable quality.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Waste and Energy Management Plan (Rev H), Chapters 4 and 5	Ongoing
<b>Ancillary facilities</b>						
AF1	Ancillary facilities (excluding temporary stockpiles) not identified in the environmental assessment will be located in areas: More than 50 metres from waterways for the active area of the ancillary facility. Where there is no significant clearing of native vegetation beyond that already required for the project. That minimise impact on amenity of the closest sensitive receiver (unless a negotiated agreement is in place). On relatively level ground.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev H), Section 2.4 and Appendix A5	Ongoing
AF2	Ancillary chemical storage facilities will be located above the 1 in 100 year flood level unless otherwise identified the construction environmental management plan.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Environmental Management Plan (Rev H), Section 2.4 and Appendix A5	Ongoing
AF3	Temporary stockpiles will be located in areas: Of low ecological and heritage conservation significance. At least 50 metres from waterways. Outside the 10 year ARI floodplain. On relatively level ground.	Pre-construction and construction	Fulton Hogan	Compliant	Construction Soil and Water Quality Management Sub-plan (Rev F), Appendix F	Ongoing

## **Appendix B Surface Water Quality Monitoring Results**

# Surface Water Monitoring

## Construction Event 26

Monitoring event triggered after 15mm of rainfall was received in 24 hours. This event was of low significance and did not trigger the full suite of analysis as 50mm of rainfall was not received within 24 hours.

Date of Monitoring: 7<sup>th</sup> November 2017

Rainfall Monitoring is shown below.

Woodhill Mountain Road	
Date:	Rainfall Received:
06/11/17	24mm
07/11/17	3mm

Toolijooa Road	
Date:	Rainfall Received:
06/11/17	48mm
07/11/17	3mm

Austral Park	
Date:	Rainfall Received:
06/11/17	30mm
07/11/17	5mm

## Scope and Limitations

In accordance with the Princes Highway upgrade for Foxground and Berry Bypass (FBB) – Water Monitoring Project Brief, surface water monitoring at seventeen locations (SW01 to SW017) was undertaken. This report presents the information collected during the monitoring event with some discussion on field observations and results with respect to upstream vs downstream conditions.

## Field Programme

Surface water sampling was undertaken at all surface locations where flow conditions allowed a representative sample to be taken. This monthly water sampling event was conducted in accordance with the sampling program and protocols provided in:

- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water and Groundwater Sampling Protocol, prepared for Roads and Maritime Services
- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services
- 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring

Report, prepared for Roads and Maritime Services.

Field parameters were measured during sampling including temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), and reduction-oxidation potential (redox), and are provided in Table B1, Attachment B. Field sheets are provided in Attachment C.

Water samples were submitted to a NATA certified testing laboratory (Australian Laboratory services (ALS)) to be analysed for:

- Total suspended solids.

## Weather Monitoring

The project has three weather stations used to monitor weather and rainfall. For the purpose of triggering water quality monitoring events the project uses these weather stations. The locations of the weather stations are:

- The project office on Woodhill Mountain Road, Berry
- Austral Park Road, ancillary facility, Broughton
- Toolijooa Road, Toolijooa,

During the construction phase minor events are classified as at least 15 mm of rainfall in 24 hours and major events are classified as at least 50 mm of rainfall in 24 hours.

## Surface water sampling results

Results for the water quality monitoring event are located as attachments at the end of this document, they are:

- Attachment A, Location maps
- Attachment B, Tabulated results
- Attachment C, Field sheets
- Attachment D, Laboratory results
- Attachment E, Field photographs.

## Surface water locations

The upstream location represents the 'reference' (un-impacted) site while the down-stream locations represent the 'test' sites (potentially impacted sites during construction and operation). By comparing upstream water quality with down-stream water quality potential impacts from construction are assessed.

**Table 1 Surface water locations within specific surface water bodies**

<b>Surface water</b>	<b>Upstream of Alignment</b>	<b>Downstream of Alignment (test)</b>
Broughton Creek	SW01	SW02, SW03, SW05
Connelly's Creek and Broughton Mill Creek and Bundewallah Creek	SW04, SW06	SW07, SW09
Bundewallah Creek and Connelly's Creek	SW08	SW06
Town Creek	SW10	SW11
Hitchcocks Lane Creek Tributary	SW12	SW13

Hitchcocks Lane Creek	SW14	SW15
Unnamed Tributary	SW16	SW17

## Results summary

The monitoring for this rainfall event was triggered by 15mm of rainfall received in 24 hours. The total event volume was ranged from approximately 24mm to 48mm across the project over 1 day. This rainfall has not significantly impacted the flows through the waterways on the project as rainfall has been significantly lower over the 5 months and as a result runoff was observed much lower than normal conditions.

In the projects current state there is a reduced risk in site runoff effecting the surrounding catchment due to the completed nature and reduction in construction footprint. Consequently, there were no observed construction impacts as a result of this rainfall event.

It is to be noted that sites SW11, SW12, SW14, SW15 and SW16 were not sampled due to the low to no flow observed in these locations.

Broughton Creek: Showed no impacts from construction. Conductivity at SW05 was again elevated due to the low flow conditions mixed with the incoming tide. Observations saw an increase in turbidity downstream at SW03 where there was unrelated excavation work in close proximity carried out upstream of SW03 sampling site. Total suspended solids (TSS) results indicate that this was a very minor impact with SW03 TSS resulting in <5mg/L.

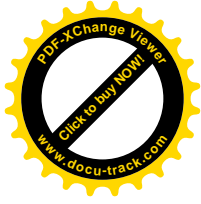
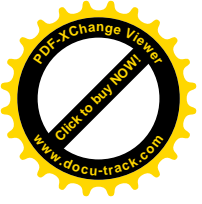
Connelly's Creek and Broughton Mill Creek and Bundewallah Creek: Showed no impacts from construction. It was noted that there was very low flow in all monitoring locations. As a result of these low flow conditions there was a large amount of algal growth throughout all sampling sites. It is possible that the algae is the cause of the low dissolved oxygen result and a negative oxidation reduction potential identified at SW09.

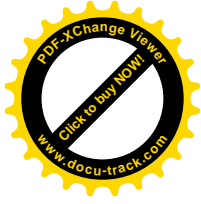
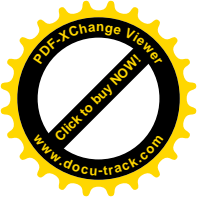
Town Creek: Catchment is stabilised and operational resulting in no impacts from construction. Downstream sampling location SW11 was not sampled due to no flow conditions.

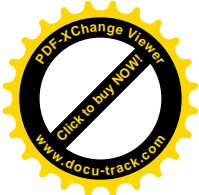
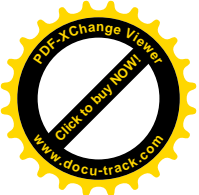
Hitchcocks Lane Creek Tributary: Catchment is stabilised and operational resulting in no impacts from construction. The upstream reference sites SW12 was unable to be sampled as no flow was observed.

Hitchcocks Lane Creek: Catchment is stabilised and operational resulting in no impacts from construction. Sampling did not occur at the upstream or downstream reference sites (SW14 and SW15) due to low flow conditions observed in the waterway.

Unnamed Tributary: Catchment is stabilised and operational resulting in no impacts from construction. Upstream location SW16 unable to be sampled due to shallow depths in waterway caused by low flow conditions.









# Surface water monitoring

**Document No.**

000005

**Conducted on**

7/11/17, 08:32

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 08:35

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	1	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pool after riffle underneath bridge
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	15.3	
<b>pH</b>		
	6	
<b>REDOX</b>		
	306	
<b>Conductivity (uS/cm)</b>		
	147	
<b>Turbidity</b>		
	3.9	
<b>DO (mg/L)</b>		
	5.62	

### Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000007

**Conducted on**

7/11/17, 09:29

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 09:31

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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	2	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Downstream of weir
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	15.7	
<b>pH</b>		
	6.7	
<b>REDOX</b>		
	276	
<b>Conductivity (uS/cm)</b>		
	178	
<b>Turbidity</b>		
	4.8	
<b>DO (mg/L)</b>		
	6.2	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		



## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000006

**Conducted on**

7/11/17, 09:04

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 09:08

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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	3	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Upstream of riffle on bend
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.23	
<b>pH</b>		
	6.5	
<b>REDOX</b>		
	245	
<b>Conductivity (uS/cm)</b>		
	210	
<b>Turbidity</b>		
	9.5	
<b>DO (mg/L)</b>		
	5.58	



## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Slightly turbid	
<b>Other</b>		
	Farmer with excavator working upstream of sampling location. Possible cause of turbid runoff	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000015

**Conducted on**

7/11/17, 12:04

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 12:08

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Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	4	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Upstream pond before riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Developed riparian
Slope	Yes	Gentle
Erosion	No	



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	17.30	
<b>pH</b>		
	7.5	
<b>REDOX</b>		
	236	
<b>Conductivity (uS/cm)</b>		
	148	
<b>Turbidity</b>		
	0.7	
<b>DO (mg/L)</b>		
	6.34	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000008

**Conducted on**

7/11/17, 09:49

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 09:53

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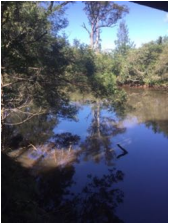
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Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	5	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widening of creek
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Mix between riparian and agricultural
Slope	Yes	Very slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.2	
<b>pH</b>		
	7.4	
<b>REDOX</b>		
	244	
<b>Conductivity (uS/cm)</b>		
	987	
<b>Turbidity</b>		
	1.6	
<b>DO (mg/L)</b>		
	4.17	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	Tidal influence rising tide causing greater salinity	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000014

**Conducted on**

7/11/17, 11:51

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 11:54

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<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	6	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pond before riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Very slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	19.20	
<b>pH</b>		
	7.2	
<b>REDOX</b>		
	245	
<b>Conductivity (uS/cm)</b>		
	190	
<b>Turbidity</b>		
	7.3	
<b>DO (mg/L)</b>		
	5.58	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Slighty turbid	
<b>Other</b>		
	Turbid due to upstream dairy/catchment. Elevated turbidity was found in upstream location 8	

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	2	
Preservatives	No	
Duplicate	Yes	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000009

**Conducted on**

7/11/17, 10:01

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 10:04

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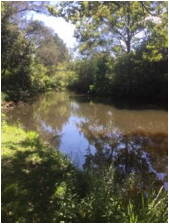
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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	7	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widening of creek
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian mix with grassland
Slope	Yes	Very slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.6	
<b>pH</b>		
	7.1	
<b>REDOX</b>		
	246	
<b>Conductivity (uS/cm)</b>		
	178	
<b>Turbidity</b>		
	2.0	
<b>DO (mg/L)</b>		
	4.19	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	Algal growth high due to past dry conditions	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000010

**Conducted on**

7/11/17, 10:20

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 10:24



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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	8	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Slight constriction around bend. Confluence between bundewallah and TC
<div style="display: flex; align-items: center;">  <div style="margin-left: 10px;">Appendix 1</div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian with exotic weeds
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	15.73	
<b>pH</b>		
	7.1	
<b>REDOX</b>		
	225	
<b>Conductivity (uS/cm)</b>		
	285	
<b>Turbidity</b>		
	17.6	
<b>DO (mg/L)</b>		
	4.53	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Slightly turbid	
<b>Other</b>		
	Sample site downstream of primary dairy land	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000016

**Conducted on**

7/11/17, 12:15

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 12:23

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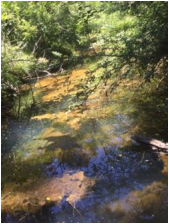
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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	9	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Deep pool after riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Developed riparian
Slope	Yes	Slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.40	
<b>pH</b>		
	6.7	
<b>REDOX</b>		
	-14	
<b>Conductivity (uS/cm)</b>		
	213	
<b>Turbidity</b>		
	0.2	
<b>DO (mg/L)</b>		
	1.04	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	Flow is very low. Lot of algal growth and very low dissolved oxygen content	

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number	9	
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000011

**Conducted on**

7/11/17, 10:37

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 10:41

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 4/4 - 100%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	10	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Outlet of TC into pond
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 4/4 - 100%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Grassland agricultural
Slope	Yes	Very slight
Erosion	Yes	Evidence of high flow erosion on banks
 <p>Appendix 2</p>		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	17.14	
<b>pH</b>		
	7.4	
<b>REDOX</b>		
	205	
<b>Conductivity (uS/cm)</b>		
	165	
<b>Turbidity</b>		
	18.2	
<b>DO (mg/L)</b>		
	4.84	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Turbid	
<b>Other</b>		
	Possible agricultural influence to turbidity	



## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1



Appendix 2

# Surface water monitoring

**Document No.**

000012

**Conducted on**

7/11/17, 11:07

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 11:14

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 4/4 - 100%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	13	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Small drainage line
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 4/4 - 100%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Grassland recreational
Slope	Yes	Gentle
Erosion	Yes	High flow bank erosion. Not associated with this event
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 2</p> </div> </div>		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	18.11	
<b>pH</b>		
	7.8	
<b>REDOX</b>		
	236	
<b>Conductivity (uS/cm)</b>		
	474	
<b>Turbidity</b>		
	36	
<b>DO (mg/L)</b>		
	5.44	



## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Turbid	
<b>Other</b>		
	FBB construction completed in catchment, no possible cause of turbid runoff from site. Upstream development in earthworks phase may influence water quality. However flow conditions do not allow water sampling occur to Aus standards	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1



Appendix 2

# Surface water monitoring

**Document No.**

000013

**Conducted on**

7/11/17, 11:27

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 11:33

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	17	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Slightly deep pool 200mm underneath bridge. Upstream location 16 cannot be assessed due to insufficient depth to sample <100mm.
 <p style="text-align: center;">Appendix 1</p>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Limited underneath bridge. Wetland sedges growing in water line. Heavy scour around sample location
Slope	Yes	Very slight
Erosion	No	



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	18.75	
<b>pH</b>		
	7.7	
<b>REDOX</b>		
	198	
<b>Conductivity (uS/cm)</b>		
	394	
<b>Turbidity</b>		
	3.5	
<b>DO (mg/L)</b>		
	6.56	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	None	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	No construction work in catchment area. Area is stabilised and well established	

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	2	
Preservatives	No	
Duplicate	Yes	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000014

**Conducted on**

7/11/17, 11:51

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 11:54

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	6	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pond before riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Very slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	19.20	
<b>pH</b>		
	7.2	
<b>REDOX</b>		
	245	
<b>Conductivity (uS/cm)</b>		
	190	
<b>Turbidity</b>		
	7.3	
<b>DO (mg/L)</b>		
	5.58	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Slighty turbid	
<b>Other</b>		
	Turbid due to upstream dairy/catchment. Elevated turbidity was found in upstream location 8	

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	2	
Preservatives	No	
Duplicate	Yes	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000009

**Conducted on**

7/11/17, 10:01

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 10:04

## **Disclaimer**

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## **Confidentiality Statement**

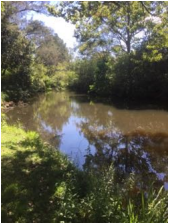
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<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	7	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widening of creek
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian mix with grassland
Slope	Yes	Very slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.6	
<b>pH</b>		
	7.1	
<b>REDOX</b>		
	246	
<b>Conductivity (uS/cm)</b>		
	178	
<b>Turbidity</b>		
	2.0	
<b>DO (mg/L)</b>		
	4.19	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	Algal growth high due to past dry conditions	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000010

**Conducted on**

7/11/17, 10:20

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 10:24

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	8	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Slight constriction around bend. Confluence between bundewallah and TC
 <p>Appendix 1</p>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian with exotic weeds
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	15.73	
<b>pH</b>		
	7.1	
<b>REDOX</b>		
	225	
<b>Conductivity (uS/cm)</b>		
	285	
<b>Turbidity</b>		
	17.6	
<b>DO (mg/L)</b>		
	4.53	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Slightly turbid	
<b>Other</b>		
	Sample site downstream of primary dairy land	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000016

**Conducted on**

7/11/17, 12:15

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 12:23



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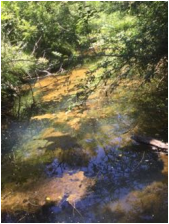
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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	9	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Deep pool after riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Developed riparian
Slope	Yes	Slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.40	
<b>pH</b>		
	6.7	
<b>REDOX</b>		
	-14	
<b>Conductivity (uS/cm)</b>		
	213	
<b>Turbidity</b>		
	0.2	
<b>DO (mg/L)</b>		
	1.04	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	Flow is very low. Lot of algal growth and very low dissolved oxygen content	

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number	9	
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000011

**Conducted on**

7/11/17, 10:37

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 10:41

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 4/4 - 100%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	10	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Outlet of TC into pond
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 4/4 - 100%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Grassland agricultural
Slope	Yes	Very slight
Erosion	Yes	Evidence of high flow erosion on banks
 <p>Appendix 2</p>		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	17.14	
<b>pH</b>		
	7.4	
<b>REDOX</b>		
	205	
<b>Conductivity (uS/cm)</b>		
	165	
<b>Turbidity</b>		
	18.2	
<b>DO (mg/L)</b>		
	4.84	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Turbid	
<b>Other</b>		
	Possible agricultural influence to turbidity	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	



## Media



Appendix 1



Appendix 2

# Surface water monitoring

**Document No.**

000012

**Conducted on**

7/11/17, 11:07

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 11:14

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 4/4 - 100%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	13	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Small drainage line
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 4/4 - 100%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Grassland recreational
Slope	Yes	Gentle
Erosion	Yes	High flow bank erosion. Not associated with this event



Appendix 2

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	18.11	
<b>pH</b>		
	7.8	
<b>REDOX</b>		
	236	
<b>Conductivity (uS/cm)</b>		
	474	
<b>Turbidity</b>		
	36	
<b>DO (mg/L)</b>		
	5.44	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Turbid	
<b>Other</b>		
	FBB construction completed in catchment, no possible cause of turbid runoff from site. Upstream development in earthworks phase may influence water quality. However flow conditions do not allow water sampling occur to Aus standards	



## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1



Appendix 2

# Surface water monitoring

**Document No.**

000013

**Conducted on**

7/11/17, 11:27

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 11:33

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	17	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Slightly deep pool 200mm underneath bridge. Upstream location 16 cannot be assessed due to insufficient depth to sample <100mm.
 <p style="text-align: center;">Appendix 1</p>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Limited underneath bridge. Wetland sedges growing in water line. Heavy scour around sample location
Slope	Yes	Very slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	18.75	
<b>pH</b>		
	7.7	
<b>REDOX</b>		
	198	
<b>Conductivity (uS/cm)</b>		
	394	
<b>Turbidity</b>		
	3.5	
<b>DO (mg/L)</b>		
	6.56	



## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	None	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	No construction work in catchment area. Area is stabilised and well established	

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	2	
Preservatives	No	
Duplicate	Yes	

## Media



Appendix 1



## CERTIFICATE OF ANALYSIS

**Work Order** : **EW1704616**  
**Client** : **FULTON HOGAN PTY LTD**  
**Contact** : JACOB COOPER  
**Address** : LEVEL1 3 - 90 BOURKE ROAD  
 ALEXANDRIA NSW, AUSTRALIA 2015  
  
**Telephone** : +61 02 8346 9400  
**Project** : Foxground and Berry Bypass  
**Order number** : ----  
**C-O-C number** : ----  
**Sampler** : JACOB COOPER  
**Site** : ----  
**Quote number** : WO/044/15 Blanket Quote  
**No. of samples received** : 14  
**No. of samples analysed** : 14

**Page** : 1 of 5  
**Laboratory** : Environmental Division NSW South Coast  
**Contact** : Aneta Prosaroski  
**Address** : 1/19 Ralph Black Dr, North Wollongong 2500  
 4/13 Geary Pl, North Nowra 2541  
 Australia NSW  
**Telephone** : 02 4225 3125  
**Date Samples Received** : 07-Nov-2017 16:26  
**Date Analysis Commenced** : 10-Nov-2017  
**Issue Date** : 13-Nov-2017 13:53



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

### Signatories

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

*Signatories*

*Position*

*Accreditation Category*

Dian Dao

Sydney Inorganics, Smithfield, NSW



## General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
LOR = Limit of reporting  
^ = This result is computed from individual analyte detections at or above the level of reporting  
ø = ALS is not NATA accredited for these tests.  
~ = Indicates an estimated value.



### Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW01	SW02	SW03	SW04	SW05
Client sampling date / time				07-Nov-2017 08:30	07-Nov-2017 09:30	07-Nov-2017 08:50	07-Nov-2017 12:15	07-Nov-2017 09:45	
Compound	CAS Number	LOR	Unit	EW1704616-001	EW1704616-002	EW1704616-003	EW1704616-004	EW1704616-005	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5	



### Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW06_A	SW06_B	SW07	SW08	SW09
Client sampling date / time				07-Nov-2017 11:40	07-Nov-2017 11:55	07-Nov-2017 10:00	07-Nov-2017 10:20	07-Nov-2017 12:30	
Compound	CAS Number	LOR	Unit	EW1704616-006	EW1704616-007	EW1704616-008	EW1704616-009	EW1704616-010	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	9	<5	





### Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	SW10	SW13	SW17_A	SW17_B	----
Client sampling date / time			07-Nov-2017 10:35	07-Nov-2017 11:10	07-Nov-2017 11:30	07-Nov-2017 11:45	----	----
Compound	CAS Number	LOR	Unit	EW1704616-011	EW1704616-012	EW1704616-013	EW1704616-014	-----
				Result	Result	Result	Result	----
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
Suspended Solids (SS)	----	5	mg/L	13	10	<5	<5	----

## Attachment C: Field Sheets

# Surface water monitoring

**Document No.**

000005

**Conducted on**

7/11/17, 08:32

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 08:35

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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	1	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pool after riffle underneath bridge
 <p>Appendix 1</p>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	15.3	
<b>pH</b>		
	6	
<b>REDOX</b>		
	306	
<b>Conductivity (uS/cm)</b>		
	147	
<b>Turbidity</b>		
	3.9	
<b>DO (mg/L)</b>		
	5.62	



### Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000007

**Conducted on**

7/11/17, 09:29

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 09:31

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	2	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Downstream of weir
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	15.7	
<b>pH</b>		
	6.7	
<b>REDOX</b>		
	276	
<b>Conductivity (uS/cm)</b>		
	178	
<b>Turbidity</b>		
	4.8	
<b>DO (mg/L)</b>		
	6.2	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000006

**Conducted on**

7/11/17, 09:04

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 09:08

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	3	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Upstream of riffle on bend
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.23	
<b>pH</b>		
	6.5	
<b>REDOX</b>		
	245	
<b>Conductivity (uS/cm)</b>		
	210	
<b>Turbidity</b>		
	9.5	
<b>DO (mg/L)</b>		
	5.58	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Slightly turbid	
<b>Other</b>		
	Farmer with excavator working upstream of sampling location. Possible cause of turbid runoff	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000015

**Conducted on**

7/11/17, 12:04

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 12:08

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	4	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Upstream pond before riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Developed riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	17.30	
<b>pH</b>		
	7.5	
<b>REDOX</b>		
	236	
<b>Conductivity (uS/cm)</b>		
	148	
<b>Turbidity</b>		
	0.7	
<b>DO (mg/L)</b>		
	6.34	

### Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000008

**Conducted on**

7/11/17, 09:49

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 09:53

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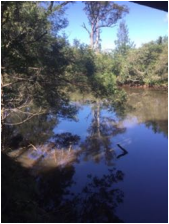
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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	5	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widening of creek
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Mix between riparian and agricultural
Slope	Yes	Very slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.2	
<b>pH</b>		
	7.4	
<b>REDOX</b>		
	244	
<b>Conductivity (uS/cm)</b>		
	987	
<b>Turbidity</b>		
	1.6	
<b>DO (mg/L)</b>		
	4.17	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	Tidal influence rising tide causing greater salinity	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000014

**Conducted on**

7/11/17, 11:51

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 11:54



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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	6	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pond before riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Very slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	19.20	
<b>pH</b>		
	7.2	
<b>REDOX</b>		
	245	
<b>Conductivity (uS/cm)</b>		
	190	
<b>Turbidity</b>		
	7.3	
<b>DO (mg/L)</b>		
	5.58	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Slighty turbid	
<b>Other</b>		
	Turbid due to upstream dairy/catchment. Elevated turbidity was found in upstream location 8	

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	2	
Preservatives	No	
Duplicate	Yes	

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000009

**Conducted on**

7/11/17, 10:01

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 10:04

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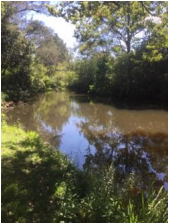
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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	7	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widening of creek
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian mix with grassland
Slope	Yes	Very slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.6	
<b>pH</b>		
	7.1	
<b>REDOX</b>		
	246	
<b>Conductivity (uS/cm)</b>		
	178	
<b>Turbidity</b>		
	2.0	
<b>DO (mg/L)</b>		
	4.19	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	Algal growth high due to past dry conditions	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000010

**Conducted on**

7/11/17, 10:20

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 10:24

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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	8	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Slight constriction around bend. Confluence between bundewallah and TC
<div style="display: flex; align-items: center;">  <div style="margin-left: 10px;">Appendix 1</div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian with exotic weeds
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	15.73	
<b>pH</b>		
	7.1	
<b>REDOX</b>		
	225	
<b>Conductivity (uS/cm)</b>		
	285	
<b>Turbidity</b>		
	17.6	
<b>DO (mg/L)</b>		
	4.53	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Slightly turbid	
<b>Other</b>		
	Sample site downstream of primary dairy land	



## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000016

**Conducted on**

7/11/17, 12:15

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 12:23

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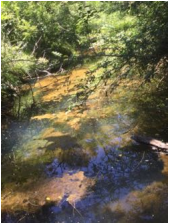
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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	9	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Deep pool after riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Developed riparian
Slope	Yes	Slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.40	
<b>pH</b>		
	6.7	
<b>REDOX</b>		
	-14	
<b>Conductivity (uS/cm)</b>		
	213	
<b>Turbidity</b>		
	0.2	
<b>DO (mg/L)</b>		
	1.04	



## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	Flow is very low. Lot of algal growth and very low dissolved oxygen content	

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number	9	
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000011

**Conducted on**

7/11/17, 10:37

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 10:41

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 4/4 - 100%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	10	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Outlet of TC into pond
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 4/4 - 100%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Grassland agricultural
Slope	Yes	Very slight
Erosion	Yes	Evidence of high flow erosion on banks
 <p>Appendix 2</p>		



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	17.14	
<b>pH</b>		
	7.4	
<b>REDOX</b>		
	205	
<b>Conductivity (uS/cm)</b>		
	165	
<b>Turbidity</b>		
	18.2	
<b>DO (mg/L)</b>		
	4.84	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Turbid	
<b>Other</b>		
	Possible agricultural influence to turbidity	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1



Appendix 2

# Surface water monitoring

**Document No.**

000012

**Conducted on**

7/11/17, 11:07

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 11:14

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 4/4 - 100%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	13	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Small drainage line
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations - 4/4 - 100%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Grassland recreational
Slope	Yes	Gentle
Erosion	Yes	High flow bank erosion. Not associated with this event
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 2</p> </div> </div>		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	18.11	
<b>pH</b>		
	7.8	
<b>REDOX</b>		
	236	
<b>Conductivity (uS/cm)</b>		
	474	
<b>Turbidity</b>		
	36	
<b>DO (mg/L)</b>		
	5.44	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Turbid	
<b>Other</b>		
	FBB construction completed in catchment, no possible cause of turbid runoff from site. Upstream development in earthworks phase may influence water quality. However flow conditions do not allow water sampling occur to Aus standards	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1



Appendix 2

# Surface water monitoring

**Document No.**

000013

**Conducted on**

7/11/17, 11:27

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 11:33

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	17	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Slightly deep pool 200mm underneath bridge. Upstream location 16 cannot be assessed due to insufficient depth to sample <100mm.
 <p style="text-align: center;">Appendix 1</p>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Limited underneath bridge. Wetland sedges growing in water line. Heavy scour around sample location
Slope	Yes	Very slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	18.75	
<b>pH</b>		
	7.7	
<b>REDOX</b>		
	198	
<b>Conductivity (uS/cm)</b>		
	394	
<b>Turbidity</b>		
	3.5	
<b>DO (mg/L)</b>		
	6.56	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	None	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	No construction work in catchment area. Area is stabilised and well established	

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	2	
Preservatives	No	
Duplicate	Yes	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000014

**Conducted on**

7/11/17, 11:51

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 11:54

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	6	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pond before riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Very slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	19.20	
<b>pH</b>		
	7.2	
<b>REDOX</b>		
	245	
<b>Conductivity (uS/cm)</b>		
	190	
<b>Turbidity</b>		
	7.3	
<b>DO (mg/L)</b>		
	5.58	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Slighty turbid	
<b>Other</b>		
	Turbid due to upstream dairy/catchment. Elevated turbidity was found in upstream location 8	

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	2	
Preservatives	No	
Duplicate	Yes	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000009

**Conducted on**

7/11/17, 10:01

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 10:04



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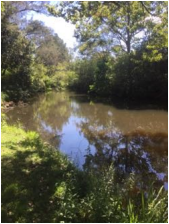
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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	7	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widening of creek
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian mix with grassland
Slope	Yes	Very slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.6	
<b>pH</b>		
	7.1	
<b>REDOX</b>		
	246	
<b>Conductivity (uS/cm)</b>		
	178	
<b>Turbidity</b>		
	2.0	
<b>DO (mg/L)</b>		
	4.19	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	Algal growth high due to past dry conditions	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000010

**Conducted on**

7/11/17, 10:20

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

7/11/17, 10:24

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	8	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Slight constriction around bend. Confluence between bundewallah and TC
<div style="display: flex; align-items: center;">  <div style="margin-left: 10px;">Appendix 1</div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian with exotic weeds
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	15.73	
<b>pH</b>		
	7.1	
<b>REDOX</b>		
	225	
<b>Conductivity (uS/cm)</b>		
	285	
<b>Turbidity</b>		
	17.6	
<b>DO (mg/L)</b>		
	4.53	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Slightly turbid	
<b>Other</b>		
	Sample site downstream of primary dairy land	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000016

**Conducted on**

7/11/17, 12:15

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 12:23

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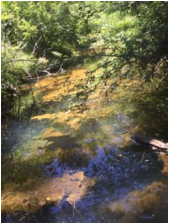
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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	9	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Deep pool after riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Developed riparian
Slope	Yes	Slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.40	
<b>pH</b>		
	6.7	
<b>REDOX</b>		
	-14	
<b>Conductivity (uS/cm)</b>		
	213	
<b>Turbidity</b>		
	0.2	
<b>DO (mg/L)</b>		
	1.04	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	Flow is very low. Lot of algal growth and very low dissolved oxygen content	



### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number	9	
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000011

**Conducted on**

7/11/17, 10:37

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 10:41

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 4/4 - 100%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	10	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Outlet of TC into pond
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 4/4 - 100%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Grassland agricultural
Slope	Yes	Very slight
Erosion	Yes	Evidence of high flow erosion on banks
 <p>Appendix 2</p>		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	17.14	
<b>pH</b>		
	7.4	
<b>REDOX</b>		
	205	
<b>Conductivity (uS/cm)</b>		
	165	
<b>Turbidity</b>		
	18.2	
<b>DO (mg/L)</b>		
	4.84	



## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Turbid	
<b>Other</b>		
	Possible agricultural influence to turbidity	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1



Appendix 2

# Surface water monitoring

**Document No.**

000012

**Conducted on**

7/11/17, 11:07

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 11:14

## **Disclaimer**

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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 4/4 - 100%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	13	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Small drainage line
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 4/4 - 100%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Grassland recreational
Slope	Yes	Gentle
Erosion	Yes	High flow bank erosion. Not associated with this event



Appendix 2



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	18.11	
<b>pH</b>		
	7.8	
<b>REDOX</b>		
	236	
<b>Conductivity (uS/cm)</b>		
	474	
<b>Turbidity</b>		
	36	
<b>DO (mg/L)</b>		
	5.44	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Turbid	
<b>Other</b>		
	FBB construction completed in catchment, no possible cause of turbid runoff from site. Upstream development in earthworks phase may influence water quality. However flow conditions do not allow water sampling occur to Aus standards	

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1



Appendix 2

# Surface water monitoring

**Document No.**

000013

**Conducted on**

7/11/17, 11:27

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

7/11/17, 11:33

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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	17	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Slightly deep pool 200mm underneath bridge. Upstream location 16 cannot be assessed due to insufficient depth to sample <100mm.
 <p style="text-align: center;">Appendix 1</p>		



## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Limited underneath bridge. Wetland sedges growing in water line. Heavy scour around sample location
Slope	Yes	Very slight
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	18.75	
<b>pH</b>		
	7.7	
<b>REDOX</b>		
	198	
<b>Conductivity (uS/cm)</b>		
	394	
<b>Turbidity</b>		
	3.5	
<b>DO (mg/L)</b>		
	6.56	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	None	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	No construction work in catchment area. Area is stabilised and well established	

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	2	
Preservatives	No	
Duplicate	Yes	

## Media



Appendix 1

## Attachment D: Laboratory Results

## CERTIFICATE OF ANALYSIS

**Work Order** : **EW1704616**  
**Client** : **FULTON HOGAN PTY LTD**  
**Contact** : JACOB COOPER  
**Address** : LEVEL1 3 - 90 BOURKE ROAD  
 ALEXANDRIA NSW, AUSTRALIA 2015  
  
**Telephone** : +61 02 8346 9400  
**Project** : Foxground and Berry Bypass  
**Order number** : ----  
**C-O-C number** : ----  
**Sampler** : JACOB COOPER  
**Site** : ----  
**Quote number** : WO/044/15 Blanket Quote  
**No. of samples received** : 14  
**No. of samples analysed** : 14

**Page** : 1 of 5  
**Laboratory** : Environmental Division NSW South Coast  
**Contact** : Aneta Prosaroski  
**Address** : 1/19 Ralph Black Dr, North Wollongong 2500  
 4/13 Geary Pl, North Nowra 2541  
 Australia NSW  
**Telephone** : 02 4225 3125  
**Date Samples Received** : 07-Nov-2017 16:26  
**Date Analysis Commenced** : 10-Nov-2017  
**Issue Date** : 13-Nov-2017 13:53



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

### Signatories

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

*Signatories*

*Position*

*Accreditation Category*

Dian Dao

Sydney Inorganics, Smithfield, NSW



## General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
LOR = Limit of reporting  
^ = This result is computed from individual analyte detections at or above the level of reporting  
ø = ALS is not NATA accredited for these tests.  
~ = Indicates an estimated value.





### Analytical Results

Sub-Matrix: <b>WATER</b> (Matrix: <b>WATER</b> )				Client sample ID	SW01	SW02	SW03	SW04	SW05
Client sampling date / time				07-Nov-2017 08:30	07-Nov-2017 09:30	07-Nov-2017 08:50	07-Nov-2017 12:15	07-Nov-2017 09:45	
Compound	CAS Number	LOR	Unit	EW1704616-001	EW1704616-002	EW1704616-003	EW1704616-004	EW1704616-005	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5	



### Analytical Results

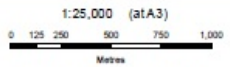
Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW06_A	SW06_B	SW07	SW08	SW09
Client sampling date / time				07-Nov-2017 11:40	07-Nov-2017 11:55	07-Nov-2017 10:00	07-Nov-2017 10:20	07-Nov-2017 12:30	
Compound	CAS Number	LOR	Unit	EW1704616-006	EW1704616-007	EW1704616-008	EW1704616-009	EW1704616-010	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	9	<5	



### Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	SW10	SW13	SW17_A	SW17_B	----
Client sampling date / time			07-Nov-2017 10:35	07-Nov-2017 11:10	07-Nov-2017 11:30	07-Nov-2017 11:45	----	----
Compound	CAS Number	LOR	Unit	EW1704616-011	EW1704616-012	EW1704616-013	EW1704616-014	-----
				Result	Result	Result	Result	----
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
Suspended Solids (SS)	----	5	mg/L	13	10	<5	<5	----

Attachment A: Location Map



Map Projection: Transverse Mercator  
 Horizontal Datum: Geocentric Datum of Australia (GDA)  
 Grid: Map Grid of Australia 1994, Zone 56



LEGEND

- \* Surface Water Sampling Locations
- Berry to Foxground upgrade alignment
- Roads
- Railways
- Waterways
- Lakes and dams

Fulton Hogan Pty Ltd  
 Water Quality Monitoring

Job Number | 21-24306  
 Revision | A  
 Date | 03 Mar 2015

Surface water sampling locations

Figure 1

lightweightAU\pwy\FProject\2104306GIS\Map\MXD\21\_24306\_2001\_SurfaceWaterSamplingLocations.mxd  
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 Data Source: NSW Department of Lands, DTDS and DCDB - 2012. Created by: mwabw

## Attachment B: Tabulated Results

No.	Date	Temperature	pH	ORP	Conductivity	Turbidity	Dissolved Oxygen
SW1	7/11/2017	15.3 °C	6.0	306 mV	0.147 mS/cm	3.9 NTU	5.62 mg/L
SW2	7/11/2017	15.7 °C	6.7	276 mV	0.178 mS/cm	4.8 NTU	6.20 mg/L
SW3	7/11/2017	16.2 °C	6.5	245 mV	0.210 mS/cm	9.5 NTU	5.58 mg/L
SW4	7/11/2017	17.3 °C	7.5	236 mV	0.148 mS/cm	0.7 NTU	6.34 mg/L
SW5	7/11/2017	16.2 °C	7.4	244 mV	0.987 mS/cm	1.6 NTU	4.17 mg/L
SW6	7/11/2017	19.2 °C	7.2	245 mV	0.190 mS/cm	7.3 NTU	5.58 mg/L
SW7	7/11/2017	16.6 °C	7.1	246 mV	0.178 mS/cm	2.0 NTU	4.19 mg/L
SW8	7/11/2017	15.73 °C	7.1	225 mV	0.285 mS/cm	17.6 NTU	4.53 mg/L
SW9	7/11/2017	16.4 °C	6.7	-14 mV	0.213 mS/cm	0.2 NTU	1.04 mg/L
SW10	7/11/2017	17.1 °C	7.4	205 mV	0.165 mS/cm	18.2 NTU	4.84 mg/L
SW11	7/11/2017	°C		mV	mS/cm	NTU	mg/L
SW12	7/11/2017	°C		mV	mS/cm	NTU	mg/L
SW13	7/11/2017	18.1 °C	7.8	236 mV	0.474 mS/cm	36.0 NTU	5.44 mg/L
SW14	7/11/2017	°C		mV	mS/cm	NTU	mg/L
SW15	7/11/2017	°C		mV	mS/cm	NTU	mg/L
SW16	7/11/2017	°C		mV	mS/cm	NTU	mg/L
SW17	7/11/2017	18.8 °C	7.7	198 mV	0.394 mS/cm	3.5 NTU	6.56 mg/L

# Surface Water Monitoring

## Construction Event 27

Monitoring event triggered after 15mm of rainfall was received in 24 hours. This event was of low significance and did not trigger the full suite of analysis as 50mm of rainfall was not received within 24 hours.

Date of Monitoring: 6<sup>th</sup> December 2017

Rainfall Monitoring is shown below.

Woodhill Mountain Road	
Date:	Rainfall Received:
05/12/17	20mm
06/12/17	28mm

Toolijooa Road	
Date:	Rainfall Received:
05/12/17	15mm
06/12/17	22mm

Austral Park	
Date:	Rainfall Received:
05/12/17	18mm
06/12/17	31mm

## Scope and Limitations

In accordance with the Princes Highway upgrade for Foxground and Berry Bypass (FBB) – Water Monitoring Project Brief, surface water monitoring at seventeen locations (SW01 to SW017) was undertaken. This report presents the information collected during the monitoring event with some discussion on field observations and results with respect to upstream vs downstream conditions.

## Field Programme

Surface water sampling was undertaken at all surface locations where flow conditions allowed a representative sample to be taken. This monthly water sampling event was conducted in accordance with the sampling program and protocols provided in:

- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water and Groundwater Sampling Protocol, prepared for Roads and Maritime Services
- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services
- 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring

Report, prepared for Roads and Maritime Services.

Field parameters were measured during sampling including temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), and reduction-oxidation potential (redox), and are provided in Table B1, Attachment B. Field sheets are provided in Attachment C.

Water samples were submitted to a NATA certified testing laboratory (Australian Laboratory services (ALS)) to be analysed for:

- Total suspended solids.

## Weather Monitoring

The project has three weather stations used to monitor weather and rainfall. For the purpose of triggering water quality monitoring events the project uses these weather stations. The locations of the weather stations are:

- The project office on Woodhill Mountain Road, Berry
- Austral Park Road, ancillary facility, Broughton
- Toolijooa Road, Toolijooa,

During the construction phase minor events are classified as at least 15 mm of rainfall in 24 hours and major events are classified as at least 50 mm of rainfall in 24 hours.

## Surface water sampling results

Results for the water quality monitoring event are located as attachments at the end of this document, they are:

- Attachment A, Location maps
- Attachment B, Tabulated results
- Attachment C, Field sheets, Field photos
- Attachment D, Laboratory results

## Surface water locations

The upstream location represents the 'reference' (un-impacted) site while the down-stream locations represent the 'test' sites (potentially impacted sites during construction and operation). By comparing upstream water quality with down-stream water quality potential impacts from construction are assessed.

**Table 1 Surface water locations within specific surface water bodies**

<b>Surface water</b>	<b>Upstream of Alignment</b>	<b>Downstream of Alignment (test</b>
Broughton Creek	SW01	SW02, SW03, SW05
Connelly's Creek and Broughton Mill Creek and Bundewallah Creek	SW04, SW06	SW07, SW09
Bundewallah Creek and Connelly's Creek	SW08	SW06
Town Creek	SW10	SW11
Hitchcocks Lane Creek Tributary	SW12	SW13
Hitchcocks Lane Creek	SW14	SW15

Unnamed Tributary	SW16	SW17
-------------------	------	------

## Results summary

The monitoring for this rainfall event was triggered by 15mm of rainfall received in 24 hours. The total event volume ranged from approximately 15mm to 31mm across the project over 1 day. Since the last monitoring event there has been steady rainfall experienced on the project, consequently, an increase in flow to the catchment has been observed during this monitoring event which has aided in reducing the drought like conditions experienced by the local environment.

In the projects current state there is a reduced risk in site runoff effecting the surrounding catchment due to the completed nature and reduction in construction footprint. Consequently, there were no observed construction impacts as a result of this rainfall event.

It is to be noted that sites SW11, SW12, SW13, SW14, SW15 and SW16 were not sampled due to the low to no flow conditions observed in these locations.

Broughton Creek: Showed no impacts from construction. Conductivity at SW05 has returned to normal levels after Event 26's elevated level. Observations identified an increase in fresh water flow which may have contributed to this result. As a result to the increase in flow results have shown a proportional growth in dissolved oxygen in both upstream and downstream sites. TSS result of <5mg/L was found across all sites in the Broughton Creek catchment demonstrating the operating stage of the project with no indication of turbid runoff.

Connelly's Creek and Broughton Mill Creek and Bundewallah Creek: Showed no impacts from construction. Similarly to Broughton Creek there was an increase in flow and dissolved oxygen observed at all locations.

Town Creek: Catchment is stabilised and operational resulting in no impacts from construction. Downstream sampling location SW11 was not sampled due to no flow conditions.

Hitchcocks Lane Creek Tributary: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

Hitchcocks Lane Creek: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

Unnamed Tributary: Catchment is stabilised and operational resulting in no impacts from construction. Upstream location SW16 unable to be sampled due to shallow depths in waterway caused by low flow conditions.



# Attachment A: Location Map



<p>1:25,000 (at A3)</p> <p>0 125 250 500 750 1,000</p> <p>Meters</p> <p>Map Projection: Transverse Mercator Horizontal Datum: Geocentric Datum of Australia (GDA) Grid: Map Grid of Australia 1994, Zone 56</p>		<p><b>LEGEND</b></p> <ul style="list-style-type: none"> <li><span style="color: red;">✕</span> Surface Water Sampling Locations</li> <li><span style="color: blue;">—</span> Berry to Foxground upgrade alignment</li> <li><span style="color: grey;">—</span> Roads</li> <li><span style="color: blue;">—</span> Railways</li> <li><span style="color: blue;">—</span> Waterways</li> <li><span style="color: blue;">■</span> Lakes and dams</li> </ul>	<p>Fulton Hogan Pty Ltd Water Quality Monitoring</p>	<p>Job Number   21-24306 Revision   A Date   03 Mar 2015</p>
---	--	--	--	--

**Surface water sampling locations** **Figure 1**

Attachment B: Tabulated Results

No.	Date	Temperature	pH	ORP	Conductivity	Turbidity	Dissolved Oxygen	
SW01	6/12/2017	16.15 °C	6.1	273 mV	0.085 mS/cm	3.4 NTU	7.64 mg/L	
SW02	6/12/2017	16.54 °C	6	293 mV	0.105 mS/cm	3.2 NTU	6.57 mg/L	
SW03	6/12/2017	16.83 °C	5.8	249 mV	0.117 mS/cm	4.6 NTU	6.34 mg/L	
SW04	6/12/2017	16.38 °C	5.9	220 mV	0.076 mS/cm	2.7 NTU	7 mg/L	
SW05	6/12/2017	17.41 °C	6.2	310 mV	0.159 mS/cm	2.9 NTU	4.91 mg/L	
SW06	6/12/2017	17.62 °C	6.2	324 mV	0.224 mS/cm	5.9 NTU	4.67 mg/L	
SW07	6/12/2017	16.43 °C	5.9	267 mV	0.082 mS/cm	4 NTU	5.64 mg/L	
SW08	6/12/2017	18.29 °C	6.2	246 mV	0.201 mS/cm	4.9 NTU	6.08 mg/L	
SW09	6/12/2017	17.97 °C	6.2	136 mV	0.172 mS/cm	5.7 NTU	3.62 mg/L	
SW10	6/12/2017	19.26 °C	6.3	264 mV	0.122 mS/cm	7.6 NTU	5.3 mg/L	
SW11	6/12/2017	<b>No Samples taken due to low flow conditions</b>						
SW12	6/12/2017							
SW13	6/12/2017							
SW14	6/12/2017							
SW15	6/12/2017							
SW16	6/12/2017							
SW17	6/12/2017	19.64 °C	6.7	284 mV	0.329 mS/cm	2.6 NTU	9.14 mg/L	

## Attachment C: Field Sheets

# Surface water monitoring

**Document No.**

000017

**Conducted on**

6/12/17, 10:15

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

6/12/17, 10:19

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	1	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Deep pool after riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.15	
<b>pH</b>		
	6.1	
<b>REDOX</b>		
	273	
<b>Conductivity (uS/cm)</b>		
	.085	
<b>Turbidity</b>		
	3.4	
<b>DO (mg/L)</b>		
	7.64	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Tannin	
<b>Other</b>		
	Cows upstream in creek. Possible sediment disturbance	

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000018

**Conducted on**

6/12/17, 10:30

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

6/12/17, 10:32

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	2	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Downstream of weir
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.54	
<b>pH</b>		
	6.0	
<b>REDOX</b>		
	293	
<b>Conductivity (uS/cm)</b>		
	.105	
<b>Turbidity</b>		
	3.2	
<b>DO (mg/L)</b>		
	6.57	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Tannin	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	2	
Preservatives	Yes	Ice
Duplicate	Yes	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000019

**Conducted on**

6/12/17, 10:52

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

6/12/17, 10:55

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<b>GENERAL INFO - 2/3 - 66.67%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 2/4 - 50%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 2/3 - 66.67%

Question	Response	Details
<b>General Info</b>		Score (2/3) 66.67%
Site	3	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	Yes	On bend of a riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 2/4 - 50%

Question	Response	Details
Weather		
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.83	
<b>pH</b>		
	5.8	
<b>REDOX</b>		
	249	
<b>Conductivity (uS/cm)</b>		
	.117	
<b>Turbidity</b>		
	4.6	
<b>DO (mg/L)</b>		
	6.34	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Tannin	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	3	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000023

**Conducted on**

6/12/17, 12:17

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

6/12/17, 12:19

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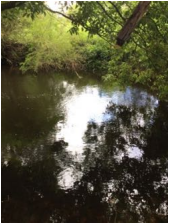
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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	4	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pool before riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.38	
<b>pH</b>		
	5.9	
<b>REDOX</b>		
	220	
<b>Conductivity (uS/cm)</b>		
	76	
<b>Turbidity</b>		
	2.7	
<b>DO (mg/L)</b>		
	7.00	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	4	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000020

**Conducted on**

6/12/17, 11:08

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

6/12/17, 11:12



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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	5	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Wide deep channel
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian/over cleared
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	17.41	
<b>pH</b>		
	6.2	
<b>REDOX</b>		
	310	
<b>Conductivity (uS/cm)</b>		
	.159	
<b>Turbidity</b>		
	2.9	
<b>DO (mg/L)</b>		
	4.91	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Tannin	
<b>Other</b>		
	High tide at the moment. Possible salinity influence	

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	4	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000021

**Conducted on**

6/12/17, 11:44

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

6/12/17, 11:47

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	6	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widening in creek pool before riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	17.62	
<b>pH</b>		
	6.2	
<b>REDOX</b>		
	324	
<b>Conductivity (uS/cm)</b>		
	.224	
<b>Turbidity</b>		
	5.9	
<b>DO (mg/L)</b>		
	4.67	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Slightly turbid	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	6	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000024

**Conducted on**

6/12/17, 12:29

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

6/12/17, 12:31

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	7	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widened channel
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.43	
<b>pH</b>		
	5.9	
<b>REDOX</b>		
	267	
<b>Conductivity (uS/cm)</b>		
	82	
<b>Turbidity</b>		
	4.0	
<b>DO (mg/L)</b>		
	5.64	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		



### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	7	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000025

**Conducted on**

6/12/17, 12:44

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

6/12/17, 12:46

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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	8	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Confluence point of two water courses
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	18.29	
<b>pH</b>		
	6.2	
<b>REDOX</b>		
	246	
<b>Conductivity (uS/cm)</b>		
	201	
<b>Turbidity</b>		
	4.9	
<b>DO (mg/L)</b>		
	6.08	



### Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	8	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000022

**Conducted on**

6/12/17, 12:05

**Prepared by**

Jacob Cooper

**Score**

10/11 - 90.91%

**Completed on**

6/12/17, 12:08

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Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 3/3 - 100%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	9	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Constricted channel
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	17.97	
<b>pH</b>		
	6.2	
<b>REDOX</b>		
	136	
<b>Conductivity (uS/cm)</b>		
	172	
<b>Turbidity</b>		
	5.7	
<b>DO (mg/L)</b>		
	3.62	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Slightly turbid	
<b>Other</b>		

### Sample info - 3/3 - 100%

Question	Response	Details
Sample number	9	
<b>No. Of containers</b>		
	2	
Preservatives	Yes	Ice
Duplicate	Yes	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000026

**Conducted on**

6/12/17, 12:56

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

6/12/17, 12:58

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# Table of Contents

<b>SURFACE WATER MONITORING - 9/11 - 81.82%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	10	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Drainage line into duck pond
<div style="display: flex; align-items: center;">  <div style="margin-left: 10px;">Appendix 1</div> </div>		



## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Agricultural
Slope	Yes	Flat
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	19.26	
<b>pH</b>		
	6.3	
<b>REDOX</b>		
	264	
<b>Conductivity (uS/cm)</b>		
	122	
<b>Turbidity</b>		
	7.6	
<b>DO (mg/L)</b>		
	5.33	

### Flow observations - 1/1 - 100%

Question	Response	Details
Flow	None	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	10	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000033

**Conducted on**

6/12/17, 13:44

**Prepared by**

Jacob Cooper

**Score**

2/11 - 18.18%

**Completed on**

6/12/17, 13:44

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<b>SURFACE WATER MONITORING - 2/11 - 18.18%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 2/3 - 66.67%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 2/3 - 66.67%

Question	Response	Details
<b>General Info</b>		Score (2/3) 66.67%
Site	11	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	Yes	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000027

**Conducted on**

6/12/17, 13:07

**Prepared by**

Jacob Cooper

**Score**

2/11 - 18.18%

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## Table of Contents

<b>SURFACE WATER MONITORING - 2/11 - 18.18%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 2/3 - 66.67%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 2/3 - 66.67%

Question	Response	Details
<b>General Info</b>		Score (2/3) 66.67%
Site	12	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	Yes	Unable to sample due to low to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000029

**Conducted on**

6/12/17, 13:20

**Prepared by**

Jacob Cooper

**Score**

2/11 - 18.18%

**Completed on**

6/12/17, 13:21



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## Table of Contents

<b>SURFACE WATER MONITORING - 2/11 - 18.18%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 2/3 - 66.67%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 2/3 - 66.67%

Question	Response	Details
<b>General Info</b>		Score (2/3) 66.67%
Site	13	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	Yes	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000032

**Conducted on**

6/12/17, 13:40

**Prepared by**

Jacob Cooper

**Score**

2/11 - 18.18%

**Completed on**

6/12/17, 13:41

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<b>SURFACE WATER MONITORING - 2/11 - 18.18%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 2/3 - 66.67%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 2/3 - 66.67%

Question	Response	Details
<b>General Info</b>		Score (2/3) 66.67%
Site	14	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	Yes	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000028

**Conducted on**

6/12/17, 13:15

**Prepared by**

Jacob Cooper

**Score**

3/11 - 27.27%

**Completed on**

6/12/17, 13:16

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<b>SURFACE WATER MONITORING - 3/11 - 27.27%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	15	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		



## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000030

**Conducted on**

6/12/17, 13:27

**Prepared by**

Jacob Cooper

**Score**

2/11 - 18.18%

**Completed on**

6/12/17, 13:28

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<b>SURFACE WATER MONITORING - 2/11 - 18.18%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 2/3 - 66.67%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 2/3 - 66.67%

Question	Response	Details
<b>General Info</b>		Score (2/3) 66.67%
Site	16	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	Yes	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		



## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000031

**Conducted on**

6/12/17, 13:31

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

6/12/17, 13:34

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## Table of Contents

<b>SURFACE WATER MONITORING - 7/11 - 63.64%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 1/4 - 25%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	17	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Shallow pool
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 1/4 - 25%

Question	Response	Details
Weather	Overcast	
Vegetation	No	Scour rock around bridge
Slope	No	Flat
Erosion	No	



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	19.64	
<b>pH</b>		
	6.7	
<b>REDOX</b>		
	284	
<b>Conductivity (uS/cm)</b>		
	329	
<b>Turbidity</b>		
	2.6	
<b>DO (mg/L)</b>		
	9.14	

### Flow observations - 1/1 - 100%

Question	Response	Details
Flow	None	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	17	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

## Attachment D: Laboratory Results

## CERTIFICATE OF ANALYSIS

**Work Order** : **EW1705133**  
**Client** : **FULTON HOGAN PTY LTD**  
**Contact** : JACOB COOPER  
**Address** : LEVEL1 3 - 90 BOURKE ROAD  
 ALEXANDRIA NSW, AUSTRALIA 2015  
  
**Telephone** : +61 02 8346 9400  
**Project** : Foxground and Berry Bypass  
**Order number** : ----  
**C-O-C number** : ----  
**Sampler** : JACOB COOPER  
**Site** : ----  
**Quote number** : EN/222/17  
**No. of samples received** : 13  
**No. of samples analysed** : 13

**Page** : 1 of 5  
**Laboratory** : Environmental Division NSW South Coast  
**Contact** : Glenn Davies  
**Address** : 1/19 Ralph Black Dr, North Wollongong 2500  
 4/13 Geary Pl, North Nowra 2541  
 Australia NSW  
**Telephone** : 02 42253125  
**Date Samples Received** : 07-Dec-2017 11:56  
**Date Analysis Commenced** : 13-Dec-2017  
**Issue Date** : 14-Dec-2017 15:22



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



## General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
LOR = Limit of reporting  
^ = This result is computed from individual analyte detections at or above the level of reporting  
ø = ALS is not NATA accredited for these tests.  
~ = Indicates an estimated value.



### Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	SW01	SW02_A	SW02_B	SW03	W04
Client sampling date / time			06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	EW1705133-001	EW1705133-002	EW1705133-003	EW1705133-004	EW1705133-005
				Result	Result	Result	Result	Result
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5





**Analytical Results**

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW05	SW06	SW07	SW08	SW09_A
Client sampling date / time				06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00	
Compound	CAS Number	LOR	Unit	EW1705133-006	EW1705133-007	EW1705133-008	EW1705133-009	EW1705133-010	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5	



**Analytical Results**

Sub-Matrix: <b>WATER</b> (Matrix: <b>WATER</b> )			Client sample ID	SW09_B	SW10	SW17	----	----
Client sampling date / time			06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EW1705133-011	EW1705133-012	EW1705133-013	-----	-----
				Result	Result	Result	----	----
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
<b>Suspended Solids (SS)</b>	----	5	mg/L	<5	<5	<5	----	----

# Surface Water Monitoring

## Construction Event 28

Monitoring event triggered after 15mm of rainfall was received in 24 hours. This event was of low significance and did not trigger the full suite of analysis as 50mm of rainfall was not received within 24 hours.

Date of Monitoring: 15<sup>th</sup> January 2018

Rainfall Monitoring is shown below.

Woodhill Mountain Road	
Date:	Rainfall Received:
13/01/18	28mm
14/01/18	22mm

Toolijooa Road	
Date:	Rainfall Received:
13/01/18	8mm
14/01/18	27mm

Austral Park	
Date:	Rainfall Received:
13/01/18	11mm
14/01/18	20mm

## Scope and Limitations

In accordance with the Princes Highway upgrade for Foxground and Berry Bypass (FBB) – Water Monitoring Project Brief, surface water monitoring at seventeen locations (SW01 to SW017) was undertaken. This report presents the information collected during the monitoring event with some discussion on field observations and results with respect to upstream vs downstream conditions.

## Field Programme

Surface water sampling was undertaken at all surface locations where flow conditions allowed a representative sample to be taken. This monthly water sampling event was conducted in accordance with the sampling program and protocols provided in:

- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water and Groundwater Sampling Protocol, prepared for Roads and Maritime Services
- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services
- 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring

Report, prepared for Roads and Maritime Services.

Field parameters were measured during sampling including temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), and reduction-oxidation potential (redox), and are provided in Table B1, Attachment B. Field sheets including photos are provided in Attachment C.

Water samples were submitted to a NATA certified testing laboratory (Australian Laboratory services (ALS)) to be analysed for:

- Total suspended solids.

## Weather Monitoring

The project has three weather stations used to monitor weather and rainfall. For the purpose of triggering water quality monitoring events the project uses these weather stations. The locations of the weather stations are:

- The project office on Woodhill Mountain Road, Berry
- Austral Park Road, ancillary facility, Broughton
- Toolijooa Road, Toolijooa,

During the construction phase minor events are classified as at least 15 mm of rainfall in 24 hours and major events are classified as at least 50 mm of rainfall in 24 hours.

## Surface water sampling results

Results for the water quality monitoring event are located as attachments at the end of this document, they are:

- Attachment A, Location maps
- Attachment B, Tabulated results
- Attachment C, Field sheets, Field photos
- Attachment D, Laboratory results

## Surface water locations

The upstream location represents the 'reference' (un-impacted) site while the down-stream locations represent the 'test' sites (potentially impacted sites during construction and operation). By comparing upstream water quality with down-stream water quality potential impacts from construction are assessed.

**Table 1 Surface water locations within specific surface water bodies**

<b>Surface water</b>	<b>Upstream of Alignment</b>	<b>Downstream of Alignment (test</b>
Broughton Creek	SW01	SW02, SW03, SW05
Connelly's Creek and Broughton Mill Creek and Bundewallah Creek	SW04, SW06	SW07, SW09
Bundewallah Creek and Connelly's Creek	SW08	SW06
Town Creek	SW10	SW11
Hitchcocks Lane Creek Tributary	SW12	SW13
Hitchcocks Lane Creek	SW14	SW15

Unnamed Tributary	SW16	SW17
-------------------	------	------

## Results summary

The monitoring for this rainfall event was triggered by 15mm of rainfall received in 24 hours. The total event volume ranged from approximately 20mm to 27mm across the project over 1 day. This monitoring event has given the environment a much needed break from the extreme heat experienced over the last few weeks, flow has remained the same throughout all catchments where all ephemeral drainage lines in the southern catchment (SW12 - SW17) experiencing very little to no flow.

In the projects current state there is a reduced risk in site runoff effecting the surrounding catchment due to the completed nature and reduction in construction footprint. Consequently, there were no observed construction impacts as a result of this rainfall event.

It is to be noted that sites SW11, SW12, SW13, SW14, SW15, SW16 and SW17 were not sampled due to the low to no flow conditions observed in these locations.

Broughton Creek: Showed no impacts from construction.

Connelly's Creek and Broughton Mill Creek and Bundewallah Creek: Showed no impacts from construction. Upstream location SW08 observations saw a decrease in DO, where downstream location SW09 gave a reading around the baseline level. These results indicate that majority of flow was coming from the Conelly Creek's catchment. This was backed up by field observations of very little flow in the upstream Bundewallah location (SW08).

Town Creek: Showed no impacts from construction. Elevated turbidity results were recorded, this was subject to grazing stock passing through watercourse concurrently during the time of sampling. Downstream sampling location SW11 was not sampled due to no flow conditions.

Hitchcocks Lane Creek Tributary: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

Hitchcocks Lane Creek: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

Unnamed Tributary: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

# Attachment A: Location Map



<p>1:25,000 (at A3)</p> <p>0 125 250 500 750 1,000</p> <p>Meters</p> <p>Map Projection: Transverse Mercator Horizontal Datum: Geocentric Datum of Australia (GDA) Grid: Map Grid of Australia 1994, Zone 56</p>		<p><b>LEGEND</b></p> <table border="0" style="width: 100%;"> <tr> <td> Surface Water Sampling Locations</td> <td> Railways</td> </tr> <tr> <td> Berry to Foxground upgrade alignment</td> <td> Waterways</td> </tr> <tr> <td> Roads</td> <td> Lakes and dams</td> </tr> </table>	Surface Water Sampling Locations	Railways	Berry to Foxground upgrade alignment	Waterways	Roads	Lakes and dams	<p>Fulton Hogan Pty Ltd Water Quality Monitoring</p>	<p>Job Number   21-24306 Revision   A Date   03 Mar 2015</p>
Surface Water Sampling Locations	Railways									
Berry to Foxground upgrade alignment	Waterways									
Roads	Lakes and dams									

**Surface water sampling locations** **Figure 1**

Ighite@ghd.com.au | Project: 2104306GISMap(MXD) | 21\_24306\_2001\_SurfaceWaterSamplingLocations.mxd  
 © 2015. While GHD has taken care to ensure the accuracy of this product, GHD and DATA CUSTODIAN, make no representations or warranties about its accuracy, completeness or suitability for any particular purpose. GHD and DATA CUSTODIAN, cannot accept liability of any kind (whether in contract, tort or otherwise), for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred as a result of the product being inaccurate, incomplete or unavailable in any way and for any reason.  
 Data Source: NSW Department of Lands, DTDB and DCDB - 2012. Created by: mveber

Attachment B: Tabulated Results

No.	Date	Time	Temperature	pH	ORP	Conductivity	Turbidity	Dissolved Oxygen
SW01	15/01/2017	9:33:00 AM	20.07 °C	6.5	306 mV	0.125 mS/cm	1.1 NTU	6.5 mg/L
SW02	15/01/2017	9:50:00 AM	20.19 °C	6.3	296 mV	0.13 mS/cm	0 NTU	6.48 mg/L
SW03	15/01/2017	12:55:00 PM	20.53 °C	6.3	255 mV	0.138 mS/cm	0 NTU	6.04 mg/L
SW04	15/01/2017	1:49:00 PM	20.62 °C	6.2	305 mV	0.103 mS/cm	1.3 NTU	5.3 mg/L
SW05	15/01/2017	2:32:00 PM	21.56 °C	6.5	229 mV	0.17 mS/cm	4 NTU	4.77 mg/L
SW06	15/01/2017	2:19:00 PM	21.2 °C	5.9	286 mV	0.216 mS/cm	0 NTU	6.56 mg/L
SW07	15/01/2017	9:01:00 AM	20.99 °C	6.2	335 mV	0.127 mS/cm	1.2 NTU	6.29 mg/L
SW08	15/01/2017	1:27:00 PM	20.62 °C	6.3	266 mV	0.311 mS/cm	0 NTU	3.87 mg/L
SW09	15/01/2017	2:01:00 PM	21.48 °C	6.1	193 mV	0.219 mS/cm	0.7 NTU	5.51 mg/L
SW10	15/01/2017	8:34:00 AM	20.81 °C	6.8	296 mV	0.131 mS/cm	24.3 NTU	6.06 mg/L
SW11	15/01/2017	<b>No Samples taken due to low flow conditions</b>						
SW12	15/01/2017							
SW13	15/01/2017							
SW14	15/01/2017							
SW15	15/01/2017							
SW16	15/01/2017							
SW17	15/01/2017							

# Surface water monitoring

**Document No.**

000043

**Conducted on**

15/1/18, 09:33

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

17/1/18, 12:35



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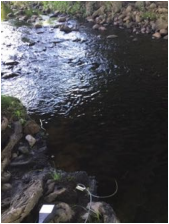
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<b>SURFACE WATER MONITORING - 8/11 - 72.73%</b>	<b>1</b>
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<b>GENERAL INFO - 2/3 - 66.67%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 2/3 - 66.67%

Question	Response	Details
<b>General Info</b>		Score (2/3) 66.67%
Site	1	
Date and time	15/1/18, 09:33	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	Yes	Pool after riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.07	
<b>pH</b>		
	6.5	
<b>REDOX</b>		
	306	
<b>Conductivity (uS/cm)</b>		
	125	
<b>Turbidity</b>		
	1.1	
<b>DO (mg/L)</b>		
	6.50	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	1	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000044

**Conducted on**

15/1/18, 09:50

**Prepared by**

Jacob Cooper

**Score**

10/11 - 90.91%

**Completed on**

17/1/18, 12:52

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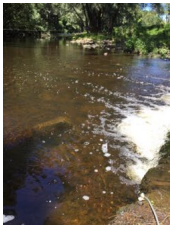
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<b>SURFACE WATER MONITORING - 10/11 - 90.91%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 3/3 - 100%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	2	
Date and time	15/1/18, 09:50	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pool after weir
 <p>Appendix 1</p>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.19	
<b>pH</b>		
	6.3	
<b>REDOX</b>		
	296	
<b>Conductivity (uS/cm)</b>		
	130	
<b>Turbidity</b>		
	0.0	
<b>DO (mg/L)</b>		
	6.48	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 3/3 - 100%

Question	Response	Details
Sample number	2	
<b>No. Of containers</b>		
	2	
Preservatives	Yes	Ice
Duplicate	Yes	



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000045

**Conducted on**

15/1/18, 12:54

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

17/1/18, 13:12

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<b>SURFACE WATER MONITORING - 9/11 - 81.82%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	3	
Date and time	15/1/18, 12:55	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pool before bend and riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.53	
<b>pH</b>		
	6.3	
<b>REDOX</b>		
	255	
<b>Conductivity (uS/cm)</b>		
	138	
<b>Turbidity</b>		
	0.0	
<b>DO (mg/L)</b>		
	6.04	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		



### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	3	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000047

**Conducted on**

15/1/18, 13:49

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

17/1/18, 13:51

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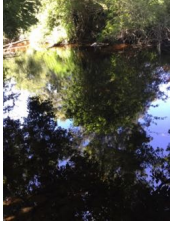
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<b>SURFACE WATER MONITORING - 9/11 - 81.82%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	4	
Date and time	15/1/18, 13:49	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pool above riffle
 <p>Appendix 1</p>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.62	
<b>pH</b>		
	6.2	
<b>REDOX</b>		
	305	
<b>Conductivity (uS/cm)</b>		
	103	
<b>Turbidity</b>		
	1.3	
<b>DO (mg/L)</b>		
	5.30	



## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	4	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000050

**Conducted on**

15/1/18, 14:32

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

17/1/18, 14:34

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Disclaimer	2
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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	5	
Date and time	15/1/18, 14:32	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widened channel
<div style="display: flex; align-items: flex-start;">  <p>Appendix 1</p> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	21.56	
<b>pH</b>		
	6.5	
<b>REDOX</b>		
	229	
<b>Conductivity (uS/cm)</b>		
	170	
<b>Turbidity</b>		
	4.0	
<b>DO (mg/L)</b>		
	4.77	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	Cows crossing down stream of location	

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	5	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000049

**Conducted on**

15/1/18, 14:19

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

17/1/18, 14:21

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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	6	
Date and time	15/1/18, 14:19	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pool before riffle
 <p>Appendix 1</p>		



## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	21.20	
<b>pH</b>		
	5.9	
<b>REDOX</b>		
	286	
<b>Conductivity (uS/cm)</b>		
	216	
<b>Turbidity</b>		
	0.0	
<b>DO (mg/L)</b>		
	6.56	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	6	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000042

**Conducted on**

15/1/18, 09:01

**Prepared by**

Jacob Cooper

**Score**

10/11 - 90.91%

**Completed on**

17/1/18, 12:11

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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 3/3 - 100%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	7	
Date and time	15/1/18, 09:01	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widening of creek large pool before riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.99	
<b>pH</b>		
	6.2	
<b>REDOX</b>		
	335	
<b>Conductivity (uS/cm)</b>		
	127	
<b>Turbidity</b>		
	1.2	
<b>DO (mg/L)</b>		
	6.29	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 3/3 - 100%

Question	Response	Details
Sample number	7	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	Yes	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000046

**Conducted on**

15/1/18, 13:27

**Prepared by**

Jacob Cooper

**Score**

10/11 - 90.91%

**Completed on**

17/1/18, 13:30

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 3/3 - 100%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	8	
Date and time	15/1/18, 13:27	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Confluence of town creek and bundewallah
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.62	
<b>pH</b>		
	6.3	
<b>REDOX</b>		
	266	
<b>Conductivity (uS/cm)</b>		
	311	
<b>Turbidity</b>		
	0.0	
<b>DO (mg/L)</b>		
	3.87	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	None	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	Water is basically stagnant	

### Sample info - 3/3 - 100%

Question	Response	Details
Sample number	8	
<b>No. Of containers</b>		
	2	
Preservatives	Yes	Ice
Duplicate	Yes	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000048

**Conducted on**

15/1/18, 14:01

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

17/1/18, 14:03



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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	9	
Date and time	15/1/18, 14:01	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Constricted channel after bridge
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	21.48	
<b>pH</b>		
	6.1	
<b>REDOX</b>		
	193	
<b>Conductivity (uS/cm)</b>		
	219	
<b>Turbidity</b>		
	0.7	
<b>DO (mg/L)</b>		
	5.51	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	9	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000038

**Conducted on**

15/1/18, 08:33

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

17/1/18, 11:37

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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	10	
Date and time	15/1/18, 08:34	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Small pool before large pond.
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Agricultural
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.81	
<b>pH</b>		
	6.8	
<b>REDOX</b>		
	296	
<b>Conductivity (uS/cm)</b>		
	131	
<b>Turbidity</b>		
	24.3	
<b>DO (mg/L)</b>		
	6.06	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	None	
<b>Colour</b>		
	Slightly turbid	
<b>Other</b>		
	Lots of mosquito fish evident	

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	10	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000041

**Conducted on**

15/1/18, 08:55

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

17/1/18, 11:56

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Confidentiality Statement	2
<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	11	
Date and time	15/1/18, 08:55	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		



## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000037

**Conducted on**

15/1/18, 08:22

**Prepared by**

Jacob Cooper

**Completed on**

17/1/18, 11:23

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Confidentiality Statement	2
<b>GENERAL INFO - 0/3 - 0%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info

Question	Response	Details
<b>General Info</b>		Score (0/3) 0%
Site	12	
Date and time	15/1/18, 08:22	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		



## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000040

**Conducted on**

15/1/18, 08:51

**Prepared by**

Jacob Cooper

**Location**

62 Little Corella Circuit  
Berry NSW 2535  
Australia  
(-34.7805595, 150.6829681)

**Score**

1/11 - 9.09%

**Completed on**

17/1/18, 11:55

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Confidentiality Statement	2
<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	13	
Date and time	15/1/18, 08:54	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000036

**Conducted on**

15/1/18, 08:17

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

17/1/18, 11:18

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	14	
Date and time	15/1/18, 08:17	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000039

**Conducted on**

15/1/18, 08:45

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

17/1/18, 11:45

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	15	
Date and time	15/1/18, 08:45	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000035

**Conducted on**

15/1/18, 08:07

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

17/1/18, 11:08

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	16	
Date and time	15/1/18, 08:07	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000034

**Conducted on**

15/1/18, 08:02

**Prepared by**

Jacob Cooper

**Location**

(-34.7861240152594, 150.676326658717)

**Score**

1/11 - 9.09%

**Completed on**

17/1/18, 11:04



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## Table of Contents

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Confidentiality Statement	2
<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	17	
Date and time	15/1/18, 08:03	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1



**Attachment D: Laboratory Results**

## CERTIFICATE OF ANALYSIS

**Work Order** : **ES1802358**  
**Client** : **FULTON HOGAN PTY LTD**  
**Contact** : JACOB COOPER  
**Address** : LEVELI 3 - 90 BOURKE ROAD  
 ALEXANDRIA NSW, AUSTRALIA 2015  
**Telephone** : +61 02 8346 9400  
**Project** : 59 Woodhill Mountain Rd, Berry 2535  
**Order number** : ----  
**C-O-C number** : ----  
**Sampler** : JACOB COOPER  
**Site** : ----  
**Quote number** : EN/222/17  
**No. of samples received** : 12  
**No. of samples analysed** : 12

**Page** : 1 of 5  
**Laboratory** : Environmental Division Sydney  
**Contact** : Customer Services ES  
**Address** : 277-289 Woodpark Road Smithfield NSW Australia 2164  
**Telephone** : +61-2-8784 8555  
**Date Samples Received** : 18-Jan-2018 12:56  
**Date Analysis Commenced** : 19-Jan-2018  
**Issue Date** : 22-Jan-2018 16:18



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



## General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
LOR = Limit of reporting  
^ = This result is computed from individual analyte detections at or above the level of reporting  
ø = ALS is not NATA accredited for these tests.  
~ = Indicates an estimated value.



**Analytical Results**

Sub-Matrix: <b>WATER</b> (Matrix: <b>WATER</b> )			Client sample ID	SW01	SW02_A	SW02_B	SW03	SW04
Client sampling date / time			15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00
Compound	CAS Number	LOR	Unit	ES1802358-001	ES1802358-002	ES1802358-003	ES1802358-004	ES1802358-005
				Result	Result	Result	Result	Result
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
<b>Suspended Solids (SS)</b>	----	5	mg/L	<5	<5	<5	<5	<5



### Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	SW05	SW06	SW07	SW08_A	SW08_B
Client sampling date / time			15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00
Compound	CAS Number	LOR	Unit	ES1802358-006	ES1802358-007	ES1802358-008	ES1802358-009	ES1802358-010
				Result	Result	Result	Result	Result
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5



**Analytical Results**

Sub-Matrix: <b>WATER</b> (Matrix: <b>WATER</b> )			Client sample ID	SW09	SW10	----	----	----
Client sampling date / time			15-Jan-2018 00:00	15-Jan-2018 00:00	----	----	----	
Compound	CAS Number	LOR	Unit	ES1802358-011	ES1802358-012	-----	-----	-----
				Result	Result	----	----	----
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
<b>Suspended Solids (SS)</b>	----	5	mg/L	<5	17	----	----	----

# Surface Water Monitoring

## Construction Event 29

Monitoring event triggered after 15mm of rainfall was received in 24 hours. This event was of low significance and did not trigger the full suite of analysis as 50mm of rainfall was not received within 24 hours.

Date of Monitoring: 13<sup>th</sup> February 2018

Rainfall Monitoring is shown below.

Berry Masonic Hall	
Date:	Rainfall Received:
12/02/18	3mm
13/02/18	5mm

## Scope and Limitations

In accordance with the Princes Highway upgrade for Foxground and Berry Bypass (FBB) – Water Monitoring Project Brief, surface water monitoring at seventeen locations (SW01 to SW017) was undertaken. This report presents the information collected during the monitoring event with some discussion on field observations and results with respect to upstream vs downstream conditions.

## Field Programme

Surface water sampling was undertaken at all surface locations where flow conditions allowed a representative sample to be taken. This monthly water sampling event was conducted in accordance with the sampling program and protocols provided in:

- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water and Groundwater Sampling Protocol, prepared for Roads and Maritime Services
- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services
- 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring Report, prepared for Roads and Maritime Services.

Field parameters were measured during sampling including temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), and reduction-oxidation potential (redox), and are provided in Table B1, Attachment B. Field sheets including photos are provided in Attachment C.

Water samples were submitted to a NATA certified testing laboratory (Australian Laboratory services (ALS)) to be analysed for:

- Total suspended solids.

## Weather Monitoring

The project has one manual gauge as well as using the Bureau of Meteorology to monitor weather and rainfall. For the purpose of triggering water quality monitoring events the project uses this weather data. The locations of the rainfall gauges are:

- The project office on Woodhill Mountain Road, Berry
- Berry Masonic Hall, Berry

During the construction phase, minor events are classified as at least 15 mm of rainfall in 24 hours and major events are classified as at least 50 mm of rainfall in 24 hours.

## Surface water sampling results

Results for the water quality monitoring event are located as attachments at the end of this document, they are:

- Attachment A, Location maps
- Attachment B, Tabulated results
- Attachment C, Field sheets, Field photos
- Attachment D, Laboratory results

## Surface water locations

The upstream location represents the 'reference' (un-impacted) site while the down-stream locations represent the 'test' sites (potentially impacted sites during construction and operation). By comparing upstream water quality with down-stream water quality potential impacts from construction are assessed.

**Table 1 Surface water locations within specific surface water bodies**

<b>Surface water</b>	<b>Upstream of Alignment</b>	<b>Downstream of Alignment (test)</b>
Broughton Creek	SW01	SW 02, SW03, SW05
Connelly's Creek and Broughton Mill Creek and Bundewallah Creek	SW 04, SW06	SW 07, SW09
Bundewallah Creek and Connelly's Creek	SW08	SW 06
Town Creek	SW 10	SW 11
Hitchcocks Lane Creek Tributary	SW 12	SW 13
Hitchcocks Lane Creek	SW 14	SW 15
Unnamed Tributary	SW 16	SW 17

## Results summary

The monitoring for this rainfall event was triggered by 15mm of rainfall received in 24 hours. The total event volume 8mm across the project over 2 days. This monitoring event has not affected the flow conditions for all catchments across the project given the past climatic conditions and minimal rainfall. Because of this flow conditions have remained the same throughout all catchments where Bundewallah Creek (SW06, SW08, SW09) and all ephemeral drainage lines in the southern catchment (SW10 - SW17) experiencing very little to no flow.



In the projects current state there is a reduced risk in site runoff effecting the surrounding catchment due to the completed nature and reduction in construction footprint. Consequently, there were no observed construction impacts as a result of this rainfall event.

It is to be noted that sites SW06, SW08, SW09, SW10, SW11, SW12, SW13, SW14, SW15, SW16 and SW17 were not sampled due to the low to no flow conditions observed in these locations.

Broughton Creek: Showed no impacts from construction. Construction has been completed in this catchment for more than a year and is completed rehabilitated. Slight increase in TSS in all locations along the catchment, being consistent with all locations identifies an external source of turbid runoff.

Connelly's Creek and Broughton Mill Creek and Bundewallah Creek: Showed no impacts from construction. Both Creek's had no to little flow, where SW04 was the only monitoring location sampled. SW07 was also very still almost stagnant conditions.

Town Creek: Showed no impacts from construction. Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

Hitchcocks Lane Creek Tributary: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

Hitchcocks Lane Creek: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

Unnamed Tributary: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

# Attachment A: Location Map



<p>1:25,000 (at A3)</p> <p>0 125 250 500 750 1,000 Meters</p> <p>Map Projection: Transverse Mercator Horizontal Datum: Geocentric Datum of Australia (GDA) Grid: Map Grid of Australia 1994, Zone 56</p>		<p><b>LEGEND</b></p> <ul style="list-style-type: none"> <li><span style="color: red;">●</span> Surface Water Sampling Locations</li> <li><span style="color: blue;">—</span> Berry to Foxground upgrade alignment</li> <li><span style="color: grey;">—</span> Roads</li> <li><span style="color: blue;">—</span> Railways</li> <li><span style="color: blue;">—</span> Waterways</li> <li><span style="color: blue;">■</span> Lakes and dams</li> </ul>	<p>Fulton Hogan Pty Ltd Water Quality Monitoring</p>	<p>Job Number   21-24306 Revision   A Date   03 Mar 2015</p>
--	--	--	--	--

**Surface water sampling locations** **Figure 1**

Ighite@ghd.com.au | Project: 2104306GISMap(MXD) | 21\_24306\_2001\_SurfaceWaterSamplingLocations.mxd  
 © 2015. While GHd has taken care to ensure the accuracy of this product, GHd and DATA CUSTODIAN, make no representations or warranties about its accuracy, completeness or suitability for any particular purpose. GHd and DATA CUSTODIAN, cannot accept liability of any kind (whether in contract, tort or otherwise), for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred as a result of the product being inaccurate, incomplete or unavailable in any way and for any reason.  
 Data Source: NSW Department of Lands, DTDR and DCDB - 2012. Created by: mveber

Attachment B: Tabulated Results

No.	Date	Time	Temperature	pH	ORP	Conductivity	Turbidity	Dissolved Oxygen
SW01	13/02/2018	10:06:00 AM	20.36 °C	6.3	293 mV	0.124 mS/cm	12.9 NTU	6.88 mg/L
SW02	13/02/2018	10:22:00 AM	20.35 °C	6	315 mV	0.118 mS/cm	19.5 NTU	6.32 mg/L
SW03	13/02/2018	10:47:00 AM	20.54 °C	5.8	302 mV	0.113 mS/cm	25.5 NTU	6.24 mg/L
SW04	13/02/2018	11:33:00 AM	21.85 °C	6	329 mV	0.108 mS/cm	1.3 NTU	5.17 mg/L
SW05	13/02/2018	11:06:00 AM	20.69 °C	6	327 mV	0.115 mS/cm	27.9 NTU	4.6 mg/L
SW06	13/02/2018	No Samples taken due to low flow conditions						
SW07	13/02/2018	11:16:00 AM	22.33 °C	5.8	298 mV	0.113 mS/cm	1.4 NTU	4.1 mg/L
SW08	13/02/2018	No Samples taken due to low flow conditions						
SW09	13/02/2018	No Samples taken due to low flow conditions						
SW10	13/02/2018	No Samples taken due to low flow conditions						
SW11	13/02/2018	No Samples taken due to low flow conditions						
SW12	13/02/2018							
SW13	13/02/2018							
SW14	13/02/2018							
SW15	13/02/2018							
SW16	13/02/2018							
SW17	13/02/2018							

# Surface water monitoring

**Document No.**

000051

**Conducted on**

13/2/18, 10:06

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

13/2/18, 10:09

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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	1	
Date and time	13/2/18, 10:06	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Sampling after constriction/riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.36	
<b>pH</b>		
	6.3	
<b>REDOX</b>		
	293	
<b>Conductivity (uS/cm)</b>		
	124	
<b>Turbidity</b>		
	12.9	
<b>DO (mg/L)</b>		
	6.88	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	High	
<b>Colour</b>		
	Slight turbid	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	1	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000052

**Conducted on**

13/2/18, 10:21

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

13/2/18, 10:26

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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	2	
Date and time	13/2/18, 10:22	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Down steam side of weir
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.35	
<b>pH</b>		
	6.0	
<b>REDOX</b>		
	315	
<b>Conductivity (uS/cm)</b>		
	118	
<b>Turbidity</b>		
	19.5	
<b>DO (mg/L)</b>		
	6.32	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	High	
<b>Colour</b>		
	Slight turbid	
<b>Other</b>		
	Downstream side has a heightened turbidity. Confirm TSS results of any change. Could be caused by agricultural runoff. No construction apparent in catchment	

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	2	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000053

**Conducted on**

13/2/18, 10:47

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

13/2/18, 10:49

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Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	3	
Date and time	13/2/18, 10:47	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Next to main flow on corner of bend
 <p>Appendix 1</p>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.54	
<b>pH</b>		
	5.8	
<b>REDOX</b>		
	302	
<b>Conductivity (uS/cm)</b>		
	113	
<b>Turbidity</b>		
	25.5	
<b>DO (mg/L)</b>		
	6.24	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	High	
<b>Colour</b>		
	Slight turbid	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	3	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000056

**Conducted on**

13/2/18, 11:33

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

13/2/18, 11:35

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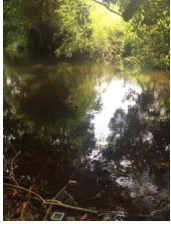
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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	4	
Date and time	13/2/18, 11:33	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pool before riffle
 <p>Appendix 1</p>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	21.85	
<b>pH</b>		
	6.0	
<b>REDOX</b>		
	329	
<b>Conductivity (uS/cm)</b>		
	108	
<b>Turbidity</b>		
	1.3	
<b>DO (mg/L)</b>		
	5.17	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	4	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000054

**Conducted on**

13/2/18, 11:06

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

13/2/18, 11:08



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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	5	
Date and time	13/2/18, 11:06	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widened part of creek
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian with agricultural impacts
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.69	
<b>pH</b>		
	6.0	
<b>REDOX</b>		
	327	
<b>Conductivity (uS/cm)</b>		
	115	
<b>Turbidity</b>		
	27.9	
<b>DO (mg/L)</b>		
	4.60	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Turbid	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	5	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000066

**Conducted on**

13/2/18, 13:00

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 13:00

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<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	6	
Date and time	13/2/18, 13:00	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000055

**Conducted on**

13/2/18, 11:16

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

13/2/18, 11:18

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	7	
Date and time	13/2/18, 11:16	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Bass point behind bowling club. Widened channel before riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	22.33	
<b>pH</b>		
	5.8	
<b>REDOX</b>		
	298	
<b>Conductivity (uS/cm)</b>		
	113	
<b>Turbidity</b>		
	1.4	
<b>DO (mg/L)</b>		
	4.10	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Clear	
<b>Other</b>		



### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	7	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000058

**Conducted on**

13/2/18, 12:14

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:15

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<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	8	
Date and time	13/2/18, 12:14	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		



## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000065

**Conducted on**

13/2/18, 12:55

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:56

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Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	9	
Date and time	13/2/18, 12:55	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000057

**Conducted on**

13/2/18, 12:05

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:15

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	10	
Date and time	13/2/18, 12:05	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Not sampled due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000059

**Conducted on**

13/2/18, 12:21

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:22

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	12	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000060

**Conducted on**

13/2/18, 12:25

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:26

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	13	
Date and time	13/2/18, 12:26	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000064

**Conducted on**

13/2/18, 12:47

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:48



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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	14	
Date and time	13/2/18, 12:47	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000063

**Conducted on**

13/2/18, 12:44

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:45

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	15	
Date and time	13/2/18, 12:44	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000062

**Conducted on**

13/2/18, 12:38

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:39

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<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	16	
Date and time	13/2/18, 12:38	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		



## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000061

**Conducted on**

13/2/18, 12:37

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:38

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<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	17	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		



## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

**Attachment D: Laboratory Results**

## CERTIFICATE OF ANALYSIS

**Work Order** : **EW1800618**  
**Client** : **FULTON HOGAN PTY LTD**  
**Contact** : JACOB COOPER  
**Address** : LEVEL 3 - 90 BOURKE ROAD  
 ALEXANDRIA NSW, AUSTRALIA 2015  
  
**Telephone** : +61 02 8346 9400  
**Project** : Foxground and Berry Bypass  
**Order number** : ----  
**C-O-C number** : ----  
**Sampler** : JACOB COOPER  
**Site** : ----  
**Quote number** : EN/222/17  
**No. of samples received** : 6  
**No. of samples analysed** : 6

**Page** : 1 of 4  
**Laboratory** : Environmental Division NSW South Coast  
**Contact** : Glenn Davies  
**Address** : 1/19 Ralph Black Dr, North Wollongong 2500  
 4/13 Geary Pl, North Nowra 2541  
 Australia NSW  
**Telephone** : 02 42253125  
**Date Samples Received** : 14-Feb-2018 13:13  
**Date Analysis Commenced** : 20-Feb-2018  
**Issue Date** : 21-Feb-2018 11:14



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



## General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
LOR = Limit of reporting  
^ = This result is computed from individual analyte detections at or above the level of reporting  
ø = ALS is not NATA accredited for these tests.  
~ = Indicates an estimated value.



### Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW01	SW02	SW03	SW04	SW05
Client sampling date / time				13-Feb-2018 10:00	13-Feb-2018 10:15	13-Feb-2018 10:45	13-Feb-2018 11:30	13-Feb-2018 11:00	
Compound	CAS Number	LOR	Unit	EW1800618-001	EW1800618-002	EW1800618-003	EW1800618-004	EW1800618-005	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	10	6	7	<5	15	



### Analytical Results

Sub-Matrix: <b>WATER</b> (Matrix: <b>WATER</b> )			Client sample ID	SW07	---	---	---	---
Client sampling date / time			13-Feb-2018 11:15	---	---	---	---	
Compound	CAS Number	LOR	Unit	EW1800618-006	-----	-----	-----	-----
Result				---	---	---	---	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
<b>Suspended Solids (SS)</b>	---	5	mg/L	<5	---	---	---	---



## Surface Water Monitoring

Construction Event 30

Monitoring event triggered after 50mm of rainfall was received in 24 hours. This event was significant which triggered the full suite of analysis as 50mm of rainfall was received within 24 hours.

Date of Monitoring: 27<sup>th</sup> February 2018

Rainfall Monitoring is shown below.

Woodhill Mountain Road	
Date:	Rainfall Received:
27/2/18	51

Note: Rainfall data from BoM has not been uploaded at the time of reporting.

## Scope and Limitations

Due to the stage of the project, monitoring of construction impacts have been significantly reduced to the main compound catchment (SW06 – SW07). The other locations are now considered to be under operational conditions and are now monitored by RMS. This report presents the information collected during the monitoring event with some discussion on field observations and results with respect to upstream vs downstream conditions.

## Field Programme

Surface water sampling was undertaken at all surface locations where flow conditions allowed a representative sample to be taken. This monthly water sampling event was conducted in accordance with the sampling program and protocols provided in:

- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water and Groundwater Sampling Protocol, prepared for Roads and Maritime Services
- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services
- 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring Report, prepared for Roads and Maritime Services.

Field parameters were measured during sampling including temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), and reduction-oxidation potential (redox), and are provided in Attachment B. Field sheets are provided in Attachment C.

Water samples were submitted to a NATA certified testing laboratory (Australian Laboratory services (ALS)) to be analysed for:

- Total suspended solids
- Total Petroleum Hydrocarbons
- Total Phosphorus
- Total Nitrogen
- Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn).

## Weather Monitoring

The project has one manual gauge as well as using the Bureau of Meteorology to monitor weather and rainfall. For the purpose of triggering water quality monitoring events the project uses this weather data. The locations of the rainfall gauges are:

- The project office on Woodhill Mountain Road, Berry
- Berry Masonic Hall, Berry

During the construction phase, minor events are classified as at least 15 mm of rainfall in 24 hours and major events are classified as at least 50 mm of rainfall in 24 hours.

## Surface water sampling results

Results for the water quality monitoring event are located as attachments at the end of this document, they are:

- Attachment A, Location maps
- Attachment B, Tabulated results
- Attachment C, Field sheets, photos
- Attachment D, Laboratory results

## Surface water locations

The upstream location represents the 'reference' (un-impacted) site while the down-stream locations represent the 'test' sites (potentially impacted sites during construction and operation). By comparing upstream water quality with down-stream water quality potential impacts from construction are assessed.

**Table 1** Surface water locations within specific surface water bodies

Surface water	Upstream of Alignment	Downstream of Alignment (test)
---------------	-----------------------	--------------------------------

Connelly's Creek and Broughton Mill Creek and Bundewallah Creek	SW06	SW07
---	------	------

## Results summary

The monitoring for this rainfall event was triggered by more than 50mm of rainfall received in 24 hours. The total event volume was 51mm across the project. Irrespective of the high rainfall experienced, the creeks remained at a high quality with no signs of impact.

Connelly's Creek and Broughton Mill Creek and Bundewallah Creek: Showed no impacts from construction. Since the last major event, nutrient (TN & TP) and TSS levels have dropped significantly due to the fact that there has been a reduction in land runoff and an increase in infiltration.

# Surface Water Monitoring

## Construction Event 27

Monitoring event triggered after 15mm of rainfall was received in 24 hours. This event was of low significance and did not trigger the full suite of analysis as 50mm of rainfall was not received within 24 hours.

Date of Monitoring: 6<sup>th</sup> December 2017

Rainfall Monitoring is shown below.

Woodhill Mountain Road	
Date:	Rainfall Received:
05/12/17	20mm
06/12/17	28mm

Toolijooa Road	
Date:	Rainfall Received:
05/12/17	15mm
06/12/17	22mm

Austral Park	
Date:	Rainfall Received:
05/12/17	18mm
06/12/17	31mm

## Scope and Limitations

In accordance with the Princes Highway upgrade for Foxground and Berry Bypass (FBB) – Water Monitoring Project Brief, surface water monitoring at seventeen locations (SW01 to SW017) was undertaken. This report presents the information collected during the monitoring event with some discussion on field observations and results with respect to upstream vs downstream conditions.

## Field Programme

Surface water sampling was undertaken at all surface locations where flow conditions allowed a representative sample to be taken. This monthly water sampling event was conducted in accordance with the sampling program and protocols provided in:

- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water and Groundwater Sampling Protocol, prepared for Roads and Maritime Services
- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services
- 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring

Report, prepared for Roads and Maritime Services.

Field parameters were measured during sampling including temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), and reduction-oxidation potential (redox), and are provided in Table B1, Attachment B. Field sheets are provided in Attachment C.

Water samples were submitted to a NATA certified testing laboratory (Australian Laboratory services (ALS)) to be analysed for:

- Total suspended solids.

## Weather Monitoring

The project has three weather stations used to monitor weather and rainfall. For the purpose of triggering water quality monitoring events the project uses these weather stations. The locations of the weather stations are:

- The project office on Woodhill Mountain Road, Berry
- Austral Park Road, ancillary facility, Broughton
- Toolijooa Road, Toolijooa,

During the construction phase minor events are classified as at least 15 mm of rainfall in 24 hours and major events are classified as at least 50 mm of rainfall in 24 hours.

## Surface water sampling results

Results for the water quality monitoring event are located as attachments at the end of this document, they are:

- Attachment A, Location maps
- Attachment B, Tabulated results
- Attachment C, Field sheets, Field photos
- Attachment D, Laboratory results

## Surface water locations

The upstream location represents the 'reference' (un-impacted) site while the down-stream locations represent the 'test' sites (potentially impacted sites during construction and operation). By comparing upstream water quality with down-stream water quality potential impacts from construction are assessed.

**Table 1 Surface water locations within specific surface water bodies**

Surface water	Upstream of Alignment	Downstream of Alignment (test
Broughton Creek	SW01	SW02, SW03, SW05
Connelly's Creek and Broughton Mill Creek and Bundewallah Creek	SW04, SW06	SW07, SW09
Bundewallah Creek and Connelly's Creek	SW08	SW06
Town Creek	SW10	SW11
Hitchcocks Lane Creek Tributary	SW12	SW13
Hitchcocks Lane Creek	SW14	SW15

Unnamed Tributary	SW16	SW17
-------------------	------	------

## Results summary

The monitoring for this rainfall event was triggered by 15mm of rainfall received in 24 hours. The total event volume ranged from approximately 15mm to 31mm across the project over 1 day. Since the last monitoring event there has been steady rainfall experienced on the project, consequently, an increase in flow to the catchment has been observed during this monitoring event which has aided in reducing the drought like conditions experienced by the local environment.

In the projects current state there is a reduced risk in site runoff effecting the surrounding catchment due to the completed nature and reduction in construction footprint. Consequently, there were no observed construction impacts as a result of this rainfall event.

It is to be noted that sites SW11, SW12, SW13, SW14, SW15 and SW16 were not sampled due to the low to no flow conditions observed in these locations.

Broughton Creek: Showed no impacts from construction. Conductivity at SW05 has returned to normal levels after Event 26's elevated level. Observations identified an increase in fresh water flow which may have contributed to this result. As a result to the increase in flow results have shown a proportional growth in dissolved oxygen in both upstream and downstream sites. TSS result of <5mg/L was found across all sites in the Broughton Creek catchment demonstrating the operating stage of the project with no indication of turbid runoff.

Connelly's Creek and Broughton Mill Creek and Bundewallah Creek: Showed no impacts from construction. Similarly to Broughton Creek there was an increase in flow and dissolved oxygen observed at all locations.

Town Creek: Catchment is stabilised and operational resulting in no impacts from construction. Downstream sampling location SW11 was not sampled due to no flow conditions.

Hitchcocks Lane Creek Tributary: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

Hitchcocks Lane Creek: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

Unnamed Tributary: Catchment is stabilised and operational resulting in no impacts from construction. Upstream location SW16 unable to be sampled due to shallow depths in waterway caused by low flow conditions.

# Attachment A: Location Map



<p>1:25,000 (at A3)</p> <p>0 125 250 500 750 1,000</p> <p>Meters</p> <p>Map Projection: Transverse Mercator Horizontal Datum: Geocentric Datum of Australia (GDA) Grid: Map Grid of Australia 1994, Zone 56</p>		<p><b>LEGEND</b></p> <ul style="list-style-type: none"> <li><span style="color: red;">●</span> Surface Water Sampling Locations</li> <li><span style="color: blue;">—</span> Bery to Foxground upgrade alignment</li> <li><span style="color: grey;">—</span> Roads</li> <li><span style="color: blue;">—</span> Railways</li> <li><span style="color: lightblue;">—</span> Waterways</li> <li><span style="color: darkblue;">—</span> Lakes and dams</li> </ul>	<p>Fulton Hogan Pty Ltd Water Quality Monitoring</p>	<p>Job Number   21-24306 Revision   A Date   03 Mar 2015</p>
---	--	--	--	--

**Surface water sampling locations** **Figure 1**

Ighite@ghd.com.au | Project 2104306GISMap\MXD\21\_24306\_2001\_SurfaceWaterSamplingLocations.mxd  
 © 2015. While GHD has taken care to ensure the accuracy of this product, GHD and DATA CUSTODIAN, make no representations or warranties about its accuracy, completeness or suitability for any particular purpose. GHD and DATA CUSTODIAN, cannot accept liability of any kind (whether in contract, tort or otherwise), for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred as a result of the product being inaccurate, incomplete or unavailable in any way and for any reason.  
 Data Source: NSW Department of Lands, DTDB and DCDB - 2012. Created by: mveber

Attachment B: Tabulated Results

No.	Date	Temperature	pH	ORP	Conductivity	Turbidity	Dissolved Oxygen	
SW01	6/12/2017	16.15 °C	6.1	273 mV	0.085 mS/cm	3.4 NTU	7.64 mg/L	
SW02	6/12/2017	16.54 °C	6	293 mV	0.105 mS/cm	3.2 NTU	6.57 mg/L	
SW03	6/12/2017	16.83 °C	5.8	249 mV	0.117 mS/cm	4.6 NTU	6.34 mg/L	
SW04	6/12/2017	16.38 °C	5.9	220 mV	0.076 mS/cm	2.7 NTU	7 mg/L	
SW05	6/12/2017	17.41 °C	6.2	310 mV	0.159 mS/cm	2.9 NTU	4.91 mg/L	
SW06	6/12/2017	17.62 °C	6.2	324 mV	0.224 mS/cm	5.9 NTU	4.67 mg/L	
SW07	6/12/2017	16.43 °C	5.9	267 mV	0.082 mS/cm	4 NTU	5.64 mg/L	
SW08	6/12/2017	18.29 °C	6.2	246 mV	0.201 mS/cm	4.9 NTU	6.08 mg/L	
SW09	6/12/2017	17.97 °C	6.2	136 mV	0.172 mS/cm	5.7 NTU	3.62 mg/L	
SW10	6/12/2017	19.26 °C	6.3	264 mV	0.122 mS/cm	7.6 NTU	5.3 mg/L	
SW11	6/12/2017	<b>No Samples taken due to low flow conditions</b>						
SW12	6/12/2017							
SW13	6/12/2017							
SW14	6/12/2017							
SW15	6/12/2017							
SW16	6/12/2017							
SW17	6/12/2017	19.64 °C	6.7	284 mV	0.329 mS/cm	2.6 NTU	9.14 mg/L	

## Attachment C: Field Sheets



# Surface water monitoring

**Document No.**

000017

**Conducted on**

6/12/17, 10:15

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

6/12/17, 10:19

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	1	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Deep pool after riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.15	
<b>pH</b>		
	6.1	
<b>REDOX</b>		
	273	
<b>Conductivity (uS/cm)</b>		
	.085	
<b>Turbidity</b>		
	3.4	
<b>DO (mg/L)</b>		
	7.64	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Tannin	
<b>Other</b>		
	Cows upstream in creek. Possible sediment disturbance	

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000018

**Conducted on**

6/12/17, 10:30

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

6/12/17, 10:32

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	2	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Downstream of weir
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.54	
<b>pH</b>		
	6.0	
<b>REDOX</b>		
	293	
<b>Conductivity (uS/cm)</b>		
	.105	
<b>Turbidity</b>		
	3.2	
<b>DO (mg/L)</b>		
	6.57	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Tannin	
<b>Other</b>		



### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
	2	
Preservatives	Yes	Ice
Duplicate	Yes	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000019

**Conducted on**

6/12/17, 10:52

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

6/12/17, 10:55

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<b>GENERAL INFO - 2/3 - 66.67%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 2/4 - 50%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 2/3 - 66.67%

Question	Response	Details
<b>General Info</b>		Score (2/3) 66.67%
Site	3	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	Yes	On bend of a riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 2/4 - 50%

Question	Response	Details
Weather		
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.83	
<b>pH</b>		
	5.8	
<b>REDOX</b>		
	249	
<b>Conductivity (uS/cm)</b>		
	.117	
<b>Turbidity</b>		
	4.6	
<b>DO (mg/L)</b>		
	6.34	



## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Tannin	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	3	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000023

**Conducted on**

6/12/17, 12:17

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

6/12/17, 12:19

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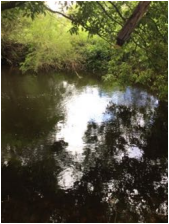
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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	4	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pool before riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.38	
<b>pH</b>		
	5.9	
<b>REDOX</b>		
	220	
<b>Conductivity (uS/cm)</b>		
	76	
<b>Turbidity</b>		
	2.7	
<b>DO (mg/L)</b>		
	7.00	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	4	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000020

**Conducted on**

6/12/17, 11:08

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

6/12/17, 11:12

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	5	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Wide deep channel
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian/over cleared
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	17.41	
<b>pH</b>		
	6.2	
<b>REDOX</b>		
	310	
<b>Conductivity (uS/cm)</b>		
	.159	
<b>Turbidity</b>		
	2.9	
<b>DO (mg/L)</b>		
	4.91	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Tannin	
<b>Other</b>		
	High tide at the moment. Possible salinity influence	

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	4	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000021

**Conducted on**

6/12/17, 11:44

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

6/12/17, 11:47

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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	6	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widening in creek pool before riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	17.62	
<b>pH</b>		
	6.2	
<b>REDOX</b>		
	324	
<b>Conductivity (uS/cm)</b>		
	.224	
<b>Turbidity</b>		
	5.9	
<b>DO (mg/L)</b>		
	4.67	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Slightly turbid	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	6	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000024

**Conducted on**

6/12/17, 12:29

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

6/12/17, 12:31

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	7	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widened channel
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	16.43	
<b>pH</b>		
	5.9	
<b>REDOX</b>		
	267	
<b>Conductivity (uS/cm)</b>		
	82	
<b>Turbidity</b>		
	4.0	
<b>DO (mg/L)</b>		
	5.64	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	7	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000025

**Conducted on**

6/12/17, 12:44

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

6/12/17, 12:46



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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	8	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Confluence point of two water courses
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	18.29	
<b>pH</b>		
	6.2	
<b>REDOX</b>		
	246	
<b>Conductivity (uS/cm)</b>		
	201	
<b>Turbidity</b>		
	4.9	
<b>DO (mg/L)</b>		
	6.08	

### Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	8	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000022

**Conducted on**

6/12/17, 12:05

**Prepared by**

Jacob Cooper

**Score**

10/11 - 90.91%

**Completed on**

6/12/17, 12:08

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<b>SURFACE WATER MONITORING - 10/11 - 90.91%</b>	<b>1</b>
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Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 3/3 - 100%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	9	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Constricted channel
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	17.97	
<b>pH</b>		
	6.2	
<b>REDOX</b>		
	136	
<b>Conductivity (uS/cm)</b>		
	172	
<b>Turbidity</b>		
	5.7	
<b>DO (mg/L)</b>		
	3.62	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Slightly turbid	
<b>Other</b>		

### Sample info - 3/3 - 100%

Question	Response	Details
Sample number	9	
<b>No. Of containers</b>		
	2	
Preservatives	Yes	Ice
Duplicate	Yes	



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000026

**Conducted on**

6/12/17, 12:56

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

6/12/17, 12:58

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<b>SURFACE WATER MONITORING - 9/11 - 81.82%</b>	<b>1</b>
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Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	10	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Drainage line into duck pond
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Agricultural
Slope	Yes	Flat
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	19.26	
<b>pH</b>		
	6.3	
<b>REDOX</b>		
	264	
<b>Conductivity (uS/cm)</b>		
	122	
<b>Turbidity</b>		
	7.6	
<b>DO (mg/L)</b>		
	5.33	

### Flow observations - 1/1 - 100%

Question	Response	Details
Flow	None	
<b>Colour</b>		
	Clear	
<b>Other</b>		



### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	10	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000033

**Conducted on**

6/12/17, 13:44

**Prepared by**

Jacob Cooper

**Score**

2/11 - 18.18%

**Completed on**

6/12/17, 13:44

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<b>GENERAL INFO - 2/3 - 66.67%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 2/3 - 66.67%

Question	Response	Details
<b>General Info</b>		Score (2/3) 66.67%
Site	11	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	Yes	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		



## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000027

**Conducted on**

6/12/17, 13:07

**Prepared by**

Jacob Cooper

**Score**

2/11 - 18.18%

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<b>GENERAL INFO - 2/3 - 66.67%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 2/3 - 66.67%

Question	Response	Details
<b>General Info</b>		Score (2/3) 66.67%
Site	12	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	Yes	Unable to sample due to low to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000029

**Conducted on**

6/12/17, 13:20

**Prepared by**

Jacob Cooper

**Score**

2/11 - 18.18%

**Completed on**

6/12/17, 13:21

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<b>GENERAL INFO - 2/3 - 66.67%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 2/3 - 66.67%

Question	Response	Details
<b>General Info</b>		Score (2/3) 66.67%
Site	13	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	Yes	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000032

**Conducted on**

6/12/17, 13:40

**Prepared by**

Jacob Cooper

**Score**

2/11 - 18.18%

**Completed on**

6/12/17, 13:41

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Confidentiality Statement	2
<b>GENERAL INFO - 2/3 - 66.67%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 2/3 - 66.67%

Question	Response	Details
<b>General Info</b>		Score (2/3) 66.67%
Site	14	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	Yes	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000028

**Conducted on**

6/12/17, 13:15

**Prepared by**

Jacob Cooper

**Score**

3/11 - 27.27%

**Completed on**

6/12/17, 13:16

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<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	15	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000030

**Conducted on**

6/12/17, 13:27

**Prepared by**

Jacob Cooper

**Score**

2/11 - 18.18%

**Completed on**

6/12/17, 13:28



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<b>SURFACE WATER MONITORING - 2/11 - 18.18%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 2/3 - 66.67%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 2/3 - 66.67%

Question	Response	Details
<b>General Info</b>		Score (2/3) 66.67%
Site	16	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	Yes	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000031

**Conducted on**

6/12/17, 13:31

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

6/12/17, 13:34

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## Table of Contents

<b>SURFACE WATER MONITORING - 7/11 - 63.64%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 1/4 - 25%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	17	
Date and time		
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Shallow pool
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 1/4 - 25%

Question	Response	Details
Weather	Overcast	
Vegetation	No	Scour rock around bridge
Slope	No	Flat
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	19.64	
<b>pH</b>		
	6.7	
<b>REDOX</b>		
	284	
<b>Conductivity (uS/cm)</b>		
	329	
<b>Turbidity</b>		
	2.6	
<b>DO (mg/L)</b>		
	9.14	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	None	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	17	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	



## Media



Appendix 1

## Attachment D: Laboratory Results

## CERTIFICATE OF ANALYSIS

**Work Order** : **EW1705133**  
**Client** : **FULTON HOGAN PTY LTD**  
**Contact** : JACOB COOPER  
**Address** : LEVEL1 3 - 90 BOURKE ROAD  
 ALEXANDRIA NSW, AUSTRALIA 2015  
  
**Telephone** : +61 02 8346 9400  
**Project** : Foxground and Berry Bypass  
**Order number** : ----  
**C-O-C number** : ----  
**Sampler** : JACOB COOPER  
**Site** : ----  
**Quote number** : EN/222/17  
**No. of samples received** : 13  
**No. of samples analysed** : 13

**Page** : 1 of 5  
**Laboratory** : Environmental Division NSW South Coast  
**Contact** : Glenn Davies  
**Address** : 1/19 Ralph Black Dr, North Wollongong 2500  
 4/13 Geary Pl, North Nowra 2541  
 Australia NSW  
**Telephone** : 02 42253125  
**Date Samples Received** : 07-Dec-2017 11:56  
**Date Analysis Commenced** : 13-Dec-2017  
**Issue Date** : 14-Dec-2017 15:22



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



## General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
LOR = Limit of reporting  
^ = This result is computed from individual analyte detections at or above the level of reporting  
ø = ALS is not NATA accredited for these tests.  
~ = Indicates an estimated value.



### Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	SW01	SW02_A	SW02_B	SW03	W04
Client sampling date / time			06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	EW1705133-001	EW1705133-002	EW1705133-003	EW1705133-004	EW1705133-005
				Result	Result	Result	Result	Result
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5



### Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW05	SW06	SW07	SW08	SW09_A
Client sampling date / time				06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00	
Compound	CAS Number	LOR	Unit	EW1705133-006	EW1705133-007	EW1705133-008	EW1705133-009	EW1705133-010	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5	



**Analytical Results**

Sub-Matrix: <b>WATER</b> (Matrix: <b>WATER</b> )			Client sample ID	SW09_B	SW10	SW17	----	----
Client sampling date / time			06-Dec-2017 00:00	06-Dec-2017 00:00	06-Dec-2017 00:00	----	----	
Compound	CAS Number	LOR	Unit	EW1705133-011	EW1705133-012	EW1705133-013	-----	-----
				Result	Result	Result	----	----
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
<b>Suspended Solids (SS)</b>	----	5	mg/L	<5	<5	<5	----	----

# Surface Water Monitoring

Construction Event 28

Monitoring event triggered after 15mm of rainfall was received in 24 hours. This event was of low significance and did not trigger the full suite of analysis as 50mm of rainfall was not received within 24 hours.

Date of Monitoring: 15<sup>th</sup> January 2018

Rainfall Monitoring is shown below.

Woodhill Mountain Road	
Date:	Rainfall Received:
13/01/18	28mm
14/01/18	22mm

Toolijooa Road	
Date:	Rainfall Received:
13/01/18	8mm
14/01/18	27mm

Austral Park	
Date:	Rainfall Received:
13/01/18	11mm
14/01/18	20mm

## Scope and Limitations

In accordance with the Princes Highway upgrade for Foxground and Berry Bypass (FBB) – Water Monitoring Project Brief, surface water monitoring at seventeen locations (SW01 to SW017) was undertaken. This report presents the information collected during the monitoring event with some discussion on field observations and results with respect to upstream vs downstream conditions.

## Field Programme

Surface water sampling was undertaken at all surface locations where flow conditions allowed a representative sample to be taken. This monthly water sampling event was conducted in accordance with the sampling program and protocols provided in:

- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water and Groundwater Sampling Protocol, prepared for Roads and Maritime Services
- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services
- 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring



Report, prepared for Roads and Maritime Services.

Field parameters were measured during sampling including temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), and reduction-oxidation potential (redox), and are provided in Table B1, Attachment B. Field sheets including photos are provided in Attachment C.

Water samples were submitted to a NATA certified testing laboratory (Australian Laboratory services (ALS)) to be analysed for:

- Total suspended solids.

## Weather Monitoring

The project has three weather stations used to monitor weather and rainfall. For the purpose of triggering water quality monitoring events the project uses these weather stations. The locations of the weather stations are:

- The project office on Woodhill Mountain Road, Berry
- Austral Park Road, ancillary facility, Broughton
- Toolijooa Road, Toolijooa,

During the construction phase minor events are classified as at least 15 mm of rainfall in 24 hours and major events are classified as at least 50 mm of rainfall in 24 hours.

## Surface water sampling results

Results for the water quality monitoring event are located as attachments at the end of this document, they are:

- Attachment A, Location maps
- Attachment B, Tabulated results
- Attachment C, Field sheets, Field photos
- Attachment D, Laboratory results

## Surface water locations

The upstream location represents the 'reference' (un-impacted) site while the down-stream locations represent the 'test' sites (potentially impacted sites during construction and operation). By comparing upstream water quality with down-stream water quality potential impacts from construction are assessed.

**Table 1 Surface water locations within specific surface water bodies**

<b>Surface water</b>	<b>Upstream of Alignment</b>	<b>Downstream of Alignment (test</b>
Broughton Creek	SW01	SW02, SW03, SW05
Connelly's Creek and Broughton Mill Creek and Bundewallah Creek	SW04, SW06	SW07, SW09
Bundewallah Creek and Connelly's Creek	SW08	SW06
Town Creek	SW10	SW11
Hitchcocks Lane Creek Tributary	SW12	SW13
Hitchcocks Lane Creek	SW14	SW15

Unnamed Tributary	SW16	SW17
-------------------	------	------

## Results summary

The monitoring for this rainfall event was triggered by 15mm of rainfall received in 24 hours. The total event volume ranged from approximately 20mm to 27mm across the project over 1 day. This monitoring event has given the environment a much needed break from the extreme heat experienced over the last few weeks, flow has remained the same throughout all catchments where all ephemeral drainage lines in the southern catchment (SW12 - SW17) experiencing very little to no flow.

In the projects current state there is a reduced risk in site runoff effecting the surrounding catchment due to the completed nature and reduction in construction footprint. Consequently, there were no observed construction impacts as a result of this rainfall event.

It is to be noted that sites SW11, SW12, SW13, SW14, SW15, SW16 and SW17 were not sampled due to the low to no flow conditions observed in these locations.

Broughton Creek: Showed no impacts from construction.

Connelly's Creek and Broughton Mill Creek and Bundewallah Creek: Showed no impacts from construction. Upstream location SW08 observations saw a decrease in DO, where downstream location SW09 gave a reading around the baseline level. These results indicate that majority of flow was coming from the Conelly Creek's catchment. This was backed up by field observations of very little flow in the upstream Bundewallah location (SW08).

Town Creek: Showed no impacts from construction. Elevated turbidity results were recorded, this was subject to grazing stock passing through watercourse concurrently during the time of sampling. Downstream sampling location SW11 was not sampled due to no flow conditions.

Hitchcocks Lane Creek Tributary: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

Hitchcocks Lane Creek: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

Unnamed Tributary: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

# Attachment A: Location Map



<p>1:25,000 (at A3)</p> <p>0 125 250 500 750 1,000</p> <p>Meters</p> <p>Map Projection: Transverse Mercator Horizontal Datum: Geocentric Datum of Australia (GDA) Grid: Map Grid of Australia 1994, Zone 56</p>		<p><b>LEGEND</b></p> <table border="0" style="width: 100%;"> <tr> <td> Surface Water Sampling Locations</td> <td> Railways</td> </tr> <tr> <td> Berry to Foxground upgrade alignment</td> <td> Waterways</td> </tr> <tr> <td> Roads</td> <td> Lakes and dams</td> </tr> </table>	Surface Water Sampling Locations	Railways	Berry to Foxground upgrade alignment	Waterways	Roads	Lakes and dams	<p>Fulton Hogan Pty Ltd Water Quality Monitoring</p>	<p>Job Number   21-24306 Revision   A Date   03 Mar 2015</p>
Surface Water Sampling Locations	Railways									
Berry to Foxground upgrade alignment	Waterways									
Roads	Lakes and dams									

**Surface water sampling locations** **Figure 1**

Ighite@ghd.com.au | Project: 2104306GISMap(MXD) | 21\_24306\_2001\_SurfaceWaterSamplingLocations.mxd  
 © 2015. While GHD has taken care to ensure the accuracy of this product, GHD and DATA CUSTODIAN, make no representations or warranties about its accuracy, completeness or suitability for any particular purpose. GHD and DATA CUSTODIAN, cannot accept liability of any kind (whether in contract, tort or otherwise), for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred as a result of the product being inaccurate, incomplete or unavailable in any way and for any reason.  
 Data Source: NSW Department of Lands, DTDB and DCDB - 2012. Created by: mveber

Attachment B: Tabulated Results

No.	Date	Time	Temperature	pH	ORP	Conductivity	Turbidity	Dissolved Oxygen
SW01	15/01/2017	9:33:00 AM	20.07 °C	6.5	306 mV	0.125 mS/cm	1.1 NTU	6.5 mg/L
SW02	15/01/2017	9:50:00 AM	20.19 °C	6.3	296 mV	0.13 mS/cm	0 NTU	6.48 mg/L
SW03	15/01/2017	12:55:00 PM	20.53 °C	6.3	255 mV	0.138 mS/cm	0 NTU	6.04 mg/L
SW04	15/01/2017	1:49:00 PM	20.62 °C	6.2	305 mV	0.103 mS/cm	1.3 NTU	5.3 mg/L
SW05	15/01/2017	2:32:00 PM	21.56 °C	6.5	229 mV	0.17 mS/cm	4 NTU	4.77 mg/L
SW06	15/01/2017	2:19:00 PM	21.2 °C	5.9	286 mV	0.216 mS/cm	0 NTU	6.56 mg/L
SW07	15/01/2017	9:01:00 AM	20.99 °C	6.2	335 mV	0.127 mS/cm	1.2 NTU	6.29 mg/L
SW08	15/01/2017	1:27:00 PM	20.62 °C	6.3	266 mV	0.311 mS/cm	0 NTU	3.87 mg/L
SW09	15/01/2017	2:01:00 PM	21.48 °C	6.1	193 mV	0.219 mS/cm	0.7 NTU	5.51 mg/L
SW10	15/01/2017	8:34:00 AM	20.81 °C	6.8	296 mV	0.131 mS/cm	24.3 NTU	6.06 mg/L
SW11	15/01/2017	<b>No Samples taken due to low flow conditions</b>						
SW12	15/01/2017							
SW13	15/01/2017							
SW14	15/01/2017							
SW15	15/01/2017							
SW16	15/01/2017							
SW17	15/01/2017							

# Surface water monitoring

**Document No.**

000043

**Conducted on**

15/1/18, 09:33

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

17/1/18, 12:35

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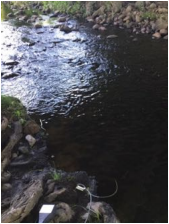
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## Table of Contents

<b>SURFACE WATER MONITORING - 8/11 - 72.73%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 2/3 - 66.67%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 2/3 - 66.67%

Question	Response	Details
<b>General Info</b>		Score (2/3) 66.67%
Site	1	
Date and time	15/1/18, 09:33	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	Yes	Pool after riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.07	
<b>pH</b>		
	6.5	
<b>REDOX</b>		
	306	
<b>Conductivity (uS/cm)</b>		
	125	
<b>Turbidity</b>		
	1.1	
<b>DO (mg/L)</b>		
	6.50	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	1	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000044

**Conducted on**

15/1/18, 09:50

**Prepared by**

Jacob Cooper

**Score**

10/11 - 90.91%

**Completed on**

17/1/18, 12:52

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## **Confidentiality Statement**

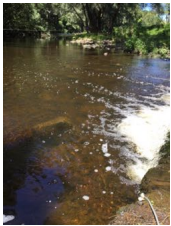
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<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 3/3 - 100%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	2	
Date and time	15/1/18, 09:50	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pool after weir
 <p>Appendix 1</p>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.19	
<b>pH</b>		
	6.3	
<b>REDOX</b>		
	296	
<b>Conductivity (uS/cm)</b>		
	130	
<b>Turbidity</b>		
	0.0	
<b>DO (mg/L)</b>		
	6.48	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 3/3 - 100%

Question	Response	Details
Sample number	2	
<b>No. Of containers</b>		
	2	
Preservatives	Yes	Ice
Duplicate	Yes	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000045

**Conducted on**

15/1/18, 12:54

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

17/1/18, 13:12

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	3	
Date and time	15/1/18, 12:55	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pool before bend and riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.53	
<b>pH</b>		
	6.3	
<b>REDOX</b>		
	255	
<b>Conductivity (uS/cm)</b>		
	138	
<b>Turbidity</b>		
	0.0	
<b>DO (mg/L)</b>		
	6.04	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	3	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000047

**Conducted on**

15/1/18, 13:49

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

17/1/18, 13:51



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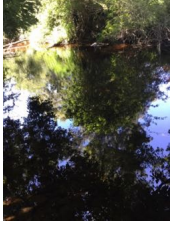
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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	4	
Date and time	15/1/18, 13:49	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pool above riffle
<div style="display: flex; align-items: center;">  </div> <p>Appendix 1</p>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.62	
<b>pH</b>		
	6.2	
<b>REDOX</b>		
	305	
<b>Conductivity (uS/cm)</b>		
	103	
<b>Turbidity</b>		
	1.3	
<b>DO (mg/L)</b>		
	5.30	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	4	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000050

**Conducted on**

15/1/18, 14:32

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

17/1/18, 14:34

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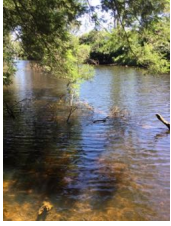
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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	5	
Date and time	15/1/18, 14:32	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widened channel
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	21.56	
<b>pH</b>		
	6.5	
<b>REDOX</b>		
	229	
<b>Conductivity (uS/cm)</b>		
	170	
<b>Turbidity</b>		
	4.0	
<b>DO (mg/L)</b>		
	4.77	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	Cows crossing down stream of location	

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	5	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000049

**Conducted on**

15/1/18, 14:19

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

17/1/18, 14:21

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	6	
Date and time	15/1/18, 14:19	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pool before riffle
 <p>Appendix 1</p>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	21.20	
<b>pH</b>		
	5.9	
<b>REDOX</b>		
	286	
<b>Conductivity (uS/cm)</b>		
	216	
<b>Turbidity</b>		
	0.0	
<b>DO (mg/L)</b>		
	6.56	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		



### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	6	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000042

**Conducted on**

15/1/18, 09:01

**Prepared by**

Jacob Cooper

**Score**

10/11 - 90.91%

**Completed on**

17/1/18, 12:11

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 3/3 - 100%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	7	
Date and time	15/1/18, 09:01	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widening of creek large pool before riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.99	
<b>pH</b>		
	6.2	
<b>REDOX</b>		
	335	
<b>Conductivity (uS/cm)</b>		
	127	
<b>Turbidity</b>		
	1.2	
<b>DO (mg/L)</b>		
	6.29	



## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 3/3 - 100%

Question	Response	Details
Sample number	7	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	Yes	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000046

**Conducted on**

15/1/18, 13:27

**Prepared by**

Jacob Cooper

**Score**

10/11 - 90.91%

**Completed on**

17/1/18, 13:30

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 3/3 - 100%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	8	
Date and time	15/1/18, 13:27	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Confluence of town creek and bundewallah
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.62	
<b>pH</b>		
	6.3	
<b>REDOX</b>		
	266	
<b>Conductivity (uS/cm)</b>		
	311	
<b>Turbidity</b>		
	0.0	
<b>DO (mg/L)</b>		
	3.87	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	None	
<b>Colour</b>		
	Clear	
<b>Other</b>		
	Water is basically stagnant	

### Sample info - 3/3 - 100%

Question	Response	Details
Sample number	8	
<b>No. Of containers</b>		
	2	
Preservatives	Yes	Ice
Duplicate	Yes	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000048

**Conducted on**

15/1/18, 14:01

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

17/1/18, 14:03

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	9	
Date and time	15/1/18, 14:01	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Constricted channel after bridge
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	21.48	
<b>pH</b>		
	6.1	
<b>REDOX</b>		
	193	
<b>Conductivity (uS/cm)</b>		
	219	
<b>Turbidity</b>		
	0.7	
<b>DO (mg/L)</b>		
	5.51	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Low	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	9	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000038

**Conducted on**

15/1/18, 08:33

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

17/1/18, 11:37

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<b>SURFACE WATER MONITORING - 9/11 - 81.82%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	10	
Date and time	15/1/18, 08:34	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Small pool before large pond.
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Sunny	
Vegetation	Yes	Agricultural
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.81	
<b>pH</b>		
	6.8	
<b>REDOX</b>		
	296	
<b>Conductivity (uS/cm)</b>		
	131	
<b>Turbidity</b>		
	24.3	
<b>DO (mg/L)</b>		
	6.06	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	None	
<b>Colour</b>		
	Slightly turbid	
<b>Other</b>		
	Lots of mosquito fish evident	

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	10	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000041

**Conducted on**

15/1/18, 08:55

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

17/1/18, 11:56

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<b>SURFACE WATER MONITORING - 1/11 - 9.09%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	11	
Date and time	15/1/18, 08:55	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000037

**Conducted on**

15/1/18, 08:22

**Prepared by**

Jacob Cooper

**Completed on**

17/1/18, 11:23



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## Table of Contents

<b>SURFACE WATER MONITORING</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 0/3 - 0%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info

Question	Response	Details
<b>General Info</b>		Score (0/3) 0%
Site	12	
Date and time	15/1/18, 08:22	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000040

**Conducted on**

15/1/18, 08:51

**Prepared by**

Jacob Cooper

**Location**

62 Little Corella Circuit  
Berry NSW 2535  
Australia  
(-34.7805595, 150.6829681)

**Score**

1/11 - 9.09%

**Completed on**

17/1/18, 11:55

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Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	13	
Date and time	15/1/18, 08:54	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000036

**Conducted on**

15/1/18, 08:17

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

17/1/18, 11:18

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Confidentiality Statement	2
<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	14	
Date and time	15/1/18, 08:17	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		



## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000039

**Conducted on**

15/1/18, 08:45

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

17/1/18, 11:45

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Confidentiality Statement	2
<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	15	
Date and time	15/1/18, 08:45	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		



## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000035

**Conducted on**

15/1/18, 08:07

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

17/1/18, 11:08

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Confidentiality Statement	2
<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	16	
Date and time	15/1/18, 08:07	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000034

**Conducted on**

15/1/18, 08:02

**Prepared by**

Jacob Cooper

**Location**

(-34.7861240152594, 150.676326658717)

**Score**

1/11 - 9.09%

**Completed on**

17/1/18, 11:04

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## Table of Contents

<b>SURFACE WATER MONITORING - 1/11 - 9.09%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	17	
Date and time	15/1/18, 08:03	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Unable to sample due to low flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

**Attachment D: Laboratory Results**

## CERTIFICATE OF ANALYSIS

<b>Work Order</b> : <b>ES1802358</b> <b>Client</b> : <b>FULTON HOGAN PTY LTD</b> <b>Contact</b> : JACOB COOPER <b>Address</b> : LEVELI 3 - 90 BOURKE ROAD ALEXANDRIA NSW, AUSTRALIA 2015  <b>Telephone</b> : +61 02 8346 9400 <b>Project</b> : 59 Woodhill Mountain Rd, Berry 2535 <b>Order number</b> : ---- <b>C-O-C number</b> : ---- <b>Sampler</b> : JACOB COOPER <b>Site</b> : ---- <b>Quote number</b> : EN/222/17 <b>No. of samples received</b> : 12 <b>No. of samples analysed</b> : 12	<b>Page</b> : 1 of 5 <b>Laboratory</b> : Environmental Division Sydney <b>Contact</b> : Customer Services ES <b>Address</b> : 277-289 Woodpark Road Smithfield NSW Australia 2164  <b>Telephone</b> : +61-2-8784 8555 <b>Date Samples Received</b> : 18-Jan-2018 12:56 <b>Date Analysis Commenced</b> : 19-Jan-2018 <b>Issue Date</b> : 22-Jan-2018 16:18
---	---



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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



## General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
LOR = Limit of reporting  
^ = This result is computed from individual analyte detections at or above the level of reporting  
ø = ALS is not NATA accredited for these tests.  
~ = Indicates an estimated value.





**Analytical Results**

Sub-Matrix: <b>WATER</b> (Matrix: <b>WATER</b> )			Client sample ID	SW01	SW02_A	SW02_B	SW03	SW04
Client sampling date / time			15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00
Compound	CAS Number	LOR	Unit	ES1802358-001	ES1802358-002	ES1802358-003	ES1802358-004	ES1802358-005
				Result	Result	Result	Result	Result
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5



### Analytical Results

Sub-Matrix: <b>WATER</b> (Matrix: <b>WATER</b> )			Client sample ID	SW05	SW06	SW07	SW08_A	SW08_B
Client sampling date / time			15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00	15-Jan-2018 00:00
Compound	CAS Number	LOR	Unit	ES1802358-006	ES1802358-007	ES1802358-008	ES1802358-009	ES1802358-010
				Result	Result	Result	Result	Result
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
<b>Suspended Solids (SS)</b>	----	5	mg/L	<5	<5	<5	<5	<5



**Analytical Results**

Sub-Matrix: <b>WATER</b> (Matrix: <b>WATER</b> )			Client sample ID	SW09	SW10	----	----	----
Client sampling date / time			15-Jan-2018 00:00	15-Jan-2018 00:00	----	----	----	
Compound	CAS Number	LOR	Unit	ES1802358-011	ES1802358-012	-----	-----	-----
				Result	Result	----	----	----
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
<b>Suspended Solids (SS)</b>	----	5	mg/L	<5	17	----	----	----

# Surface Water Monitoring

## Construction Event 29

Monitoring event triggered after 15mm of rainfall was received in 24 hours. This event was of low significance and did not trigger the full suite of analysis as 50mm of rainfall was not received within 24 hours.

Date of Monitoring: 13<sup>th</sup> February 2018

Rainfall Monitoring is shown below.

Berry Masonic Hall	
Date:	Rainfall Received:
12/02/18	3mm
13/02/18	5mm

## Scope and Limitations

In accordance with the Princes Highway upgrade for Foxground and Berry Bypass (FBB) – Water Monitoring Project Brief, surface water monitoring at seventeen locations (SW01 to SW017) was undertaken. This report presents the information collected during the monitoring event with some discussion on field observations and results with respect to upstream vs downstream conditions.

## Field Programme

Surface water sampling was undertaken at all surface locations where flow conditions allowed a representative sample to be taken. This monthly water sampling event was conducted in accordance with the sampling program and protocols provided in:

- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water and Groundwater Sampling Protocol, prepared for Roads and Maritime Services
- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services
- 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring Report, prepared for Roads and Maritime Services.

Field parameters were measured during sampling including temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), and reduction-oxidation potential (redox), and are provided in Table B1, Attachment B. Field sheets including photos are provided in Attachment C.

Water samples were submitted to a NATA certified testing laboratory (Australian Laboratory services (ALS)) to be analysed for:

- Total suspended solids.

## Weather Monitoring

The project has one manual gauge as well as using the Bureau of Meteorology to monitor weather and rainfall. For the purpose of triggering water quality monitoring events the project uses this weather data. The locations of the rainfall gauges are:

- The project office on Woodhill Mountain Road, Berry
- Berry Masonic Hall, Berry

During the construction phase, minor events are classified as at least 15 mm of rainfall in 24 hours and major events are classified as at least 50 mm of rainfall in 24 hours.

## Surface water sampling results

Results for the water quality monitoring event are located as attachments at the end of this document, they are:

- Attachment A, Location maps
- Attachment B, Tabulated results
- Attachment C, Field sheets, Field photos
- Attachment D, Laboratory results

## Surface water locations

The upstream location represents the 'reference' (un-impacted) site while the down-stream locations represent the 'test' sites (potentially impacted sites during construction and operation). By comparing upstream water quality with down-stream water quality potential impacts from construction are assessed.

**Table 1 Surface water locations within specific surface water bodies**

<b>Surface water</b>	<b>Upstream of Alignment</b>	<b>Downstream of Alignment (test)</b>
Broughton Creek	SW01	SW 02, SW03, SW05
Connelly's Creek and Broughton Mill Creek and Bundewallah Creek	SW 04, SW06	SW 07, SW09
Bundewallah Creek and Connelly's Creek	SW08	SW 06
Town Creek	SW 10	SW 11
Hitchcocks Lane Creek Tributary	SW 12	SW 13
Hitchcocks Lane Creek	SW 14	SW 15
Unnamed Tributary	SW 16	SW 17

## Results summary

The monitoring for this rainfall event was triggered by 15mm of rainfall received in 24 hours. The total event volume 8mm across the project over 2 days. This monitoring event has not affected the flow conditions for all catchments across the project given the past climatic conditions and minimal rainfall. Because of this flow conditions have remained the same throughout all catchments where Bundewallah Creek (SW06, SW08, SW09) and all ephemeral drainage lines in the southern catchment (SW10 - SW17) experiencing very little to no flow.

In the projects current state there is a reduced risk in site runoff effecting the surrounding catchment due to the completed nature and reduction in construction footprint. Consequently, there were no observed construction impacts as a result of this rainfall event.

It is to be noted that sites SW06, SW08, SW09, SW10, SW11, SW12, SW13, SW14, SW15, SW16 and SW17 were not sampled due to the low to no flow conditions observed in these locations.

Broughton Creek: Showed no impacts from construction. Construction has been completed in this catchment for more than a year and is completed rehabilitated. Slight increase in TSS in all locations along the catchment, being consistent with all locations identifies an external source of turbid runoff.

Connelly's Creek and Broughton Mill Creek and Bundewallah Creek: Showed no impacts from construction. Both Creek's had no to little flow, where SW04 was the only monitoring location sampled. SW07 was also very still almost stagnant conditions.

Town Creek: Showed no impacts from construction. Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

Hitchcocks Lane Creek Tributary: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

Hitchcocks Lane Creek: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

Unnamed Tributary: Catchment is stabilised and operational resulting in no impacts from construction. Both monitoring sites were unable to be sampled as no flow was observed.

# Attachment A: Location Map



<p>1:25,000 (at A3)</p> <p>0 125 250 500 750 1,000</p> <p>Meters</p> <p>Map Projection: Transverse Mercator Horizontal Datum: Geocentric Datum of Australia (GDA) Grid: Map Grid of Australia 1994, Zone 56</p>		<p><b>LEGEND</b></p> <table border="0" style="width: 100%;"> <tr> <td> Surface Water Sampling Locations</td> <td> Railways</td> </tr> <tr> <td> Berry to Foxground upgrade alignment</td> <td> Waterways</td> </tr> <tr> <td> Roads</td> <td> Lakes and dams</td> </tr> </table>	Surface Water Sampling Locations	Railways	Berry to Foxground upgrade alignment	Waterways	Roads	Lakes and dams	<p>Fulton Hogan Pty Ltd Water Quality Monitoring</p>	<p>Job Number   21-24306 Revision   A Date   03 Mar 2015</p>
Surface Water Sampling Locations	Railways									
Berry to Foxground upgrade alignment	Waterways									
Roads	Lakes and dams									

**Surface water sampling locations** **Figure 1**

Ighite@ghd.com.au | Project: 2104306GISMap(MXD) | 21\_24306\_2001\_SurfaceWaterSamplingLocations.mxd  
 © 2015. While GHD has taken care to ensure the accuracy of this product, GHD and DATA CUSTODIAN, make no representations or warranties about its accuracy, completeness or suitability for any particular purpose. GHD and DATA CUSTODIAN, cannot accept liability of any kind (whether in contract, tort or otherwise), for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred as a result of the product being inaccurate, incomplete or unavailable in any way and for any reason.  
 Data Source: NSW Department of Lands, DTDR and DCDB - 2012. Created by: mveber

Attachment B: Tabulated Results

No.	Date	Time	Temperature	pH	ORP	Conductivity	Turbidity	Dissolved Oxygen
SW01	13/02/2018	10:06:00 AM	20.36 °C	6.3	293 mV	0.124 mS/cm	12.9 NTU	6.88 mg/L
SW02	13/02/2018	10:22:00 AM	20.35 °C	6	315 mV	0.118 mS/cm	19.5 NTU	6.32 mg/L
SW03	13/02/2018	10:47:00 AM	20.54 °C	5.8	302 mV	0.113 mS/cm	25.5 NTU	6.24 mg/L
SW04	13/02/2018	11:33:00 AM	21.85 °C	6	329 mV	0.108 mS/cm	1.3 NTU	5.17 mg/L
SW05	13/02/2018	11:06:00 AM	20.69 °C	6	327 mV	0.115 mS/cm	27.9 NTU	4.6 mg/L
SW06	13/02/2018	No Samples taken due to low flow conditions						
SW07	13/02/2018	11:16:00 AM	22.33 °C	5.8	298 mV	0.113 mS/cm	1.4 NTU	4.1 mg/L
SW08	13/02/2018	No Samples taken due to low flow conditions						
SW09	13/02/2018	No Samples taken due to low flow conditions						
SW10	13/02/2018	No Samples taken due to low flow conditions						
SW11	13/02/2018	No Samples taken due to low flow conditions						
SW12	13/02/2018							
SW13	13/02/2018							
SW14	13/02/2018							
SW15	13/02/2018							
SW16	13/02/2018							
SW17	13/02/2018							



# Surface water monitoring

**Document No.**

000051

**Conducted on**

13/2/18, 10:06

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

13/2/18, 10:09

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<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	1	
Date and time	13/2/18, 10:06	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Sampling after constriction/riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.36	
<b>pH</b>		
	6.3	
<b>REDOX</b>		
	293	
<b>Conductivity (uS/cm)</b>		
	124	
<b>Turbidity</b>		
	12.9	
<b>DO (mg/L)</b>		
	6.88	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	High	
<b>Colour</b>		
	Slight turbid	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	1	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000052

**Conducted on**

13/2/18, 10:21

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

13/2/18, 10:26

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	2	
Date and time	13/2/18, 10:22	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Down steam side of weir
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.35	
<b>pH</b>		
	6.0	
<b>REDOX</b>		
	315	
<b>Conductivity (uS/cm)</b>		
	118	
<b>Turbidity</b>		
	19.5	
<b>DO (mg/L)</b>		
	6.32	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	High	
<b>Colour</b>		
	Slight turbid	
<b>Other</b>		
	Downstream side has a heightened turbidity. Confirm TSS results of any change. Could be caused by agricultural runoff. No construction apparent in catchment	



### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	2	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000053

**Conducted on**

13/2/18, 10:47

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

13/2/18, 10:49

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	3	
Date and time	13/2/18, 10:47	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Next to main flow on corner of bend
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.54	
<b>pH</b>		
	5.8	
<b>REDOX</b>		
	302	
<b>Conductivity (uS/cm)</b>		
	113	
<b>Turbidity</b>		
	25.5	
<b>DO (mg/L)</b>		
	6.24	



## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	High	
<b>Colour</b>		
	Slight turbid	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	3	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000056

**Conducted on**

13/2/18, 11:33

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

13/2/18, 11:35

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Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	4	
Date and time	13/2/18, 11:33	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Pool before riffle
 <p>Appendix 1</p>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	21.85	
<b>pH</b>		
	6.0	
<b>REDOX</b>		
	329	
<b>Conductivity (uS/cm)</b>		
	108	
<b>Turbidity</b>		
	1.3	
<b>DO (mg/L)</b>		
	5.17	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	4	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000054

**Conducted on**

13/2/18, 11:06

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

13/2/18, 11:08

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	5	
Date and time	13/2/18, 11:06	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widened part of creek
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian with agricultural impacts
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	20.69	
<b>pH</b>		
	6.0	
<b>REDOX</b>		
	327	
<b>Conductivity (uS/cm)</b>		
	115	
<b>Turbidity</b>		
	27.9	
<b>DO (mg/L)</b>		
	4.60	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Turbid	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	5	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000066

**Conducted on**

13/2/18, 13:00

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 13:00

## **Disclaimer**

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<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	6	
Date and time	13/2/18, 13:00	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000055

**Conducted on**

13/2/18, 11:16

**Prepared by**

Jacob Cooper

**Score**

9/11 - 81.82%

**Completed on**

13/2/18, 11:18

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Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 2/3 - 66.67%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	7	
Date and time	13/2/18, 11:16	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Bass point behind bowling club. Widened channel before riffle
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Overcast	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	22.33	
<b>pH</b>		
	5.8	
<b>REDOX</b>		
	298	
<b>Conductivity (uS/cm)</b>		
	113	
<b>Turbidity</b>		
	1.4	
<b>DO (mg/L)</b>		
	4.10	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 2/3 - 66.67%

Question	Response	Details
Sample number	7	
<b>No. Of containers</b>		
	1	
Preservatives	Yes	Ice
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000058

**Conducted on**

13/2/18, 12:14

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:15



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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	8	
Date and time	13/2/18, 12:14	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1



# Surface water monitoring

**Document No.**

000065

**Conducted on**

13/2/18, 12:55

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:56

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<b>SURFACE WATER MONITORING - 1/11 - 9.09%</b>	<b>1</b>
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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	9	
Date and time	13/2/18, 12:55	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		



## Media



Appendix 1

# Surface water monitoring

**Document No.**

000057

**Conducted on**

13/2/18, 12:05

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:15

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	10	
Date and time	13/2/18, 12:05	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	Not sampled due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		



## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000059

**Conducted on**

13/2/18, 12:21

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:22

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	12	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		



## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000060

**Conducted on**

13/2/18, 12:25

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:26

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	13	
Date and time	13/2/18, 12:26	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000064

**Conducted on**

13/2/18, 12:47

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:48

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<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	14	
Date and time	13/2/18, 12:47	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		



## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000063

**Conducted on**

13/2/18, 12:44

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:45

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<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>



## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	15	
Date and time	13/2/18, 12:44	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000062

**Conducted on**

13/2/18, 12:38

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:39

## **Disclaimer**

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## **Confidentiality Statement**


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<b>SURFACE WATER MONITORING - 1/11 - 9.09%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	16	
Date and time	13/2/18, 12:38	
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000061

**Conducted on**

13/2/18, 12:37

**Prepared by**

Jacob Cooper

**Score**

1/11 - 9.09%

**Completed on**

13/2/18, 12:38



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## Table of Contents

<b>SURFACE WATER MONITORING - 1/11 - 9.09%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 1/3 - 33.33%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 0/4 - 0%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 0/1 - 0%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 0/3 - 0%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 1/3 - 33.33%

Question	Response	Details
<b>General Info</b>		Score (1/3) 33.33%
Site	17	
Date and time		
Sampling officers		
Sampling Method: Grab		
Detailed sample location description	No	No sample due to no flow conditions
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations

Question	Response	Details
Weather		
Vegetation		
Slope		
Erosion		

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
<b>pH</b>		
<b>REDOX</b>		
<b>Conductivity (uS/cm)</b>		
<b>Turbidity</b>		
<b>DO (mg/L)</b>		

## Flow observations

Question	Response	Details
Flow		
<b>Colour</b>		
<b>Other</b>		

## Sample info

Question	Response	Details
Sample number		
<b>No. Of containers</b>		
Preservatives		
Duplicate		

## Media



Appendix 1



**Attachment D: Laboratory Results**

## CERTIFICATE OF ANALYSIS

**Work Order** : **EW1800618**  
**Client** : **FULTON HOGAN PTY LTD**  
**Contact** : JACOB COOPER  
**Address** : LEVEL 3 - 90 BOURKE ROAD  
 ALEXANDRIA NSW, AUSTRALIA 2015  
  
**Telephone** : +61 02 8346 9400  
**Project** : Foxground and Berry Bypass  
**Order number** : ----  
**C-O-C number** : ----  
**Sampler** : JACOB COOPER  
**Site** : ----  
**Quote number** : EN/222/17  
**No. of samples received** : 6  
**No. of samples analysed** : 6

**Page** : 1 of 4  
**Laboratory** : Environmental Division NSW South Coast  
**Contact** : Glenn Davies  
**Address** : 1/19 Ralph Black Dr, North Wollongong 2500  
 4/13 Geary Pl, North Nowra 2541  
 Australia NSW  
**Telephone** : 02 42253125  
**Date Samples Received** : 14-Feb-2018 13:13  
**Date Analysis Commenced** : 20-Feb-2018  
**Issue Date** : 21-Feb-2018 11:14



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



## General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
LOR = Limit of reporting  
^ = This result is computed from individual analyte detections at or above the level of reporting  
ø = ALS is not NATA accredited for these tests.  
~ = Indicates an estimated value.



### Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW01	SW02	SW03	SW04	SW05
Client sampling date / time				13-Feb-2018 10:00	13-Feb-2018 10:15	13-Feb-2018 10:45	13-Feb-2018 11:30	13-Feb-2018 11:00	
Compound	CAS Number	LOR	Unit	EW1800618-001	EW1800618-002	EW1800618-003	EW1800618-004	EW1800618-005	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	10	6	7	<5	15	



### Analytical Results

Sub-Matrix: <b>WATER</b> (Matrix: <b>WATER</b> )			Client sample ID	SW07	---	---	---	---
Client sampling date / time			13-Feb-2018 11:15	---	---	---	---	
Compound	CAS Number	LOR	Unit	EW1800618-006	-----	-----	-----	-----
Result				---	---	---	---	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
<b>Suspended Solids (SS)</b>	---	5	mg/L	<5	---	---	---	---

## Surface Water Monitoring

Construction Event 30

Monitoring event triggered after 50mm of rainfall was received in 24 hours. This event was significant which triggered the full suite of analysis as 50mm of rainfall was received within 24 hours.

Date of Monitoring: 27<sup>th</sup> February 2018

Rainfall Monitoring is shown below.

Woodhill Mountain Road	
Date:	Rainfall Received:
27/2/18	51

Note: Rainfall data from BoM has not been uploaded at the time of reporting.

## Scope and Limitations

Due to the stage of the project, monitoring of construction impacts have been significantly reduced to the main compound catchment (SW06 – SW07). The other locations are now considered to be under operational conditions and are now monitored by RMS. This report presents the information collected during the monitoring event with some discussion on field observations and results with respect to upstream vs downstream conditions.

## Field Programme

Surface water sampling was undertaken at all surface locations where flow conditions allowed a representative sample to be taken. This monthly water sampling event was conducted in accordance with the sampling program and protocols provided in:

- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water and Groundwater Sampling Protocol, prepared for Roads and Maritime Services
- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services
- 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring Report, prepared for Roads and Maritime Services.

Field parameters were measured during sampling including temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), and reduction-oxidation potential (redox), and are provided in Attachment B. Field sheets are provided in Attachment C.

Water samples were submitted to a NATA certified testing laboratory (Australian Laboratory services (ALS)) to be analysed for:

- Total suspended solids
- Total Petroleum Hydrocarbons
- Total Phosphorus
- Total Nitrogen
- Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn).

## Weather Monitoring

The project has one manual gauge as well as using the Bureau of Meteorology to monitor weather and rainfall. For the purpose of triggering water quality monitoring events the project uses this weather data. The locations of the rainfall gauges are:

- The project office on Woodhill Mountain Road, Berry
- Berry Masonic Hall, Berry

During the construction phase, minor events are classified as at least 15 mm of rainfall in 24 hours and major events are classified as at least 50 mm of rainfall in 24 hours.

## Surface water sampling results

Results for the water quality monitoring event are located as attachments at the end of this document, they are:

- Attachment A, Location maps
- Attachment B, Tabulated results
- Attachment C, Field sheets, photos
- Attachment D, Laboratory results

## Surface water locations

The upstream location represents the 'reference' (un-impacted) site while the down-stream locations represent the 'test' sites (potentially impacted sites during construction and operation). By comparing upstream water quality with down-stream water quality potential impacts from construction are assessed.

**Table 1 Surface water locations within specific surface water bodies**

Surface water	Upstream of Alignment	Downstream of Alignment (test)
---------------	-----------------------	--------------------------------

Connelly's Creek and Broughton Mill Creek and Bundewallah Creek	SW06	SW07
---	------	------

## Results summary

The monitoring for this rainfall event was triggered by more than 50mm of rainfall received in 24 hours. The total event volume was 51mm across the project. Irrespective of the high rainfall experienced, the creeks remained at a high quality with no signs of impact.

Connelly's Creek and Broughton Mill Creek and Bundewallah Creek: Showed no impacts from construction. Since the last major event, nutrient (TN & TP) and TSS levels have dropped significantly due to the fact that there has been a reduction in land runoff and an increase in infiltration.

# Attachment A: Location Map



<p>1:25,000 (at A3)</p> <p>0 125 250 500 750 1,000</p> <p>Meters</p> <p>Map Projection: Transverse Mercator Horizontal Datum: Geocentric Datum of Australia (GDA) Grid: Map Grid of Australia 1994, Zone 56</p>		<p><b>LEGEND</b></p> <table border="0" style="width: 100%;"> <tr> <td> Surface Water Sampling Locations</td> <td> Railways</td> </tr> <tr> <td> Berry to Foxground upgrade alignment</td> <td> Waterways</td> </tr> <tr> <td> Roads</td> <td> Lakes and dams</td> </tr> </table>	Surface Water Sampling Locations	Railways	Berry to Foxground upgrade alignment	Waterways	Roads	Lakes and dams	<p>Fulton Hogan Pty Ltd Water Quality Monitoring</p>	<p>Job Number   21-24306 Revision   A Date   03 Mar 2015</p>
Surface Water Sampling Locations	Railways									
Berry to Foxground upgrade alignment	Waterways									
Roads	Lakes and dams									

**Surface water sampling locations** **Figure 1**



Attachment B: Tabulated Results

No.	Date	Time	Temperature	pH	ORP	Conductivity	Turbidity	Dissolved Oxygen
SW06	27/02/2018	9:13:00 AM	18.22 °C	6	325 mV	0.202 mS/cm	1.2 NTU	6.27 mg/L
SW07	27/02/2018	9:32:00 AM	17.5 °C	5.8	306 mV	0.122 mS/cm	1.6 NTU	6.84 mg/L

## Attachment C: Field Sheets

# Surface water monitoring

conducted for

# FBB

**Document No.**

000067

**Audit Title**

Major event

**Conducted on**

27/2/18, 09:13

**Prepared by**

Jacob Cooper

**Score**

7/11 - 63.64%

**Completed on**

27/2/18, 09:15

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General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 2/4 - 50%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	6	
Date and time	27/2/18, 09:13	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Large pool before channel diversion
<div style="display: flex; align-items: flex-start;">  <div style="margin-left: 10px;"> <p>Appendix 1</p> </div> </div>		

## Environmental observations - 2/4 - 50%

Question	Response	Details
Weather		
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	

## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	18.22	
<b>pH</b>		
	6.0	
<b>REDOX</b>		
	325	
<b>Conductivity (uS/cm)</b>		
	202	
<b>Turbidity</b>		
	1.2	
<b>DO (mg/L)</b>		
	6.27	



## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number	6	
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

# Surface water monitoring

**Document No.**

000068

**Conducted on**

27/2/18, 09:32

**Prepared by**

Jacob Cooper

**Score**

8/11 - 72.73%

**Completed on**

27/2/18, 09:34

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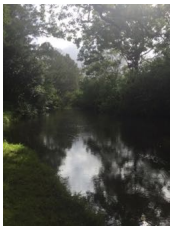
## **Confidentiality Statement**

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## Table of Contents

<b>SURFACE WATER MONITORING - 8/11 - 72.73%</b>	<b>1</b>
Disclaimer	2
Confidentiality Statement	2
<b>GENERAL INFO - 3/3 - 100%</b>	<b>4</b>
General Info	4
<b>ENVIRONMENTAL OBSERVATIONS - 3/4 - 75%</b>	<b>5</b>
<b>FIELD OBSERVATIONS</b>	<b>6</b>
Temperature (degrees C)	6
pH	6
REDOX	6
Conductivity (uS/cm)	6
Turbidity	6
DO (mg/L)	6
<b>FLOW OBSERVATIONS - 1/1 - 100%</b>	<b>7</b>
Colour	7
Other	7
<b>SAMPLE INFO - 1/3 - 33.33%</b>	<b>8</b>
No. Of containers	8
<b>MEDIA</b>	<b>9</b>

## General info - 3/3 - 100%

Question	Response	Details
<b>General Info</b>		Score (3/3) 100%
Site	7	
Date and time	27/2/18, 09:32	
Sampling officers	Jacob Cooper	
Sampling Method: Grab		
Detailed sample location description	Yes	Widening of channel before riffle down stream bass park
 <p>Appendix 1</p>		

## Environmental observations - 3/4 - 75%

Question	Response	Details
Weather	Showers	
Vegetation	Yes	Riparian
Slope	Yes	Gentle
Erosion	No	



## Field observations

Question	Response	Details
<b>Temperature (degrees C)</b>		
	17.50	
<b>pH</b>		
	5.8	
<b>REDOX</b>		
	306	
<b>Conductivity (uS/cm)</b>		
	122	
<b>Turbidity</b>		
	1.6	
<b>DO (mg/L)</b>		
	6.84	

## Flow observations - 1/1 - 100%

Question	Response	Details
Flow	Moderate	
<b>Colour</b>		
	Clear	
<b>Other</b>		

### Sample info - 1/3 - 33.33%

Question	Response	Details
Sample number	7	
<b>No. Of containers</b>		
	1	
Preservatives	No	
Duplicate	No	

## Media



Appendix 1

**Attachment D: Laboratory Results**

## CERTIFICATE OF ANALYSIS

**Work Order** : **EW1800805**  
**Client** : **FULTON HOGAN PTY LTD**  
**Contact** : JACOB COOPER  
**Address** : LEVEL1 3 - 90 BOURKE ROAD  
 ALEXANDRIA NSW, AUSTRALIA 2015  
  
**Telephone** : +61 02 8346 9400  
**Project** : Foxground and Berry Bypass  
**Order number** : ----  
**C-O-C number** : ----  
**Sampler** : JACOB COOPER  
**Site** : ----  
**Quote number** : EN/222/17  
**No. of samples received** : 2  
**No. of samples analysed** : 2

**Page** : 1 of 5  
**Laboratory** : Environmental Division NSW South Coast  
**Contact** : Glenn Davies  
**Address** : 1/19 Ralph Black Dr, North Wollongong 2500  
 4/13 Geary Pl, North Nowra 2541  
 Australia NSW  
**Telephone** : 02 42253125  
**Date Samples Received** : 27-Feb-2018 11:43  
**Date Analysis Commenced** : 28-Feb-2018  
**Issue Date** : 06-Mar-2018 11:48



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW



## General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
LOR = Limit of reporting  
^ = This result is computed from individual analyte detections at or above the level of reporting  
ø = ALS is not NATA accredited for these tests.  
~ = Indicates an estimated value.



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID		SW6	SW7	----	----	----
Client sampling date / time		27-Feb-2018 00:00		27-Feb-2018 00:00		----	----	----
Compound	CAS Number	LOR	Unit	EW1800805-001	EW1800805-002	-----	-----	-----
				Result	Result	----	----	----
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
Suspended Solids (SS)	----	5	mg/L	5	<5	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	0.002	0.001	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.006	<0.005	----	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	1.00	0.49	----	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.4	0.3	----	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	1.4	0.8	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	0.07	0.03	----	----	----
<b>EP080/071: Total Petroleum Hydrocarbons</b>								
C6 - C9 Fraction	----	20	µg/L	<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	----	----	----
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	----	----	----
>C10 - C16 Fraction	----	100	µg/L	<100	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	----	----	----





### Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW6	SW7	----	----	----
Client sampling date / time				27-Feb-2018 00:00	27-Feb-2018 00:00	----	----	----	
Compound	CAS Number	LOR	Unit	EW1800805-001	EW1800805-002	-----	-----	-----	
				Result	Result	----	----	----	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>									
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	----	----	----	
<b>EP080: BTEXN</b>									
Benzene	71-43-2	1	µg/L	<1	<1	----	----	----	
Toluene	108-88-3	2	µg/L	<2	<2	----	----	----	
Ethylbenzene	100-41-4	2	µg/L	<2	<2	----	----	----	
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	----	----	----	
ortho-Xylene	95-47-6	2	µg/L	<2	<2	----	----	----	
^ Total Xylenes	----	2	µg/L	<2	<2	----	----	----	
^ Sum of BTEX	----	1	µg/L	<1	<1	----	----	----	
Naphthalene	91-20-3	5	µg/L	<5	<5	----	----	----	
<b>EP080S: TPH(V)/BTEX Surrogates</b>									
1,2-Dichloroethane-D4	17060-07-0	2	%	92.6	94.8	----	----	----	
Toluene-D8	2037-26-5	2	%	105	105	----	----	----	
4-Bromofluorobenzene	460-00-4	2	%	98.3	99.1	----	----	----	



## Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
<b>EP080S: TPH(V)/BTEX Surrogates</b>			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

# Surface Water Monitoring

Construction Event 31

Monitoring event triggered after 15mm of rainfall was received in 24 hours. This event was of low significance and did not trigger the full suite of analysis as 50mm of rainfall was not received within 24 hours.

Date of Monitoring: 21<sup>st</sup> March 2018

Rainfall Monitoring is shown below.

Berry Masonic Hall	
Date:	Rainfall Received:
21/03/18	29.2mm

## Scope and Limitations

Due to the stage of the project, monitoring of construction impacts have been significantly reduced to the main compound catchment (SW06 – SW07). The other locations are now considered to be under operational conditions and are now monitored by RMS. This report presents the information collected during the monitoring event with some discussion on field observations and results with respect to upstream vs downstream conditions.

## Field Programme

Surface water sampling was undertaken at all surface locations where flow conditions allowed a representative sample to be taken. This monthly water sampling event was conducted in accordance with the sampling program and protocols provided in:

- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water and Groundwater Sampling Protocol, prepared for Roads and Maritime Services
- 2014, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services
- 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring Report, prepared for Roads and Maritime Services.

Field parameters were measured during sampling including temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), and reduction-oxidation potential (redox), and are provided in Table B1, Attachment B. Field sheets including photos are provided in Attachment C.

Water samples were submitted to a NATA certified testing laboratory (Australian Laboratory services (ALS)) to be analysed for:

- Total suspended solids.

## Weather Monitoring

The project has one manual gauge as well as using the Bureau of Meteorology to monitor weather and rainfall. For the purpose of triggering water quality monitoring events the project uses this weather data. The locations of the rainfall gauges are:

- Berry Masonic Hall, Berry

During the construction phase, minor events are classified as at least 15 mm of rainfall in 24 hours and major events are classified as at least 50 mm of rainfall in 24 hours.

## Surface water sampling results

Results for the water quality monitoring event are located as attachments at the end of this document, they are:

- Attachment A, Location maps
- Attachment B, Tabulated results
- Attachment C, Field sheets, Field photos
- Attachment D, Laboratory results

## Surface water locations

The upstream location represents the 'reference' (un-impacted) site while the down-stream locations represent the 'test' sites (potentially impacted sites during construction and operation). By comparing upstream water quality with down-stream water quality potential impacts from construction are assessed.

**Table 1 Surface water locations within specific surface water bodies**

<b>Surface water</b>	<b>Upstream of Alignment (reference site)</b>	<b>Downstream of Alignment (test site)</b>
Connelly's Creek and Bundewallah Creek and Broughton Mill Creek	SW06	SW07

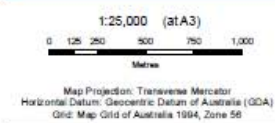
## Results summary

The monitoring for this rainfall event was triggered by 15mm of rainfall received in 24 hours. The total event volume 29.2mm across the project over 1 day. This monitoring event has affected the flow conditions for all catchments across the project given previous rainfall during the month.

In the projects current state there is a reduced risk in site runoff effecting the surrounding catchment due to the completed nature and reduction in construction footprint. Consequently, there were no observed construction impacts as a result of this rainfall event.

Connelly's Creek and Bundewallah Creek and Broughton Mill Creek: Showed no impacts from construction. Both Creek's had medium to high flows. Upstream and downstream monitoring location show high turbidity levels and laboratory results confirmed this with high TSS levels. Upstream levels were higher than downstream levels.

Attachment A, Location maps



LEGEND	
Surface Water Sampling Locations	Railways
Berry to Foxground upgrade alignment	Waterways
Roads	Lakes and dams

Fulton Hogan Pty Ltd  
Water Quality Monitoring

Job Number	21-24306
Revision	A
Date	03 Mar 2015

Surface water sampling locations

Figure 1

lightweight@sydneyProject2124306@MapMXD21\_24306\_2015\_SurfaceWaterSamplingLocations.mxd  
© 2015. While GHD has taken care to ensure the accuracy of this product, GHD and DATA CUSTODIAN, make no representations or warranties about the accuracy, completeness or suitability for any particular purpose. GHD and DATA CUSTODIAN, cannot accept liability of any kind (whether in contract, tort or otherwise), for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred as a result of the product being inaccurate, incomplete or unsuitable in any way and for any reason.  
Data Source: NSW Department of Lands, DTDB and DCDR - 2012. Created by: mwleier

Attachment B, Tabulated results

No.	Date	Time	Temperature		pH	ORP		Conductivity		Turbidity		Dissolved Oxygen	
SW06	21/03/2018	2:45:00 PM	18	°C	5.6	274	mV	0.15	mS/cm	55.9	NTU	8.01	mg/L
SW07	21/03/2018	11:16:00 AM	17.9	°C	5.8	323	mV	0.123	mS/cm	38	NTU	7.06	mg/L

Attachment C, Field photos, Field sheets



*SW06 – Bundewallah Creek, upstream of works*



*SW07 – Broughton Mill Creek, downstream of works*

**FOXGROUND AND BERRY BYPASS  
SURFACE WATER SAMPLING RECORD**

SITE: SW 6  
 DATE: 21.03.2018 TIME: 14:45  
 SAMPLING OFFICERS: James  
 SAMPLING METHOD (ie grab, bucket): GRAB  
 DETAILED SAMPLE LOCATION DESCRIPTION: upstream of Berry Bridge

**ENVIRONMENTAL OBSERVATIONS**

WEATHER: Showers  
 VEGETATION: Riparian, grasses & weeds  
 SLOPE: Gentle  
 EROSION: N/A  
 OTHER: < 50mm of rainfall

**FIELD MEASUREMENTS**

TEMPERATURE (OC): 17.99°C  
 CONDUCTIVITY (uS/cm): 0.150 mS/cm  
 pH: 5.56  
 DO (mg/L & %): 8.01 mg/L & 87.2%  
 REDOX (mV): 274  
 TURBIDITY (NTU): 55.9

**FLOW OBSERVATIONS**

FLOW: Median to high flow  
 COLOUR: Turbid  
 OTHER: \_\_\_\_\_

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
<u>SW6</u>	<u>1</u>	<u>ESKY &amp; ICE</u>	<u>—</u>	<u>—</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

FIELD SUPERVISOR \_\_\_\_\_ CHECKED (SIGN & DATE) \_\_\_\_\_



**FOXGROUND AND BERRY BYPASS  
SURFACE WATER SAMPLING RECORD**

SITE: SW 7  
 DATE: 21.03.2018 TIME: 15:10  
 SAMPLING OFFICERS: James  
 SAMPLING METHOD (ie grab, bucket): GRAB  
 DETAILED SAMPLE LOCATION DESCRIPTION: Behind Berry Bowling Club

**ENVIRONMENTAL OBSERVATIONS**

WEATHER: Showers  
 VEGETATION: Pasture  
 SLOPE: Gentle  
 EROSION: N/A  
 OTHER: < 50mm of rainfall

**FIELD MEASUREMENTS**

TEMPERATURE (OC): 17.91°C  
 CONDUCTIVITY (uS/cm): 0.123 mS/cm  
 pH: 5.41  
 DO (mg/L & %): 7.06 mg/L & 76.7%  
 REDOX (mV): 323  
 TURBIDITY (NTU): 38.0

**FLOW OBSERVATIONS**

FLOW: Median  
 COLOUR: Turbid  
 OTHER: \_\_\_\_\_

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
<u>SW7</u>	<u>1</u>	<u>ESKY &amp; ICE</u>	<u>—</u>	<u>—</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

FIELD SUPERVISOR \_\_\_\_\_ CHECKED (SIGN & DATE) \_\_\_\_\_

## Attachment D, Laboratory results

## CERTIFICATE OF ANALYSIS

**Work Order** : **ES1808598**  
**Client** : **FULTON HOGAN PTY LTD**  
**Contact** : **MR JAMES DIAMOND**  
**Address** : **LEVELI 3 - 90 BOURKE ROAD**  
**ALEXANDRIA NSW, AUSTRALIA 2015**  
**Telephone** : **+61 02 8346 9400**  
**Project** : **Foxground and Berry Bypass**  
**Order number** :  
**C-O-C number** : **----**  
**Sampler** : **James Diamond**  
**Site** : **59 Woodhill Mountain Rd, Berry 2535**  
**Quote number** : **EN/222/17**  
**No. of samples received** : **2**  
**No. of samples analysed** : **2**

**Page** : 1 of 2  
**Laboratory** : Environmental Division Sydney  
**Contact** : Customer Services ES  
**Address** : 277-289 Woodpark Road Smithfield NSW Australia 2164  
**Telephone** : +61-2-8784 8555  
**Date Samples Received** : 22-Mar-2018 13:35  
**Date Analysis Commenced** : 27-Mar-2018  
**Issue Date** : 29-Mar-2018 10:52



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

### Signatories

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

Signatories	Position	Accreditation Category
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW



## General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
 LOR = Limit of reporting  
 ^ = This result is computed from individual analyte detections at or above the level of reporting  
 ø = ALS is not NATA accredited for these tests.  
 ~ = Indicates an estimated value.

## Analytical Results

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

Client sample ID

				SW6	SW7	----	----	----
Client sampling date / time				21-Mar-2018 00:00	21-Mar-2018 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ES1808598-001	ES1808598-002	-----	-----	-----
				Result	Result	---	---	---
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
<b>Suspended Solids (SS)</b>	----	5	mg/L	<b>44</b>	<b>36</b>	----	----	----



27 May 2018

Ryan Whiddon  
Roads and Maritime Services  
PO Box 477  
Wollongong NSW 2500

Our ref: 23/16261  
Draft A

Dear Ryan,

## **Surface Water Monitoring – Post Construction Event 1 (Minor Event 1)**

### **1 Scope and limitations**

In accordance with the Princes Highway upgrade for Foxground and Berry Bypass (FBB) - Water Monitoring Project Brief (*Contract No. 17.0000303651.0922*), GHD undertook surface water monitoring at 17 locations (SW01 to SW17) after a minor rainfall event ( $\geq 15$  mm rain in a 24 hour period). During the operational phase, minor events are considered to have occurred when at least 15 mm of rainfall has fallen in the past 24 hours, and major events where at least 50 mm of rainfall in the past 24 hours has occurred.

Sampling locations have been selected based on their proximity to permanent water quality basins located along the FBB alignment and proximity to operational water control measures (such as sedimentation basins and vegetation swales). This report documents the first surface water sampling event (Event 1) undertaken since the completion of construction, which is also the first minor surface water sampling event (Minor Event 1) since operation began in October 2017. Limitations are provided in Section 5.

The objective of this monitoring event is to collect and assess upstream and downstream waterway data to contribute to their eventual certification. Certification of waterways as remediated has not occurred; therefore, all 17 locations were monitored during this event.

### **2 Field Program**

Surface water sampling was undertaken at all surface water sampling locations on 14 February 2018; refer to Figure 1, Attachment A for sampling locations. This minor surface water sampling event was conducted in accordance with the sampling program and protocols provided in:

- GHD 2014, Foxground to Berry Bypass Water Quality Management - Surface Water and Groundwater Sampling Protocol, prepared for Roads and Maritime Services.
- GHD 2016, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services.
- GHD 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring Report, prepared for Roads and Maritime Services.

Field parameters were measured during the monitoring event including temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), and reduction-oxidation potential (redox), and are provided in Table B1, Attachment B. Field sheets are provided in Attachment G.

Water samples were submitted to a NATA accredited testing laboratory (ALS) to be analysed for the following analysis:

- Turbidity
- Total suspended solids (TSS)
- Total recoverable hydrocarbons (TRH)
- Total Phosphorus and Total Nitrogen
- Heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn)

Locations SW08, SW11 and SW12 were unable to be sampled due to low stream flow. SW08 and SW12 are upstream locations and SW11 is a downstream location.

### 3 Results and Discussion

This section presents control charts and discusses results in respect to exceedances of criteria or inconsistencies in the surface water results for Event 1 (Minor Event 1) in accordance with the following:

- The limitations provided in Section 5.
- GHD 2016, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services.
- GHD 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring Report, prepared for Roads and Maritime Services.

#### 3.1 Control charts

The surface water locations have been grouped into separate control charts by the specific surface water bodies they are located within and whether they are up and down gradient of the FBB alignment. The upstream locations represent the 'reference' (un-impacted) sites while the down-stream locations represent the 'test' sites (impacted by operation). By comparing upstream water quality with downstream water quality using the control chart methods it is expected that impacts will be able to be adequately characterised during operation. The groupings used for the control charts are summarised in Table 1.

**Table 1 Surface water locations within specific surface water bodies**

Surface water location	Upstream of Alignment	Downstream of Alignment
Broughton Creek	SW01	SW02, SW03, SW05
Connelly's Creek and Broughton Mill Creek and Bundewallah Creek	SW04, SW06	SW07, SW09
Bundewallah Creek and Connelly's Creek	SW08	SW06
Town Creek (realigned)	SW10	SW11
Hitchcocks Lane Creek Tributary	SW12	SW13
Hitchcocks Lane Creek	SW14	SW15

Unnamed Tributary	SW16	SW17
-------------------	------	------

The primary control chart indicators for assessing potential impacts associated with the FBB upgrade works during operation for Event 1 include pH, turbidity, TSS and heavy metals. The control charts for are presented in Attachment C.

Operational data has been compared against baseline data in the control charts to understand what changes may be occurring following the construction of the FBB. Final 80<sup>th</sup> percentile data and median data from baseline monitoring has been used for pH, turbidity and TSS and maximum baseline values have been used for heavy metal results as an upper threshold. Control charts for metals are unable to include 80<sup>th</sup> percentile or median data as concentrations are usually zero or very low.

A review of Event 1 control charts is provided in Section 3.4.

### 3.2 Recorded rainfall event

The rainfall within Broughton Creek catchment and the surface water flows within Broughton Creek are presented in Figure 2, Attachment A. This information was obtained from the NSW Office of Water (NOW) website (<http://realtimedata.water.nsw.gov.au/water.stm>). The location of this gauge is on Broughton Mill Creek approximately 2 km upstream of SW04.

The data in Figure 2 illustrates a high correlation between rainfall and river flow, with a spike in rainfall coinciding with a spike in river flow. The surface water sampling events are also marked on Figure 2, Attachment A.

### 3.3 Surface water monitoring QA/QC

Surface water analytical results for the suite listed in Section 2, are tabulated against selected criteria (in accordance with the protocol documents detailed in Section 2) in Table B1 of Attachment B. Laboratory certificates are provided in Attachment D.

Sampling was completed as per the method outlined within the project WQMP. The water quality meter used during water quality monitoring is certified every six months and between certification, calibrated before each event. Evidence of calibration is provided in Attachment E.

A field quality control and laboratory control assessment of the results from this monthly monitoring round (Event 1 – Minor Event 1) is provided in Attachment F. Matrix spike recovery for Nitrite and Nitrate (NO<sub>x</sub>) indicate matrix spike interference could be occurring and therefore impacting Total Nitrogen results.

### 3.4 Discussion of Results

The field and laboratory analytical results are summarised in Attachment B. The adopted assessment criteria are also included in these tables. Laboratory reports are included in Attachment D.

Exceedances of assessment criteria in samples analysed are highlighted in these Tables and exceedances reported for Event 1 are discussed in the following sections.

#### 3.4.1 pH (field)

Exceedances of assessment criteria in samples analysed included:

Upstream locations:

- pH 80<sup>th</sup> percentile value for baseline monitoring was exceeded at locations SW10 and SW14.

Downstream locations:

- pH results above the median baseline value at SW02, SW06, SW13, SW15 and SW17
- pH results just outside the ADWG 2015 Aesthetic guidelines at SW06, SW09 and SW13, where the highest pH found in SW06 (pH 8.87) and the lowest pH found in SW09 (pH 6.4).

No results were outside the selected ANZECC 2000 – Lowland Rivers (NSW rivers) guidelines.

pH results have been graphed in control charts available in Attachment C.

### **3.4.2 Turbidity and Total Suspended Solids (TSS)**

Exceedances in samples analysed for Turbidity and TSS include the following:

Upstream:

- Turbidity concentrations at SW10 located within the realigned Town Creek off North Street were above ANZECC 2000 – Lowland Rivers (NSW) with a value of 99.1 NTU, almost double the criteria value limit of 50 NTU.
- TSS values were exceeded at SW10 with a value of 462 mg/L. SW10 is considered an upstream location, although realignment works of Town Creek have occurred upstream during construction and may be impacting this location due to erosional activity within the new channel.
- SW10 downstream site SW11 did not have enough water for a sample to be collected. SW10 was observed to have very low flow.

Downstream:

- TSS exceeded ANZECC criteria at location SW13 with a value of 74 mg/L located in the Hitchcocks Lane Tributary.
- SW13 associated upstream location, SW12, did not have enough water for a sample to be collected. SW12 was observed to have very low flow.

Results have been graphed in control charts against baseline 80<sup>th</sup> percentile and median values. These charts can be found in Attachment C.

### **3.4.3 Electrical Conductivity (field)**

The following exceedances were identified for Electrical Conductivity:

Upstream:

- Electrical Conductivity (EC) ANZECC 2000 criteria exceedances occurred SW14.

Downstream:

- EC ANZECC criteria was exceeded at locations SW13, SW15 and SW17. The upstream location of SW13 could not be sampled due to low flow. SW15 upstream location is SW14 which also have an EC exceedance.
- The upstream location of SW17 did not have an EC exceedance.

### **3.4.4 Nitrogen and Phosphorus**

Exceedances in samples analysed for Nitrogen and Phosphorus include the following:

Upstream:

- Exceedances against the ANZECC 2000 criteria for Total Nitrogen was detected at locations SW01, SW10, SW14.



- The highest Total Nitrogen exceedance was in SW14 with 1.5 mg/L and the lowest exceedance was in SW01 with a value of 0.6 mg/L.
- ANZECC criteria for Total Phosphorus was exceeded at upstream locations SW06 and SW10.

Downstream:

- Exceedances in Total Nitrogen similar to the upstream location SW01 in downstream locations SW02, SW03 and SW05.
- ANZECC criteria for Total Phosphorus was exceeded at downstream locations SW03, SW05, SW09 and SW15. Associated upstream locations also had exceedances for SW03, SW05 and SW09. The upstream location for SW15 did not have an exceedance for Total Phosphorus.

### **3.4.5 TRH**

No TRH's were detected above Limit of Reporting (LOR) during this event. No oily sheen was observed within creeks sampled during sampling Event 1 which is consistent with laboratory results. .

### **3.4.6 Heavy Metals**

The concentrations for dissolved heavy metals (with detectable concentrations) were plotted in time series to assess the changes before and after construction and identify any emergence of trends. Control charts have not been included as the metals data generally have a high percentage of values below detection limits. This resulted in identified exceedances in the control charts that were associated with statistical issues rather than trends in the data. Time series graphs of the results were created for the following metals which had detectable concentrations:

- Copper
- Zinc.

The results graphs for Event 1 are presented in Attachment F and are summarised below.

#### **Copper**

Concentrations of copper are similar to those detected during baseline pre-construction monitoring. All results are at or below the maximum copper concentration detected during baseline monitoring other than upstream location SW14 which has a value of 0.005 mg/L, slightly above the maximum baseline concentration value of 0.003 mg/L. Further monitoring will indicate if this is an emerging trend. The associated downstream location SW15 had a lower concentration therefore the result in SW14 could be due to background variations.

The following exceedances against the ANZECC (2000) 95% Freshwater guidelines occurred:

Upstream:

- Exceedances at locations SW02, SW03, SW05, SW10, and SW14.

Downstream:

- Downstream location SW13. The associated upstream location, SW12, could not be sampled due to very low flow. The value detected in SW13 is the same as the maximum value detected during baseline monitoring (0.003 mg/L).

#### **Zinc**

The following exceedances against criteria and baseline maximum values were detected:

Upstream:

- Locations SW04 and SW14 were above the selected ANZECC criteria.
- The value in SW04 was above the maximum value detected during baseline monitoring.

Downstream:

- Associated downstream locations for detected exceedances in upstream were not above selected criteria or above maximum values detected during baseline monitoring.

#### **4 Conclusion**

Upstream exceedances at locations suggest background variation may be occurring within a number of catchments along the FBB alignment which is consistent with baseline monitoring. An exceedance in Total Phosphorus against ANZECC 2000 criteria was detected in SW17 which did not reflect variations in the associated upstream location (SW16). The exceedance may suggest impact is occurring from operation of the FBB in this creek. Further sampling should clarify if exceedances are suggesting residual impact remains at this location.

## 5 Limitations

This report has been prepared by GHD Pty Ltd (GHD) for Roads and Maritime Services (RMS) and may only be used and relied on by RMS for the purpose agreed between GHD and RMS, as set out in Section 1 of this report.

GHD otherwise disclaims responsibility to any person other than RMS arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Roads and Maritime Services and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

Please contact the undersigned if you have any questions or require further information.

Sincerely,

GHD Pty Ltd

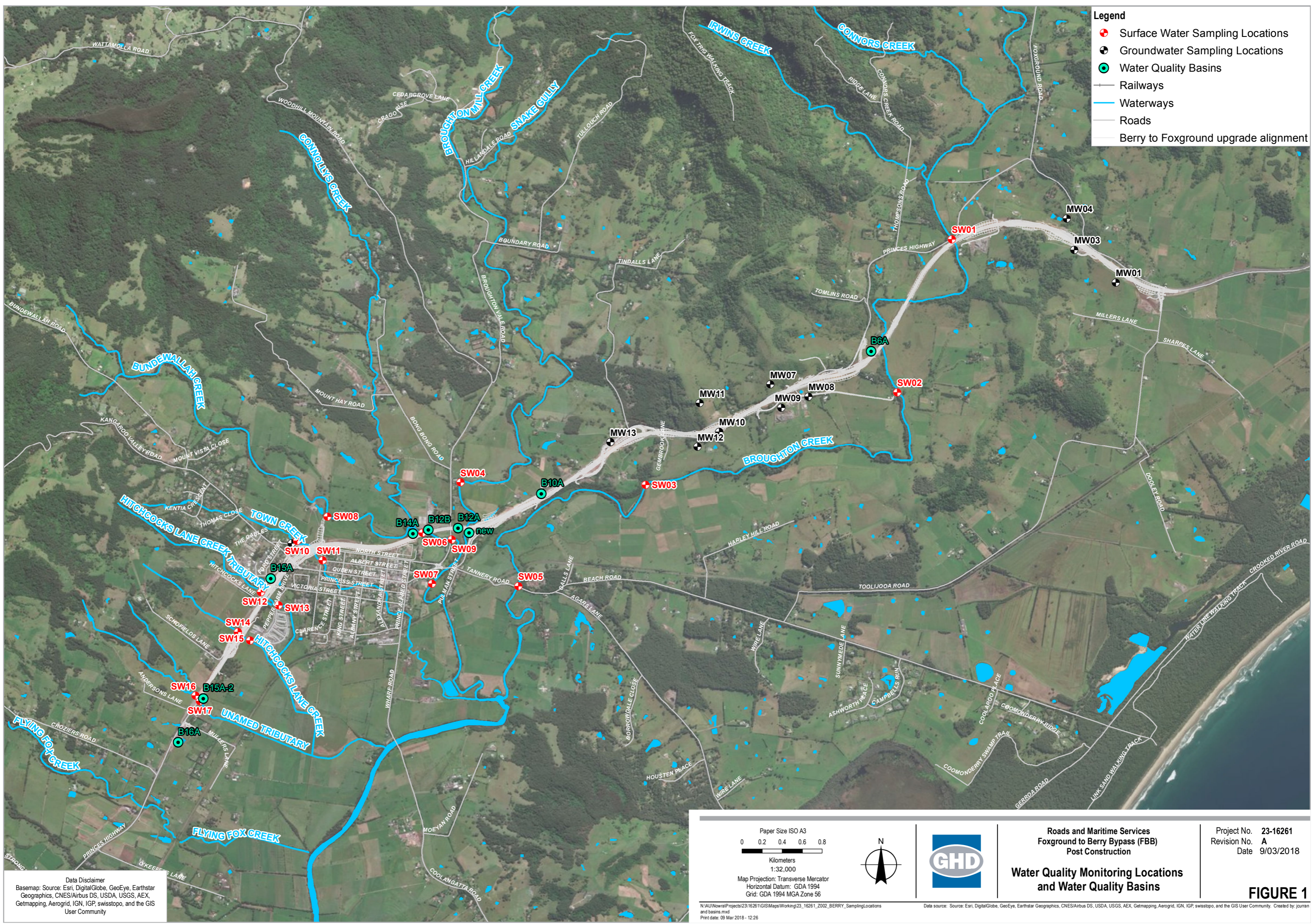
A handwritten signature in cursive script, appearing to read 'J Curran', written in black ink.

**Jane Curran**

Environmental Scientist

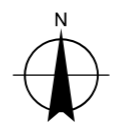
02 4424 4960

## Attachment A - Figures



- Legend**
- + Surface Water Sampling Locations
  - + Groundwater Sampling Locations
  - Water Quality Basins
  - Railways
  - Waterways
  - Roads
  - Berry to Foxground upgrade alignment

Paper Size ISO A3  
 0 0.2 0.4 0.6 0.8  
 Kilometers  
 1:32,000  
 Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 56



Roads and Maritime Services  
 Foxground to Berry Bypass (FBB)  
 Post Construction

**Water Quality Monitoring Locations  
 and Water Quality Basins**

Project No. 23-16261  
 Revision No. A  
 Date 9/03/2018

**FIGURE 1**

Data Disclaimer  
 Basemap: Source: Esri, DigitalGlobe, GeoEye, Earthstar  
 Geographics, CNES/Airbus DS, USDA, USGS, AEX,  
 Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS  
 User Community

N:\AU\Nowra\Projects\23-16261\GIS\Maps\Working\23\_16261\_2002\_BERRY\_SamplingLocations  
 and basins.mxd  
 Print date: 09 Mar 2018 - 12:26

Data source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community. Created by: jcurran

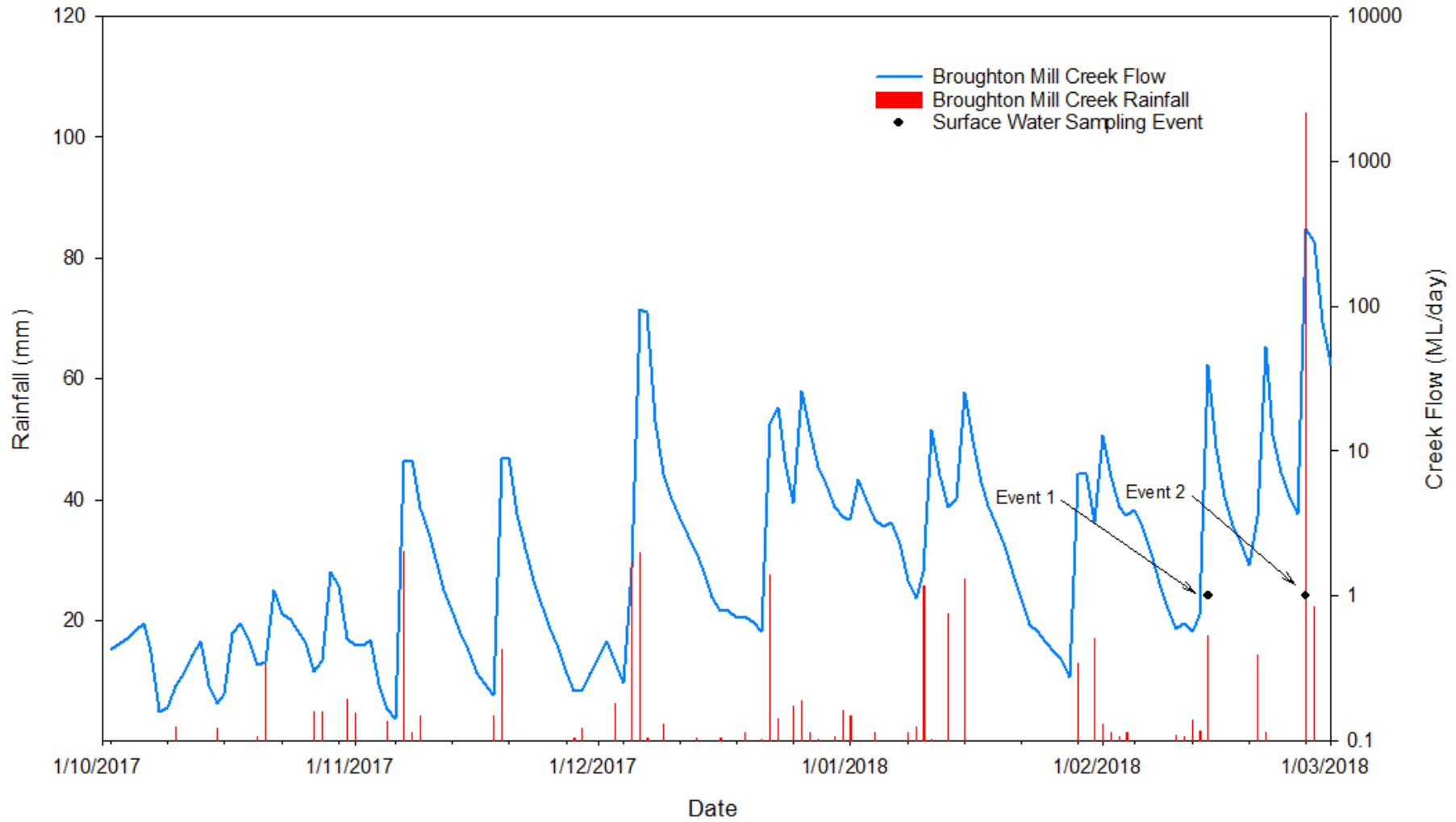


Figure 2 Rainfall vs Flow within Broughton Mill Creek

## Attachment B - Tabulated Results







**Attachment B  
Table B2  
QA Checker - Event 1**

RMS  
Foxground to Berry Bypass  
Post construction Monitoring

Field Duplicates (water)  
Filter: SDG in('ALSE-Sydney 16-Feb-18')

SDG Field ID	ALSE-Sydney 16-Feb-18	ALSE-Sydney 16-Feb-18	RPD	ALSE-Sydney 16-Feb-18	ALSE-Sydney 16-Feb-18	RPD
Sampled Date/Time	SW01 14/02/2018 15:00	QC01 14/02/2018 15:00		SW07 14/02/2018 15:00	QC2 14/02/2018 15:00	

Chem Group	ChemName	Units	EQL						
Inorganics	Total Susp	mg/l	5	<5	<5	0	<5	6	18
	Turbidity	NTU	0.1	4.2	4.2	0	2.4	2.3	4
Metals	Arsenic (Fi	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Cadmium	mg/l	0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	0
	Chromium	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Copper (Fi	mg/l	0.001	0.001	0.001	0	<0.001	0.002	67
	Lead (Filt	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Mercury (F	mg/l	0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	0
	Nickel (Filt	mg/l	0.001	<0.001	<0.001	0	<0.001	0.001	0
	Zinc (Filter	mg/l	0.005	<0.005	<0.005	0	0.005	0.034	149
PAHs	Naphthale	µg/L	5	<5	<5	0	<5	<5	0
TRH - NEPM 2013	C6-C10 mi	µg/L	20	<20	<20	0	<20	<20	0
	C6-C10 Fr	µg/L	20	<20	<20	0	<20	<20	0
	>C10-C16	µg/L	100	<100	<100	0	<100	<100	0
	>C10-C16	µg/L	100	<100	<100	0	<100	<100	0
	>C16-C34	µg/L	100	<100	<100	0	<100	<100	0
	>C34-C40	µg/L	100	<100	<100	0	<100	<100	0
	>C10-C40	µg/L	100	<100	<100	0	<100	<100	0
TRH - NEPM 1999	C6-C9 Fra	µg/L	20	<20	<20	0	<20	<20	0
	C10-C14 F	µg/L	50	<50	<50	0	<50	<50	0
	C15-C28 F	µg/L	100	<100	<100	0	<100	<100	0
	C29-C36 F	µg/L	50	<50	<50	0	<50	<50	0
	C10-C36 (	µg/L	50	<50	<50	0	<50	<50	0
BTEXN	Benzene	µg/L	1	<1	<1	0	<1	<1	0
	Toluene	µg/L	2	<2	<2	0	<2	<2	0
	Ethylbenz	µg/L	2	<2	<2	0	<2	<2	0
	Xylene (o)	µg/L	2	<2	<2	0	<2	<2	0
	Xylene (m	µg/L	2	<2	<2	0	<2	<2	0
	Xylene Tot	µg/L	2	<2	<2	0	<2	<2	0
	BTEX (Sur	µg/L	1	<1	<1	0	<1	<1	0
Nutrients	Total Kjeld	mg/l	0.1	0.3	0.3	0	0.3	0.3	0
	Nitrate + N	mg/l	0.01	0.25	0.25	0	0.01	0.01	0
	Nitrogen (T	mg/l	0.1	0.6	0.6	0	0.3	0.3	0
	Phosphoru	mg/l	0.01	0.04	0.04	0	0.02	0.03	40

\*RPDs have only been considered where a concentration is greater than 1 times the EQL.

\*\*High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 200 (1-10 x EQL); 50 (10-30 x EQL); 50 (> 30 x EQL) )

\*\*\*Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

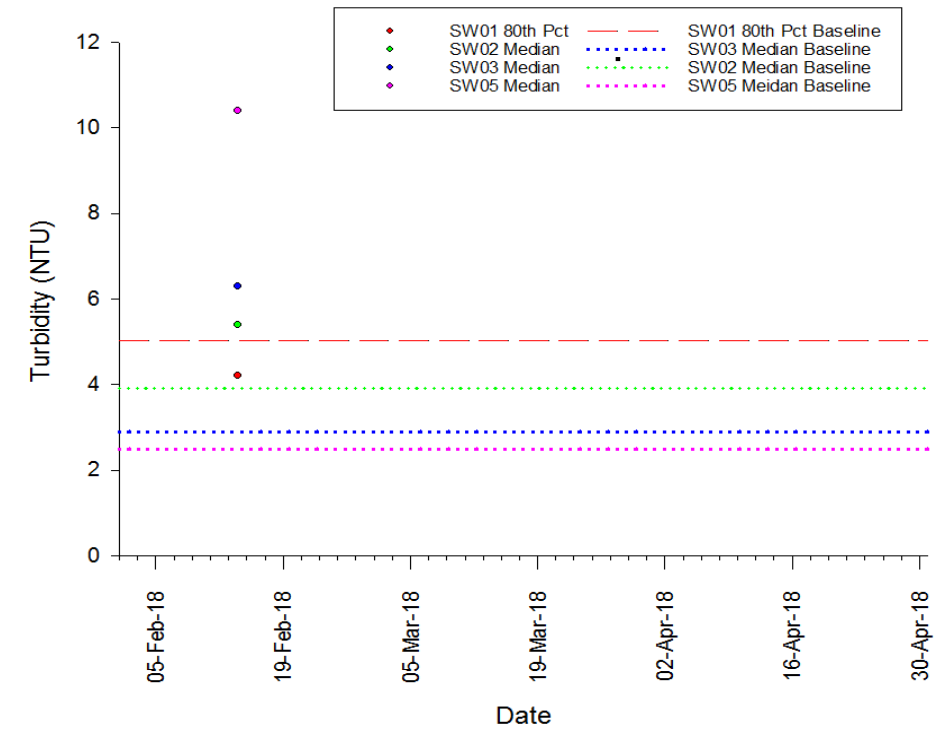
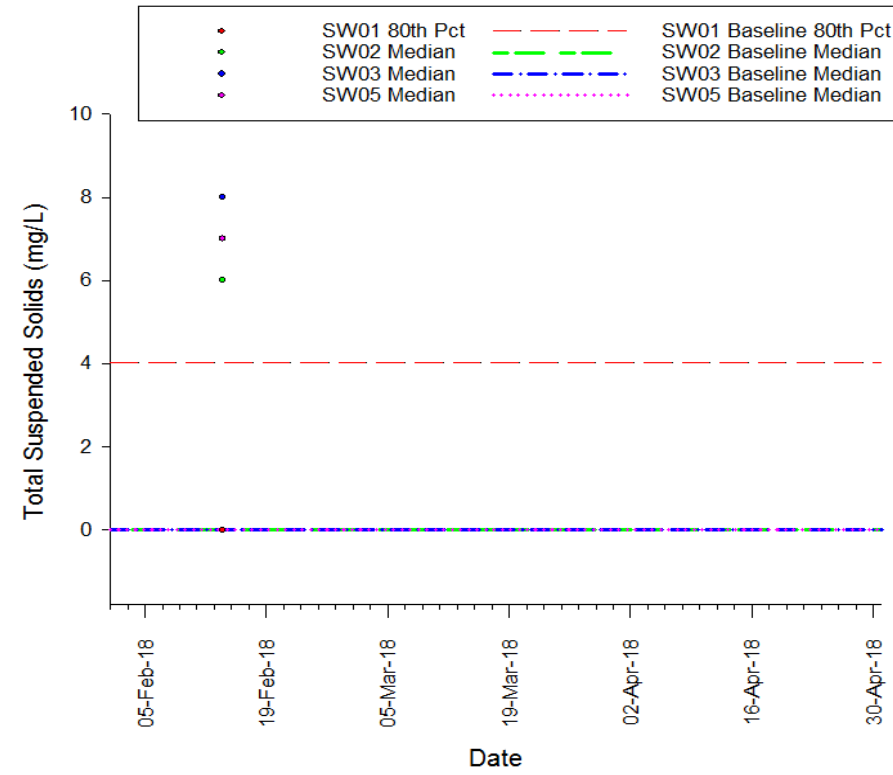
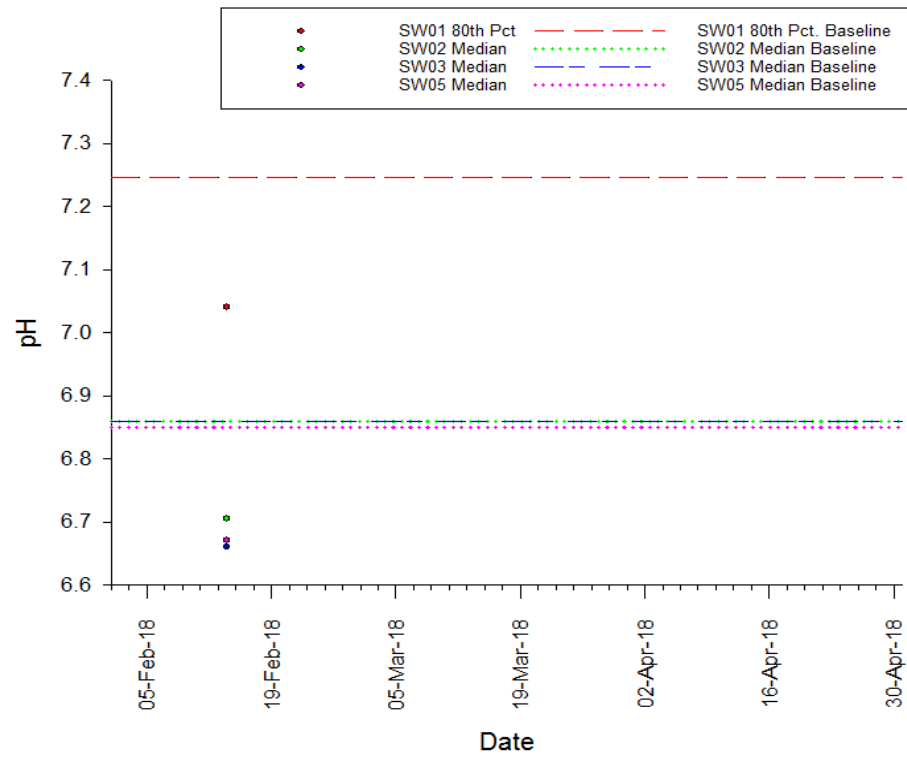
Filter: SDG in('ALSE-Sydney 16-Feb-18')

## Attachment C - Control Charts

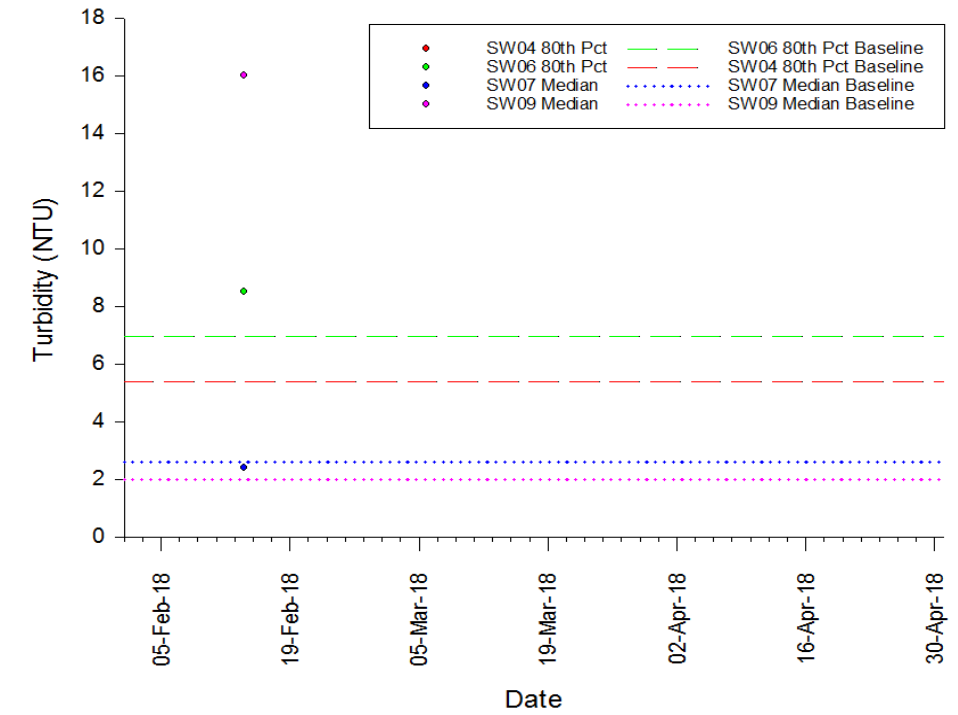
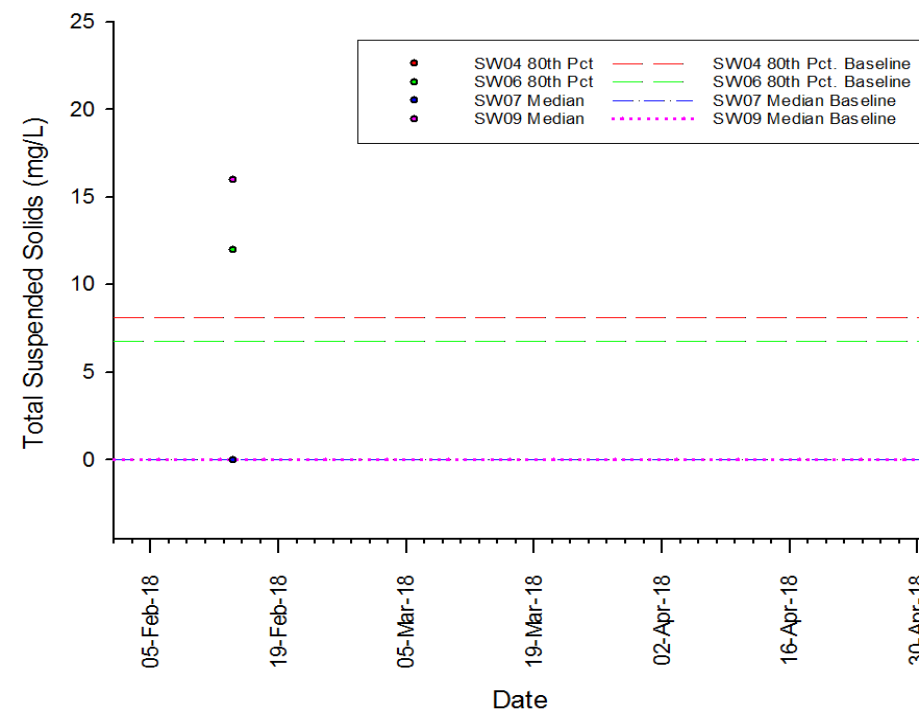
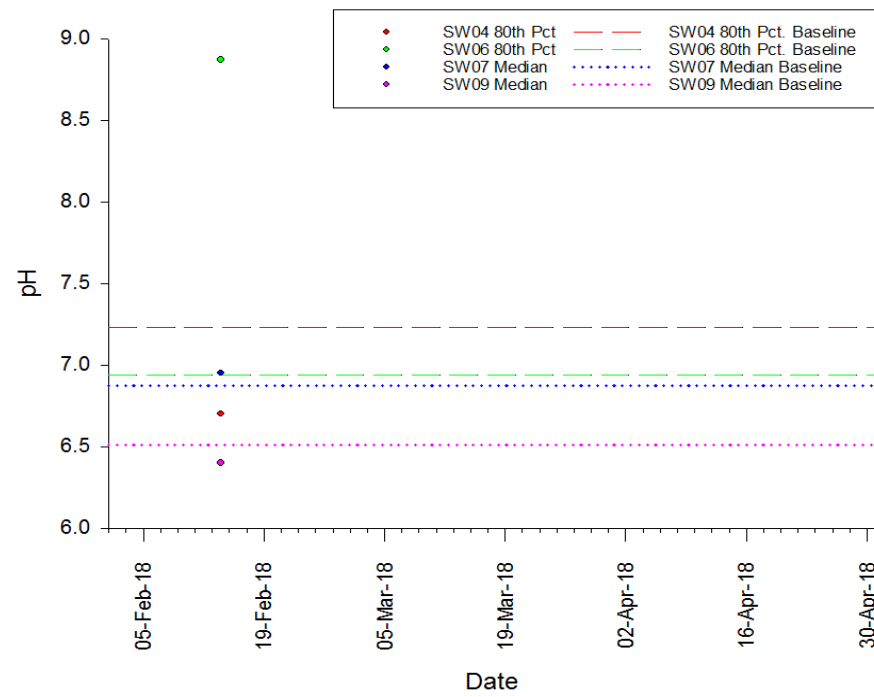


# Event 1 - Attachment E Control Charts -pH, TSS, Turbidity

## 1. Broughton Creek



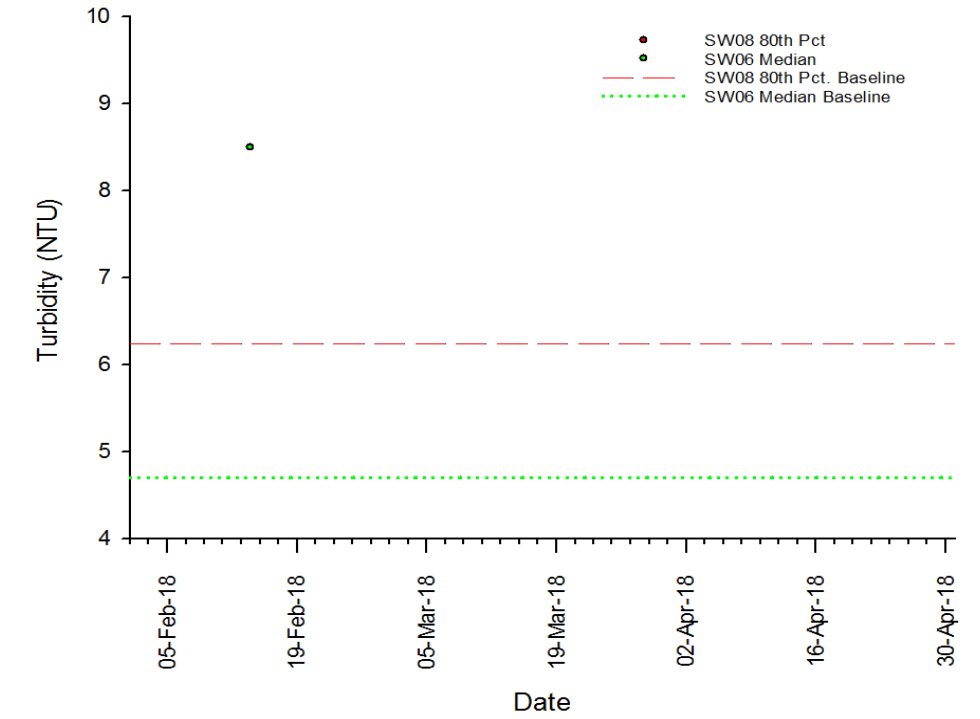
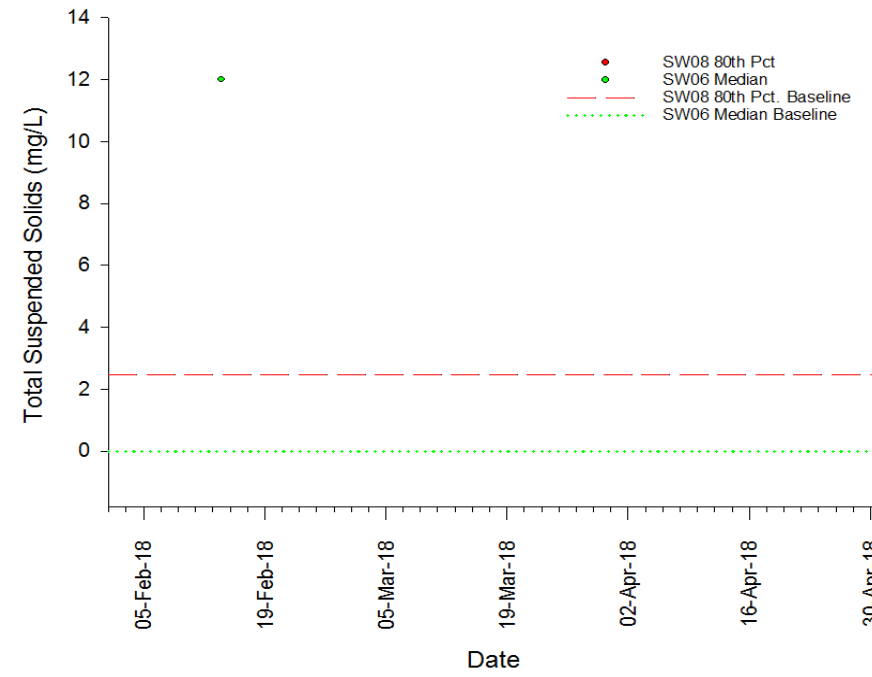
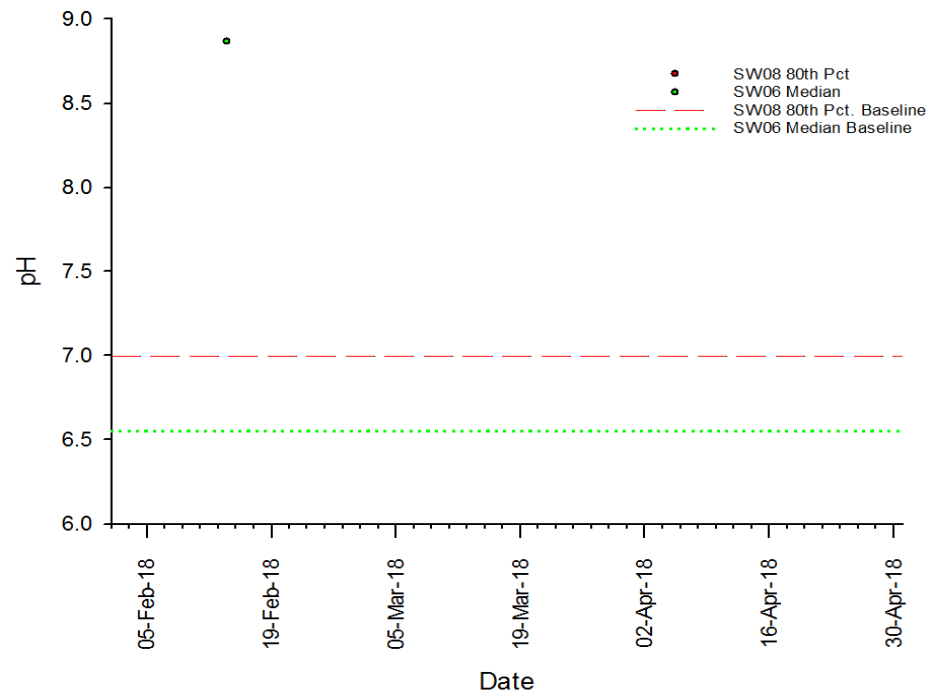
## 2. Connelly's Creek and Broughton Mill Creek and Bundewallah Creek



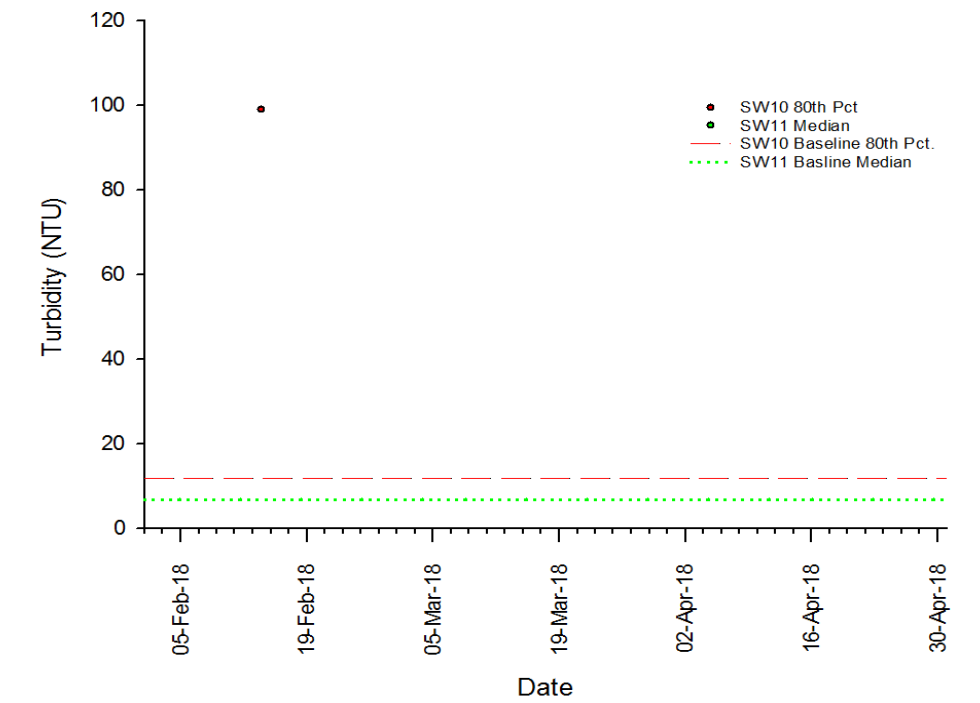
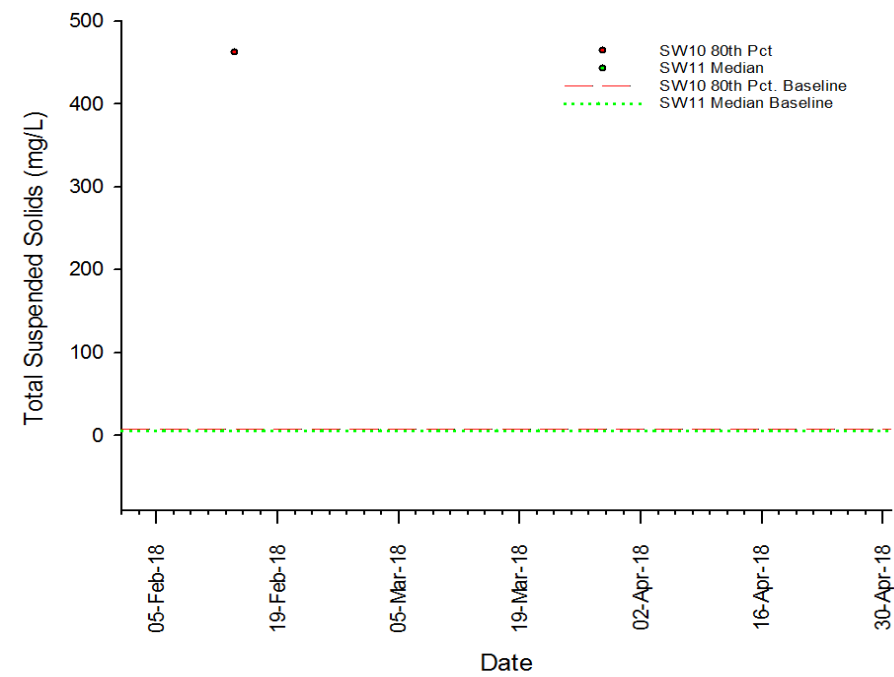
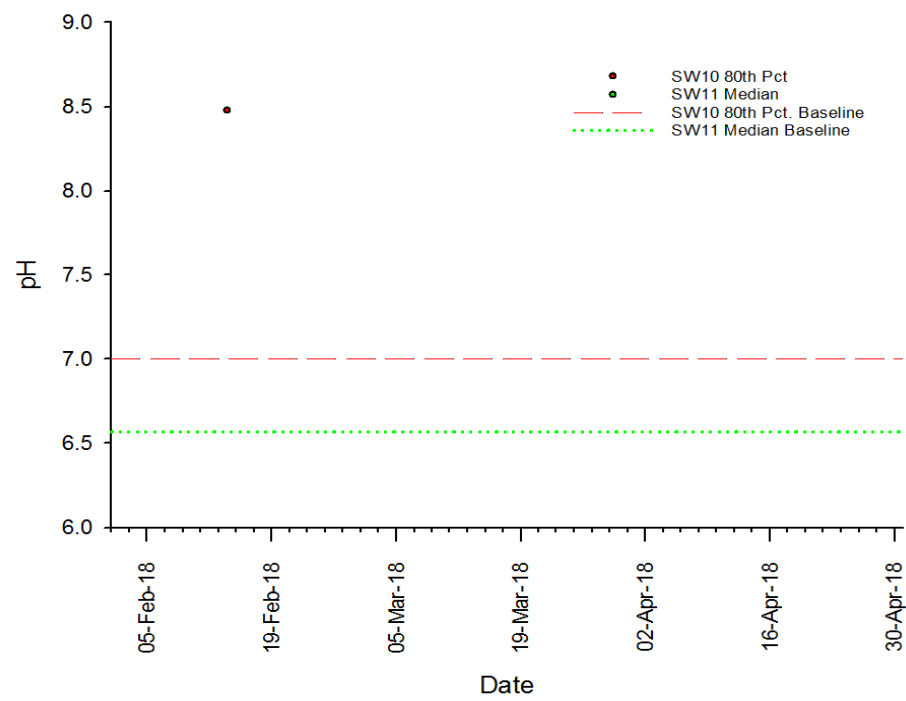


### Event 1 - Attachment E Control Charts -pH, TSS, Turbidity

#### 3. Bundewallah Creek and Connelly's Creek



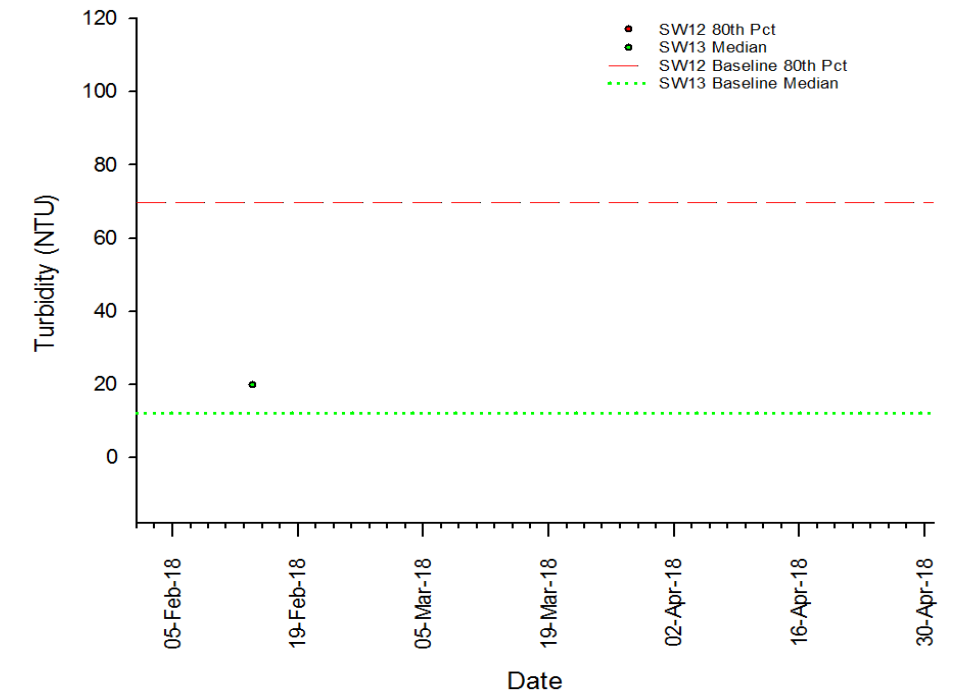
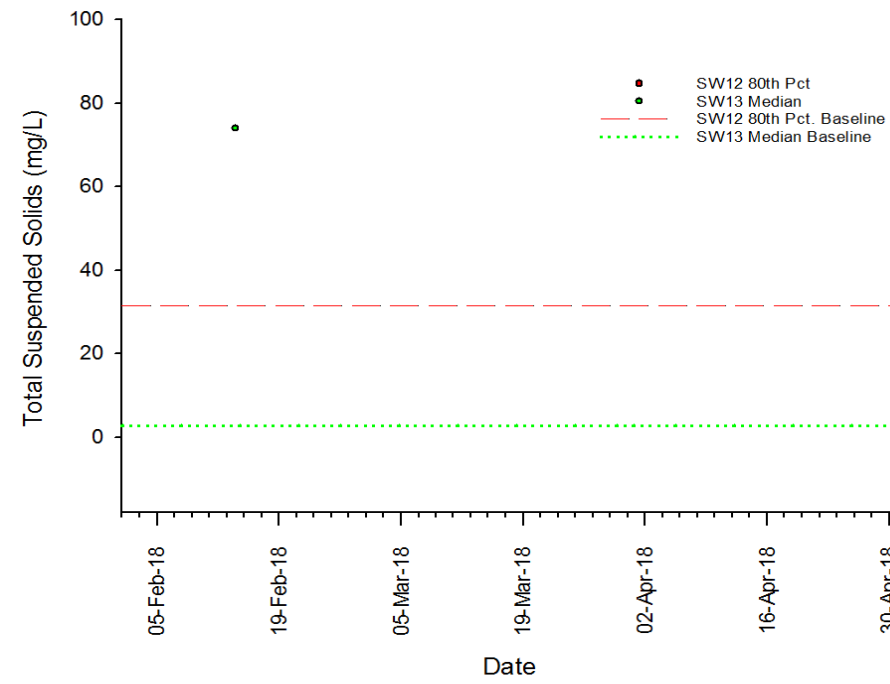
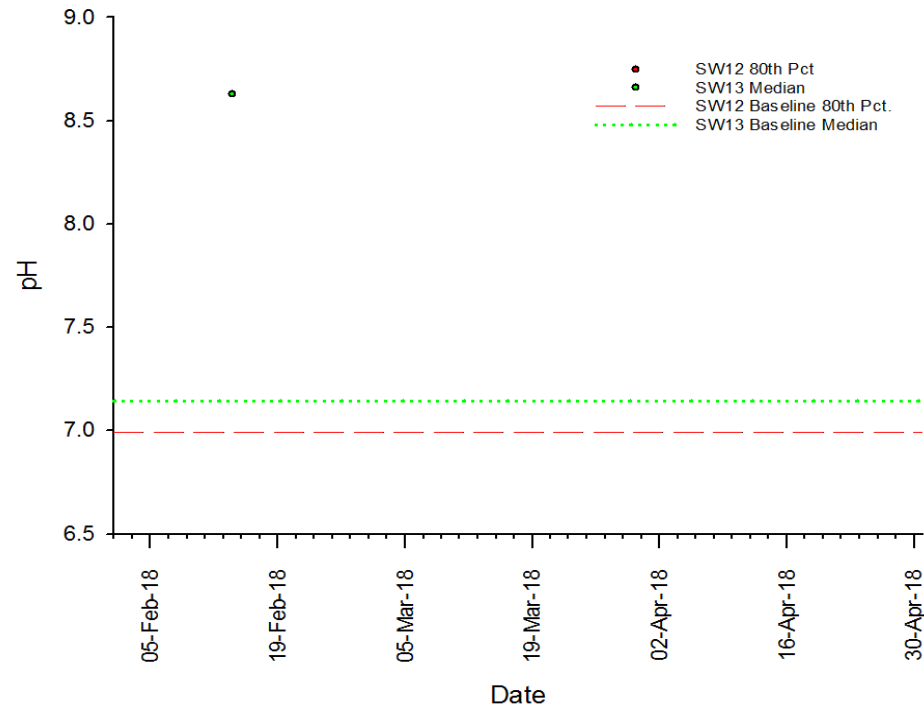
#### 4. Town Creek



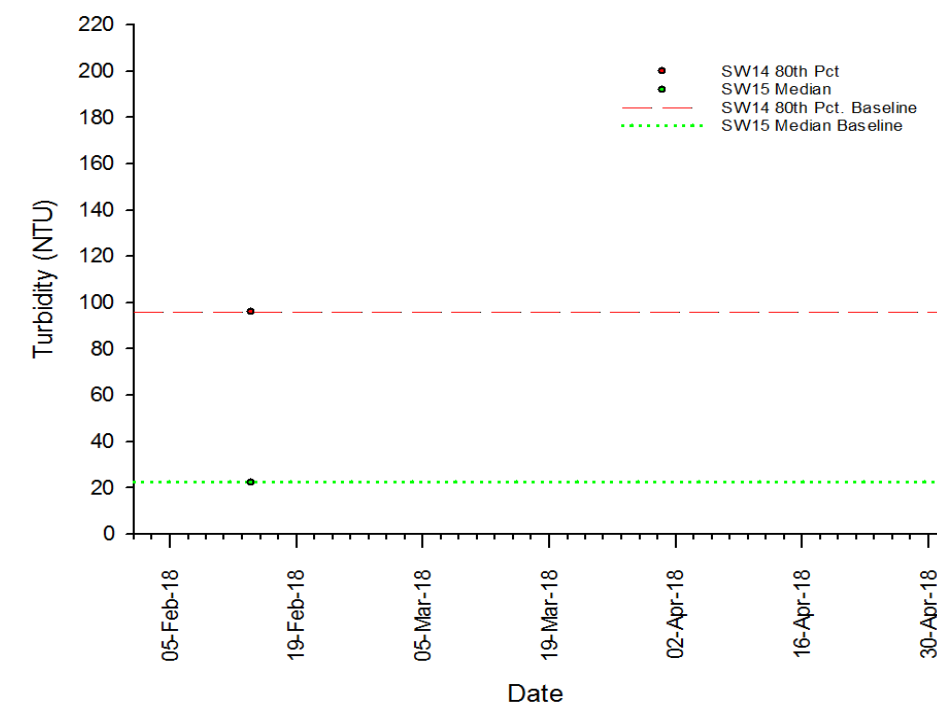
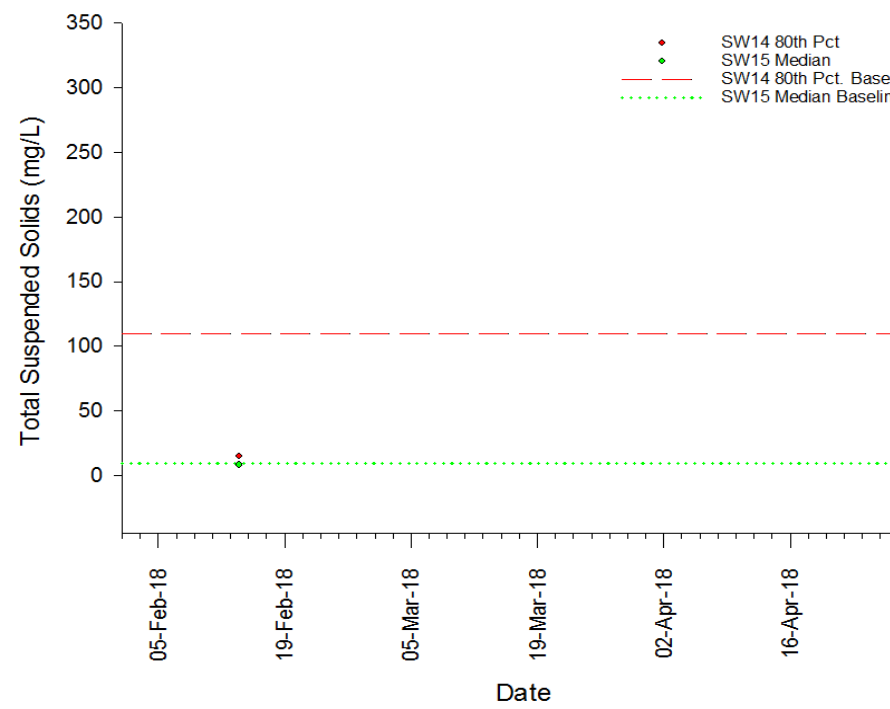
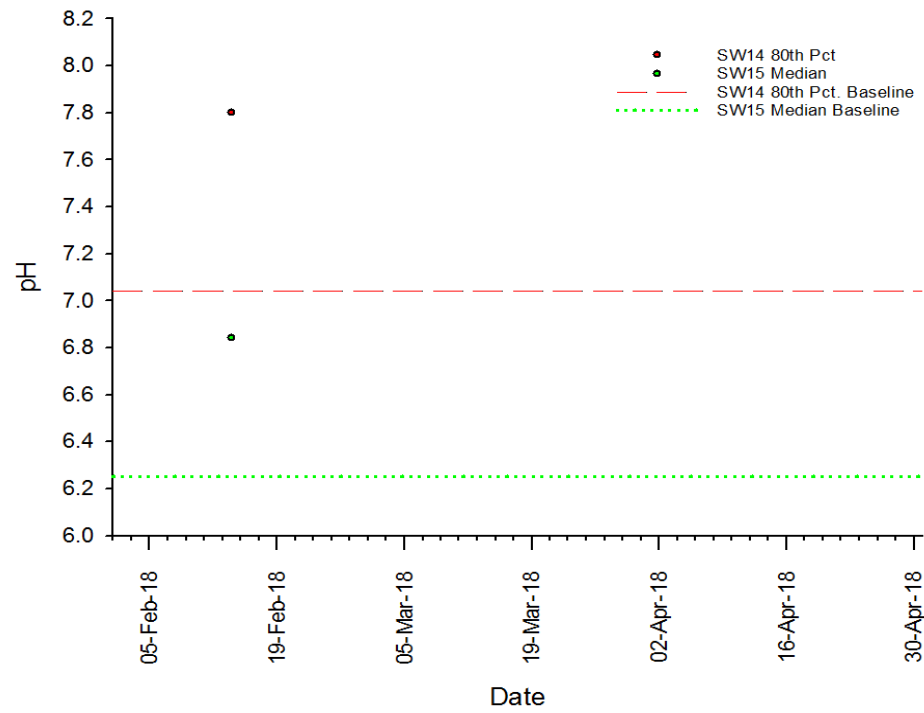


# Event 1 - Attachment E Control Charts -pH, TSS, Turbidity

## 5. Hitchcocks Lane Creek Tributary



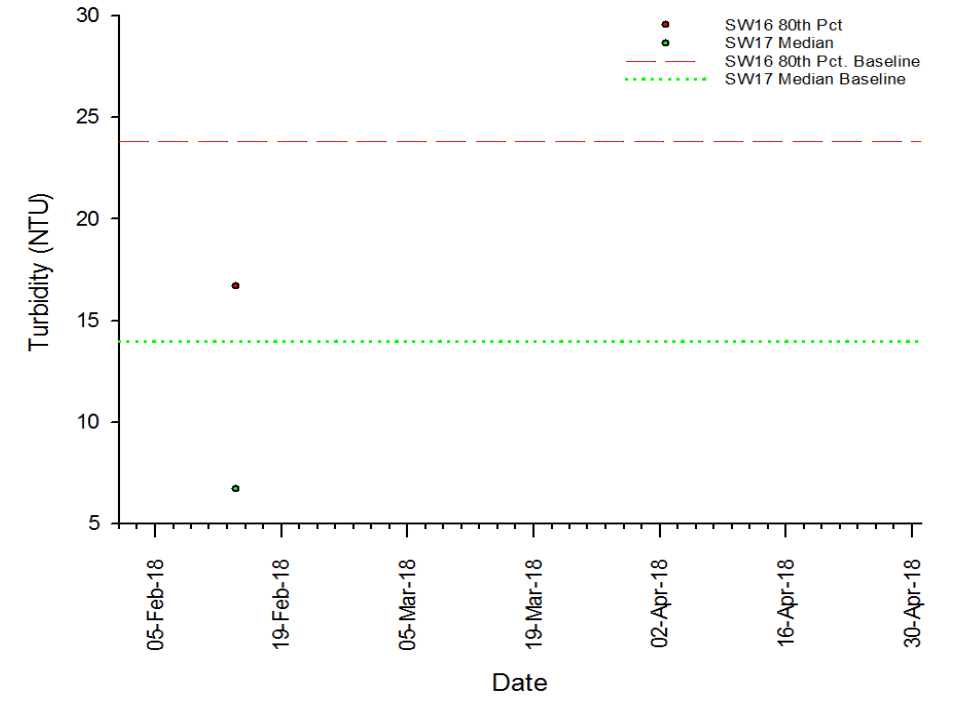
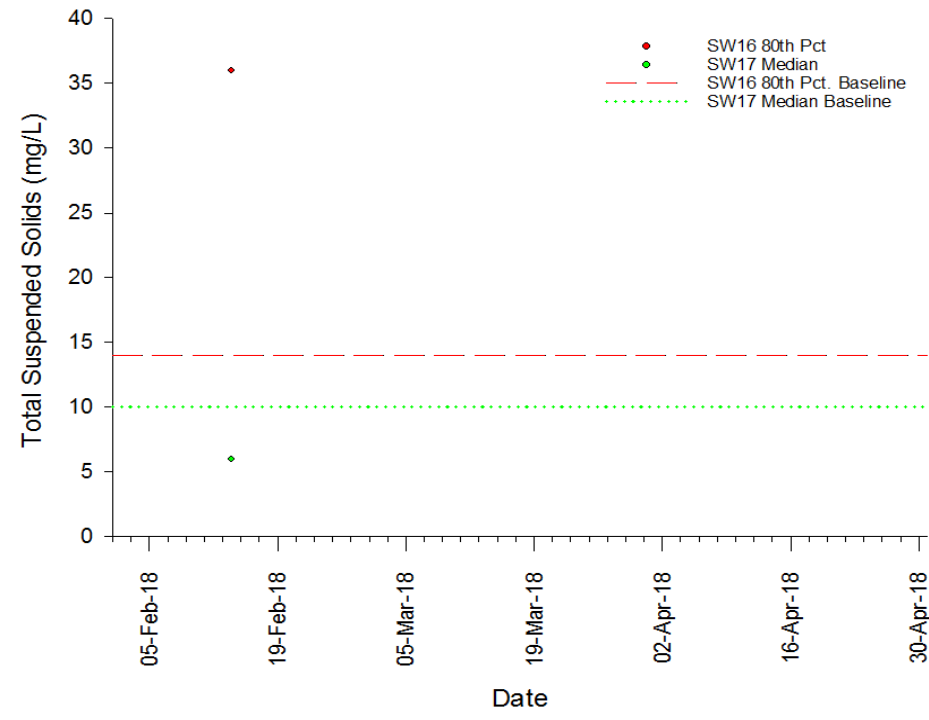
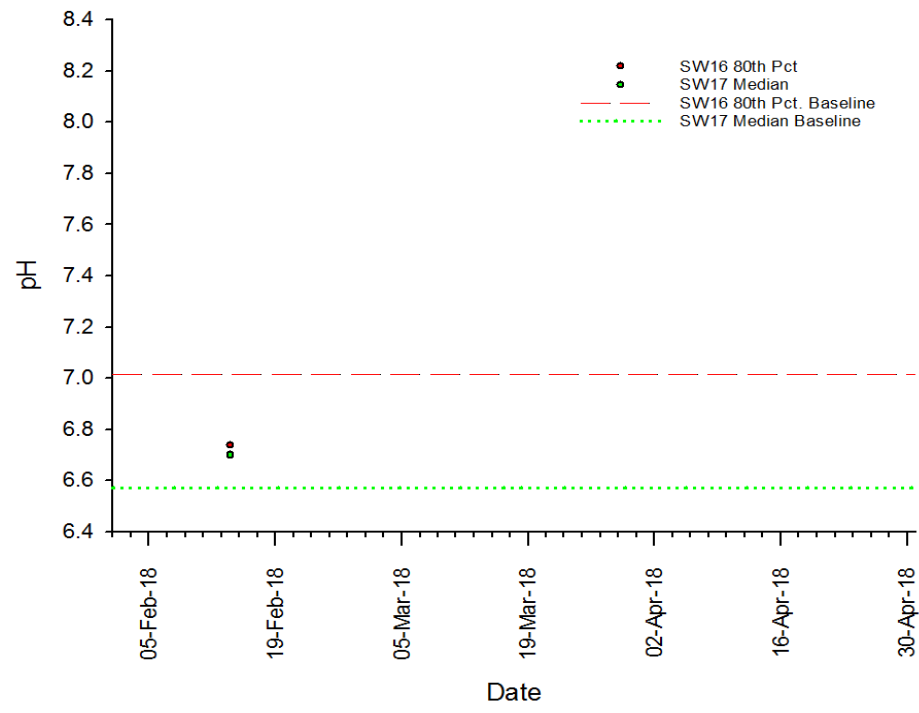
## 6. Hitchcocks Lane Creek





# Event 1 - Attachment E Control Charts -pH, TSS, Turbidity

## 7. Unnamed Tributary

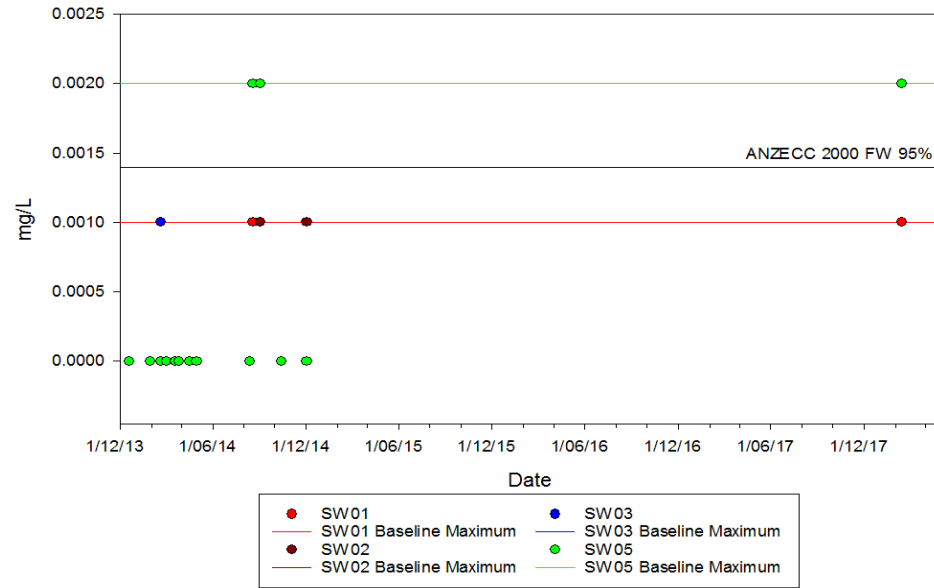




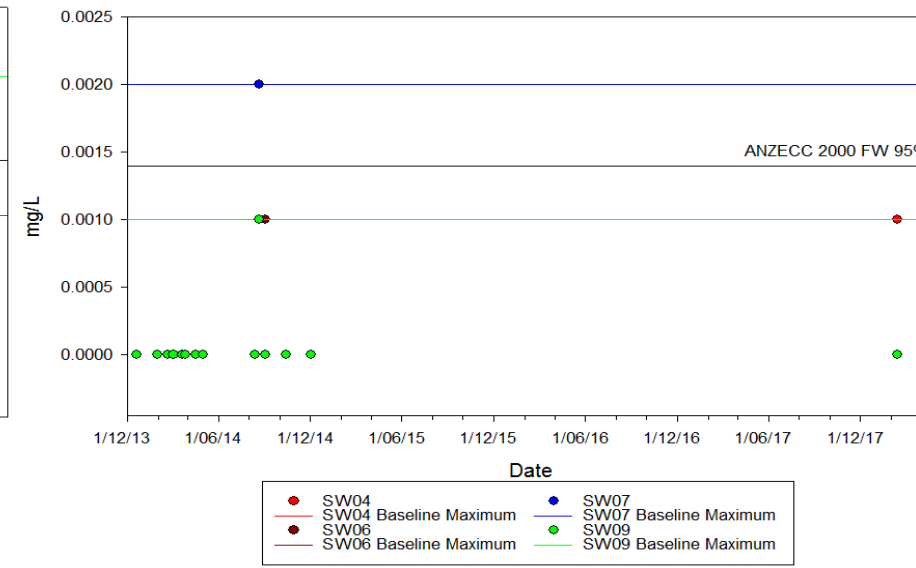
# Attachment C Control Charts - Heavy Metals

## Copper

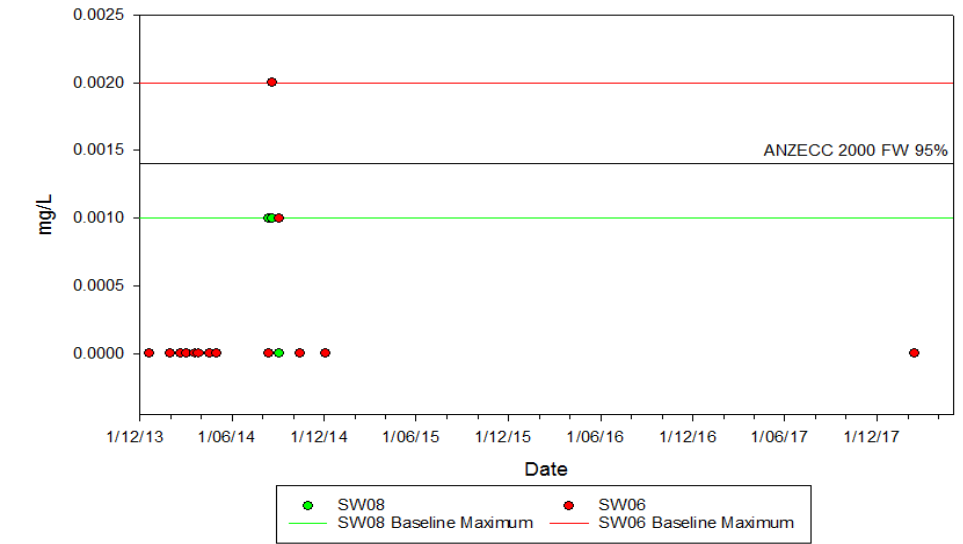
### Copper Concentration Broughton Creek



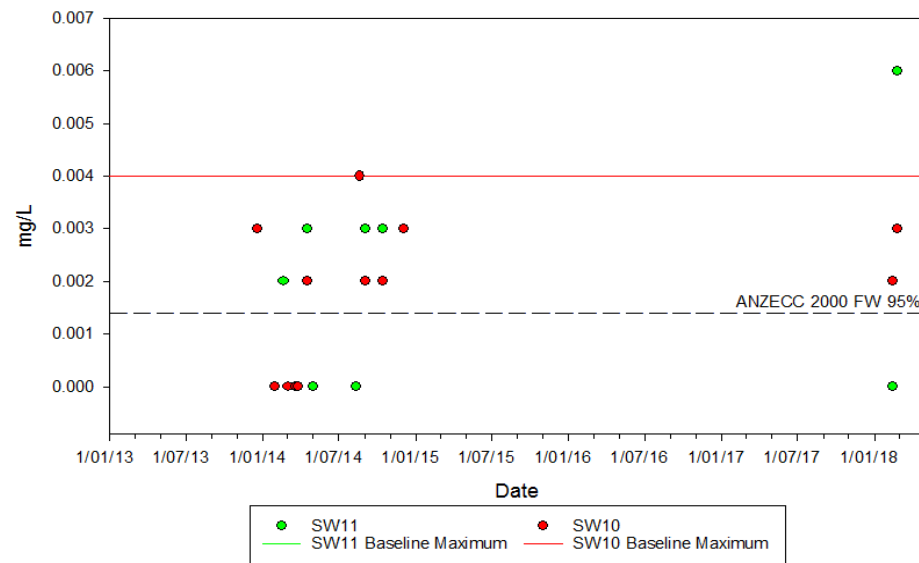
### Copper Concentration Connelly's Creek, Broughton Mill Creek and Bundewallah Creek



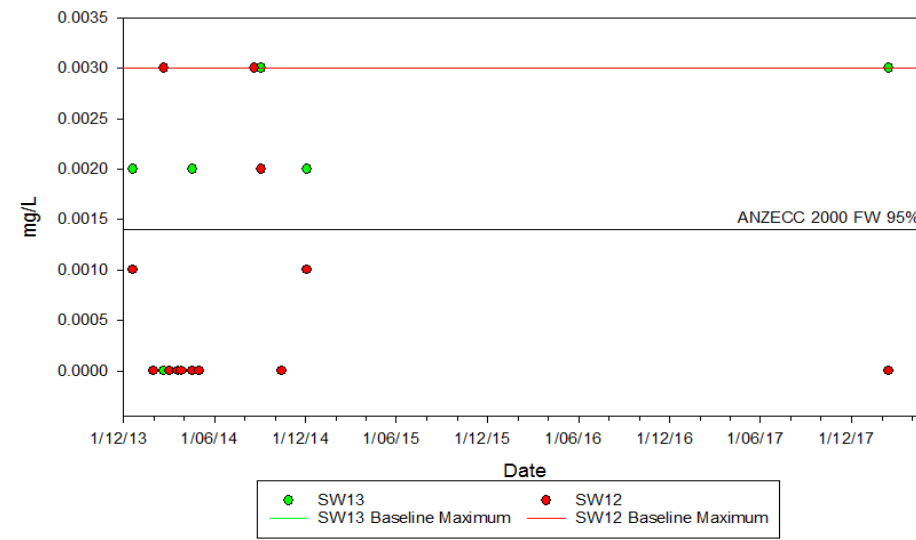
### Copper Concentration Bundewallah Creek and Connelly's Creek



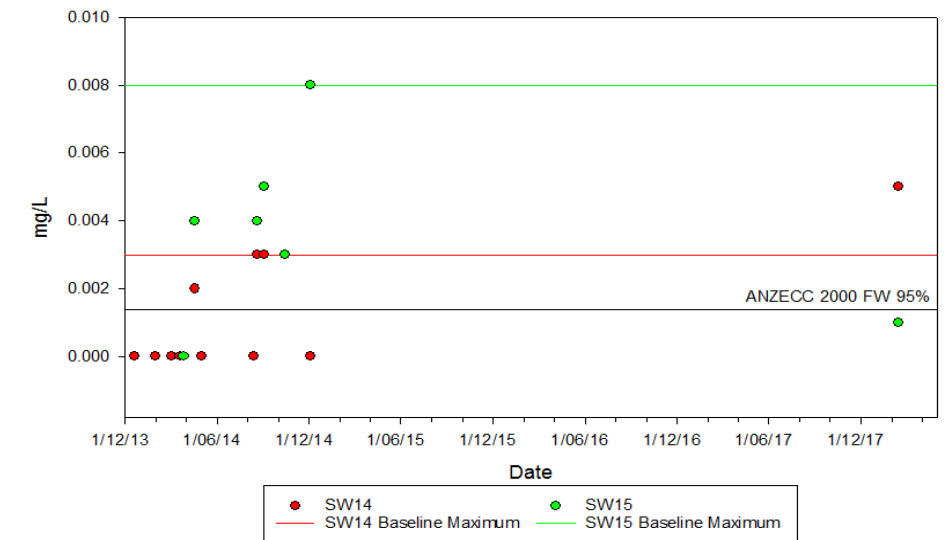
### Copper Concentration Town Creek



### Copper Concentration Hitchcocks Lane Creek Tributary



### Copper Concentration Hitchcocks Lane Creek Tributary

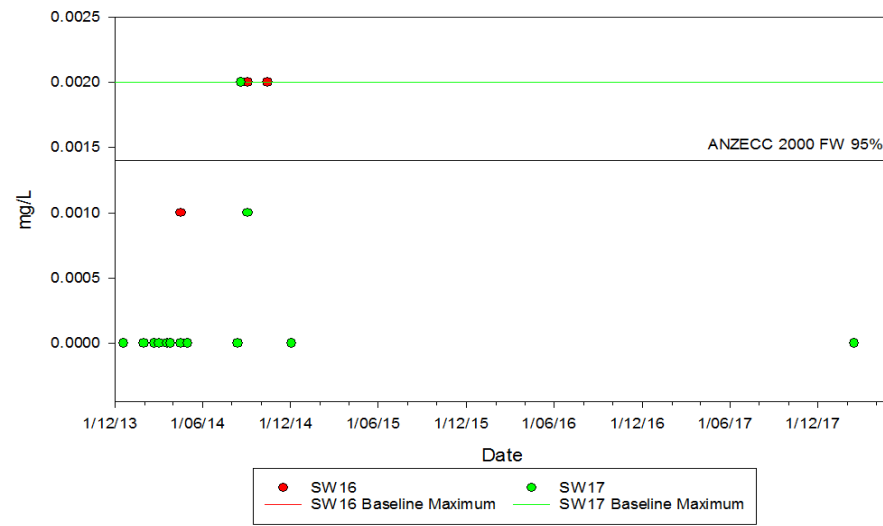






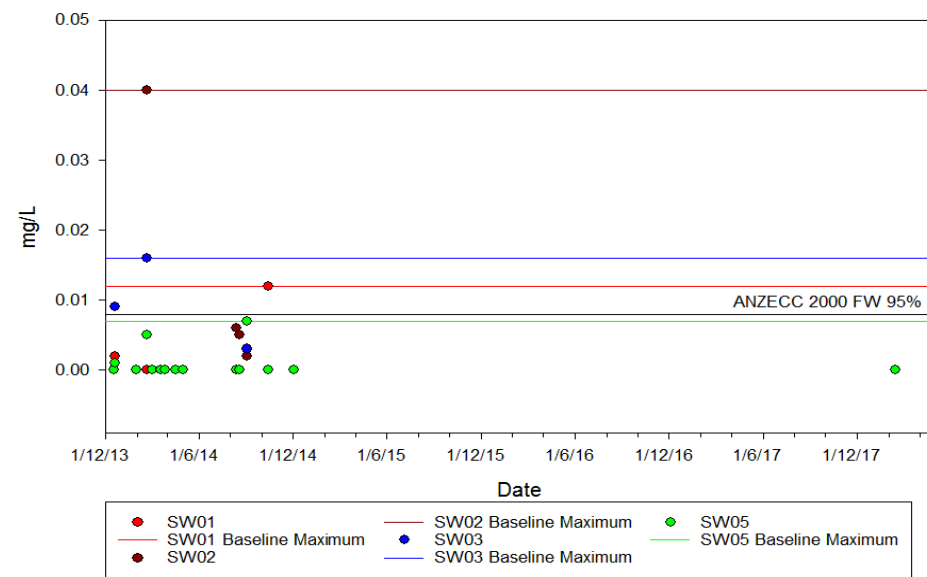
## Attachment E Control Charts - Heavy Metals

Copper Concentration Unnamed Tributary

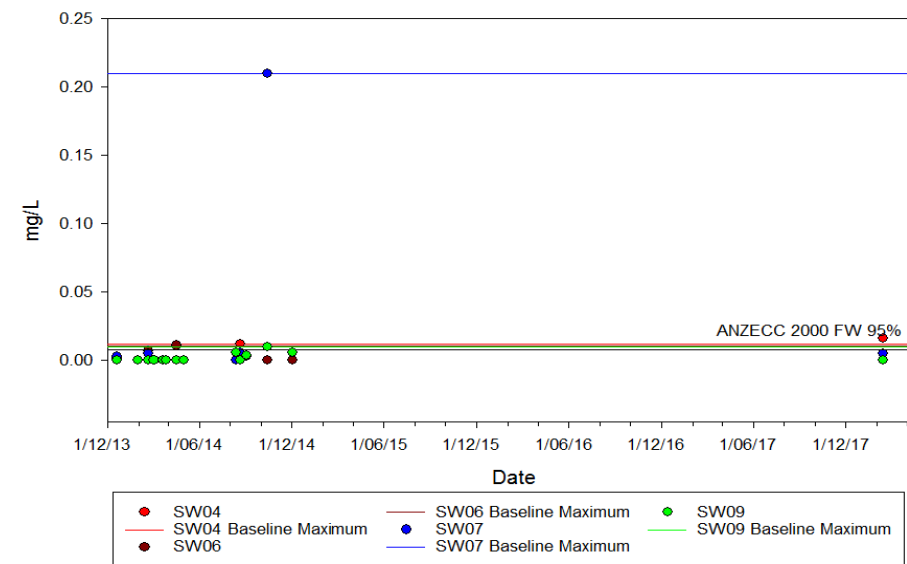


## Zinc

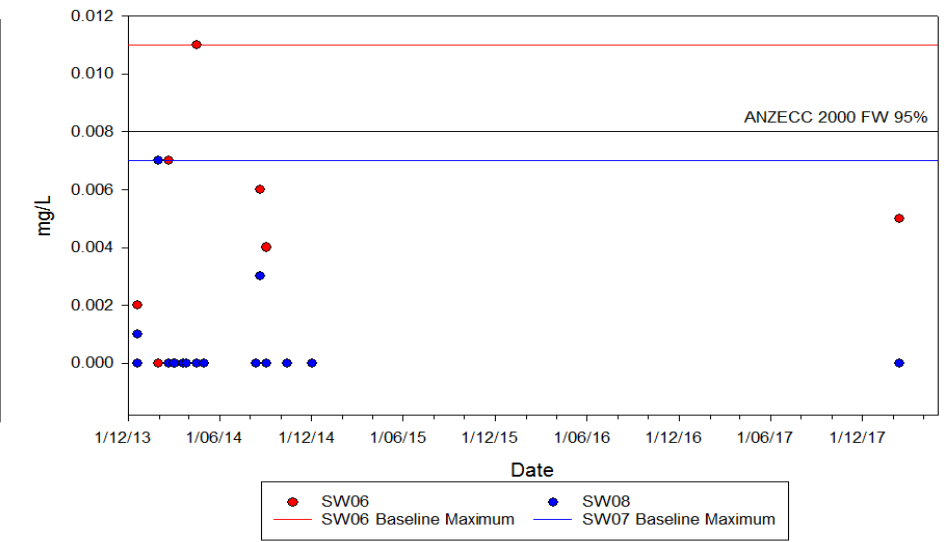
Zinc Concentration Broughton Creek



Zinc Concentration Connelly's Creek, Broughton Mill Creek and Bundewallah Creek



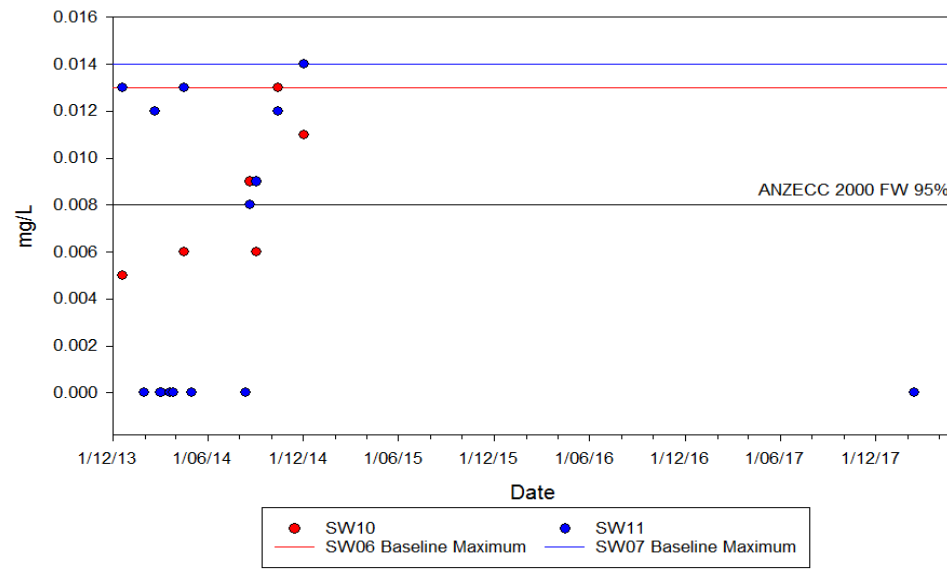
Zinc Concentration Bundewallah Creek and Connelly's Creek



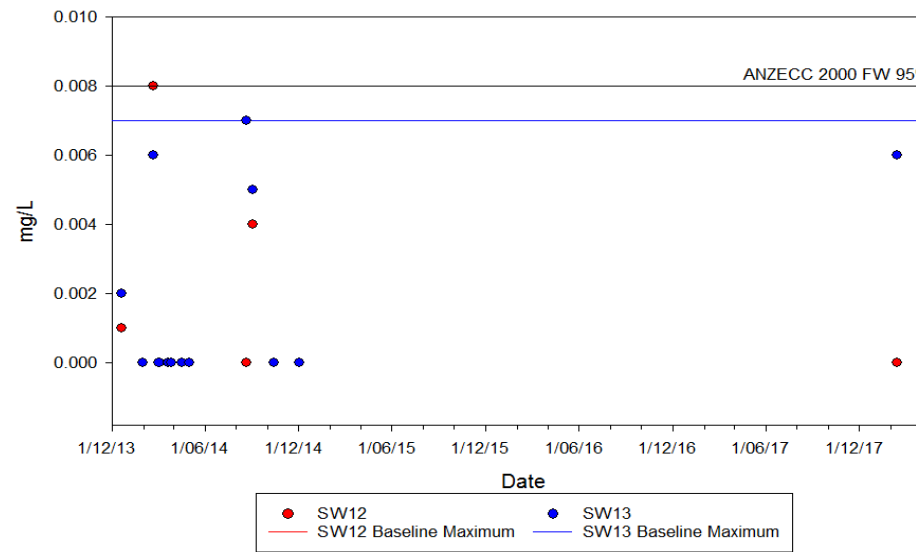


# Attachment E Control Charts - Heavy Metals

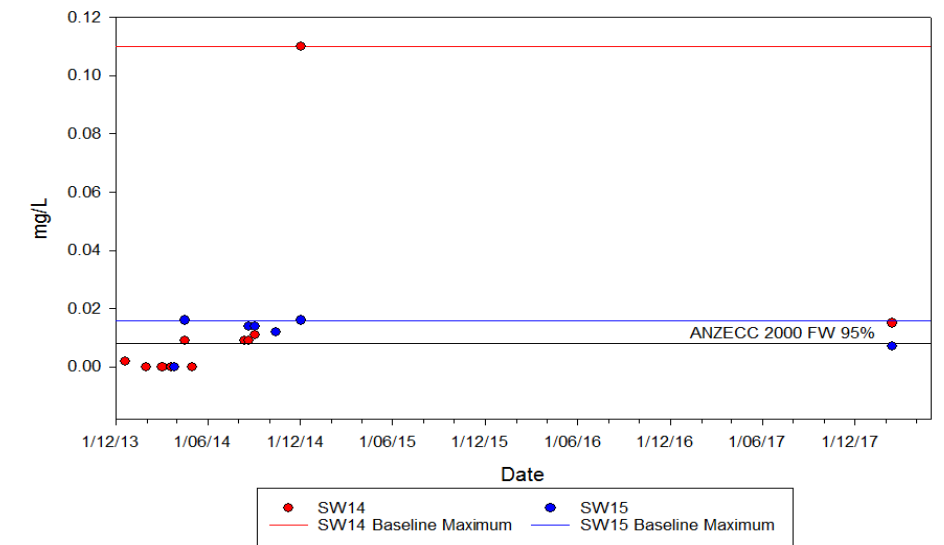
### Zinc Concentration Town Creek



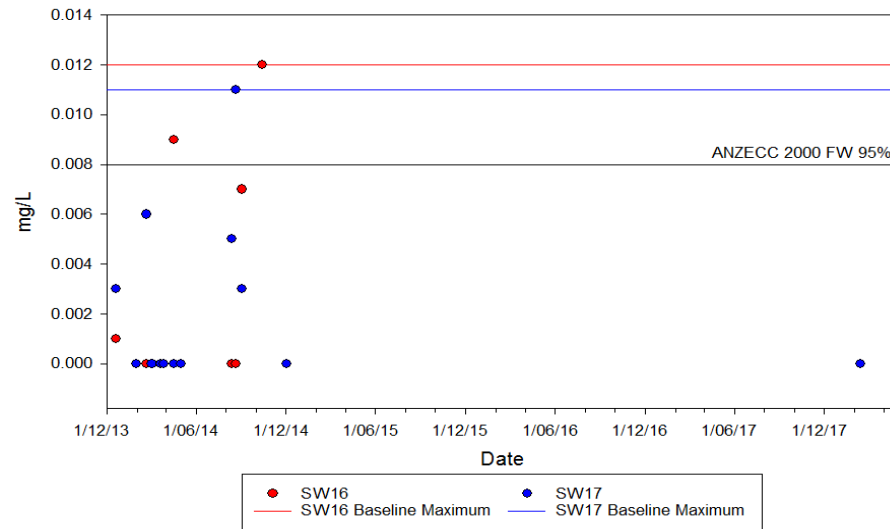
### Zinc Concentration Hitchcock Lane Creek Tributary



### Zinc Concentration Hitchcocks Lane Creek



### Zinc Concentration Unnamed Tributary



## Attachment D - Laboratory Certificates

## CERTIFICATE OF ANALYSIS

**Work Order** : **ES1805055**  
**Client** : **GHD PTY LTD**  
**Contact** : **MS JANE CURRAN**  
**Address** : **LEVEL 15, 133 CASTLEREAGH STREET**  
**SYDNEY NSW, AUSTRALIA 2000**  
**Telephone** : **+61 02 9239 7100**  
**Project** : **2316261**  
**Order number** : **2316261**  
**C-O-C number** : **----**  
**Sampler** : **LAIN LINDLEY, ROB WEBB**  
**Site** : **----**  
**Quote number** : **SY/603/17 A**  
**No. of samples received** : **16**  
**No. of samples analysed** : **16**

**Page** : 1 of 11  
**Laboratory** : Environmental Division Sydney  
**Contact** : Customer Services ES  
**Address** : 277-289 Woodpark Road Smithfield NSW Australia 2164  
**Telephone** : +61-2-8784 8555  
**Date Samples Received** : 16-Feb-2018 09:30  
**Date Analysis Commenced** : 16-Feb-2018  
**Issue Date** : 22-Feb-2018 15:21



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW



## General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
LOR = Limit of reporting  
^ = This result is computed from individual analyte detections at or above the level of reporting  
ø = ALS is not NATA accredited for these tests.  
~ = Indicates an estimated value.



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW16	SW17	SW15	SW14	SW13
Client sampling date / time				14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1805055-001	ES1805055-002	ES1805055-003	ES1805055-004	ES1805055-005	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	36	6	8	15	74	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	16.7	6.7	3.0	2.3	19.8	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.001	0.005	0.003	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.001	0.001	0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.007	0.015	0.006	
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	0.01	0.04	<0.01	0.03	0.07	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.2	0.2	0.5	1.5	0.4	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L	0.2	0.2	0.5	1.5	0.5	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L	0.03	0.04	0.12	0.02	0.02	
<b>EP080/071: Total Petroleum Hydrocarbons</b>									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	<50	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW16	SW17	SW15	SW14	SW13	
Client sampling date / time				14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00		
Compound	CAS Number	LOR	Unit	ES1805055-001	ES1805055-002	ES1805055-003	ES1805055-004	ES1805055-005		
				Result	Result	Result	Result	Result		
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>										
^ >C10 - C40 Fraction (sum)				----	100	µg/L	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)				----	100	µg/L	<100	<100	<100	<100
<b>EP080: BTEXN</b>										
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1		
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2	<2		
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2		
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2		
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2		
^ Total Xylenes				----	2	µg/L	<2	<2	<2	
^ Sum of BTEX				----	1	µg/L	<1	<1	<1	
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5		
<b>EP080S: TPH(V)/BTEX Surrogates</b>										
1,2-Dichloroethane-D4	17060-07-0	2	%	108	91.4	114	119	108		
Toluene-D8	2037-26-5	2	%	94.8	82.0	102	108	95.6		
4-Bromofluorobenzene	460-00-4	2	%	91.5	81.6	100	103	94.4		



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW10	SW02	SW03	SW01	QC01
Client sampling date / time				14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1805055-006	ES1805055-007	ES1805055-008	ES1805055-009	ES1805055-010	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	462	6	8	<5	<5	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	99.1	5.4	6.3	4.2	4.2	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Arsenic	7440-38-2	0.001	mg/L	0.002	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.002	0.001	0.001	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.31	0.44	0.25	0.25	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.0	0.4	0.4	0.3	0.3	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L	1.0	0.7	0.8	0.6	0.6	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L	0.14	0.04	0.05	0.04	0.04	
<b>EP080/071: Total Petroleum Hydrocarbons</b>									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	<50	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	





## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW10	SW02	SW03	SW01	QC01	
Client sampling date / time				14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00		
Compound	CAS Number	LOR	Unit	ES1805055-006	ES1805055-007	ES1805055-008	ES1805055-009	ES1805055-010		
				Result	Result	Result	Result	Result		
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>										
^ >C10 - C40 Fraction (sum)				----	100	µg/L	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)				----	100	µg/L	<100	<100	<100	<100
<b>EP080: BTEXN</b>										
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1		
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2	<2		
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2		
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2		
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2		
^ Total Xylenes				----	2	µg/L	<2	<2	<2	
^ Sum of BTEX				----	1	µg/L	<1	<1	<1	
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5		
<b>EP080S: TPH(V)/BTEX Surrogates</b>										
1,2-Dichloroethane-D4	17060-07-0	2	%	115	107	104	107	107		
Toluene-D8	2037-26-5	2	%	105	93.2	91.9	95.5	92.0		
4-Bromofluorobenzene	460-00-4	2	%	101	94.8	90.4	93.0	92.9		



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW06	SW09	SW05	SW04	SW07
Client sampling date / time				14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1805055-011	ES1805055-012	ES1805055-013	ES1805055-014	ES1805055-015	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	12	16	7	<5	<5	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	8.5	16.0	10.4	2.4	2.4	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.002	0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	0.005	<0.005	<0.005	0.016	0.005	
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.01	0.50	0.01	0.01	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	0.3	0.5	0.3	0.3	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L	0.3	0.3	1.0	0.3	0.3	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L	0.06	0.23	0.06	0.01	0.02	
<b>EP080/071: Total Petroleum Hydrocarbons</b>									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	<50	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW06	SW09	SW05	SW04	SW07		
Client sampling date / time				14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00	14-Feb-2018 00:00			
Compound	CAS Number	LOR	Unit	ES1805055-011	ES1805055-012	ES1805055-013	ES1805055-014	ES1805055-015			
				Result	Result	Result	Result	Result			
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>											
^ >C10 - C40 Fraction (sum)				----	100	µg/L	<100	<100	<100	<100	
^ >C10 - C16 Fraction minus Naphthalene (F2)				----	100	µg/L	<100	<100	<100	<100	
<b>EP080: BTEXN</b>											
Benzene				71-43-2	1	µg/L	<1	<1	<1	<1	
Toluene				108-88-3	2	µg/L	<2	<2	<2	<2	
Ethylbenzene				100-41-4	2	µg/L	<2	<2	<2	<2	
meta- & para-Xylene				108-38-3	106-42-3	2	µg/L	<2	<2	<2	
ortho-Xylene				95-47-6	2	µg/L	<2	<2	<2	<2	
^ Total Xylenes				----	2	µg/L	<2	<2	<2	<2	
^ Sum of BTEX				----	1	µg/L	<1	<1	<1	<1	
Naphthalene				91-20-3	5	µg/L	<5	<5	<5	<5	
<b>EP080S: TPH(V)/BTEX Surrogates</b>											
1,2-Dichloroethane-D4				17060-07-0	2	%	108	94.4	96.4	91.0	98.7
Toluene-D8				2037-26-5	2	%	94.1	90.0	93.3	80.8	99.6
4-Bromofluorobenzene				460-00-4	2	%	93.9	88.5	89.0	83.4	94.5



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	QC2	----	----	----	----
Client sampling date / time			14-Feb-2018 00:00	----	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1805055-016	-----	-----	-----	-----
				Result	----	----	----	----
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
Suspended Solids (SS)	----	5	mg/L	6	----	----	----	----
<b>EA045: Turbidity</b>								
Turbidity	----	0.1	NTU	2.3	----	----	----	----
<b>EG020F: Dissolved Metals by ICP-MS</b>								
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	0.002	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.034	----	----	----	----
<b>EG035F: Dissolved Mercury by FIMS</b>								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
Nitrite + Nitrate as N	----	0.01	mg/L	0.01	----	----	----	----
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	----	----	----	----
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>								
^ Total Nitrogen as N	----	0.1	mg/L	0.3	----	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
Total Phosphorus as P	----	0.01	mg/L	0.03	----	----	----	----
<b>EP080/071: Total Petroleum Hydrocarbons</b>								
C6 - C9 Fraction	----	20	µg/L	<20	----	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	----	----	----	----
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	----	----	----	----
>C10 - C16 Fraction	----	100	µg/L	<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	QC2	----	----	----	----
Client sampling date / time				14-Feb-2018 00:00	----	----	----	----	
Compound	CAS Number	LOR	Unit	ES1805055-016	-----	-----	-----	-----	
				Result	----	----	----	----	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>									
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	----	----	----	----	
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	----	----	----	----	
<b>EP080: BTEXN</b>									
Benzene	71-43-2	1	µg/L	<1	----	----	----	----	
Toluene	108-88-3	2	µg/L	<2	----	----	----	----	
Ethylbenzene	100-41-4	2	µg/L	<2	----	----	----	----	
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	----	----	----	----	
ortho-Xylene	95-47-6	2	µg/L	<2	----	----	----	----	
^ Total Xylenes	----	2	µg/L	<2	----	----	----	----	
^ Sum of BTEX	----	1	µg/L	<1	----	----	----	----	
Naphthalene	91-20-3	5	µg/L	<5	----	----	----	----	
<b>EP080S: TPH(V)/BTEX Surrogates</b>									
1,2-Dichloroethane-D4	17060-07-0	2	%	97.5	----	----	----	----	
Toluene-D8	2037-26-5	2	%	91.6	----	----	----	----	
4-Bromofluorobenzene	460-00-4	2	%	88.0	----	----	----	----	



## Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
<b>EP080S: TPH(V)/BTEX Surrogates</b>			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

## QUALITY CONTROL REPORT

<b>Work Order</b>	: <b>ES1805055</b>	Page	: 1 of 7
Client	: <b>GHD PTY LTD</b>	Laboratory	: Environmental Division Sydney
Contact	: MS JANE CURRAN	Contact	: Customer Services ES
Address	: LEVEL 15, 133 CASTLEREAGH STREET SYDNEY NSW, AUSTRALIA 2000	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 9239 7100	Telephone	: +61-2-8784 8555
Project	: 2316261	Date Samples Received	: 16-Feb-2018
Order number	: 2316261	Date Analysis Commenced	: 16-Feb-2018
C-O-C number	: ----	Issue Date	: 22-Feb-2018
Sampler	: LAIN LINDLEY, ROB WEBB		
Site	: ----		
Quote number	: SY/603/17 A		
No. of samples received	: 16		
No. of samples analysed	: 16		



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

This Quality Control Report contains the following information:

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW



## General Comments

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

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

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

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

## Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 1446546)</b>									
ES1804855-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	21	17	23.7	No Limit
ES1805055-002	SW17	EA025H: Suspended Solids (SS)	----	5	mg/L	6	6	0.00	No Limit
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 1446547)</b>									
ES1805055-012	SW09	EA025H: Suspended Solids (SS)	----	5	mg/L	16	16	0.00	No Limit
ES1805266-003	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	14	15	10.3	No Limit
<b>EA045: Turbidity (QC Lot: 1439314)</b>									
ES1805047-025	Anonymous	EA045: Turbidity	----	0.1	NTU	2.2	2.2	0.00	0% - 20%
ES1805055-006	SW10	EA045: Turbidity	----	0.1	NTU	99.1	99.0	0.101	0% - 20%
<b>EG020F: Dissolved Metals by ICP-MS (QC Lot: 1440926)</b>									
ES1805055-008	SW03	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.005	0.00	No Limit
ES1804869-005	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.003	104	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.037	0.037	0.00	0% - 20%
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.004	0.005	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.010	0.009	0.00	No Limit
<b>EG035F: Dissolved Mercury by FIMS (QC Lot: 1440927)</b>									



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 Work Order : ES1805055  
 Client : GHD PTY LTD  
 Project : 2316261



Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)	
<b>EG035F: Dissolved Mercury by FIMS (QC Lot: 1440927) - continued</b>										
ES1805055-001	SW16	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit	
ES1805055-009	SW01	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 1443292)</b>										
ES1805055-008	SW03	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.44	0.44	0.00	0% - 20%	
ES1804913-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	4.50	4.45	0.965	0% - 20%	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 1443287)</b>										
ES1805055-001	SW16	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.2	0.2	0.00	No Limit	
ES1805055-011	SW06	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	0.3	0.00	No Limit	
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 1443288)</b>										
ES1805055-001	SW16	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.03	0.03	0.00	No Limit	
ES1805055-011	SW06	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.06	0.07	0.00	No Limit	
<b>EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1438750)</b>										
ES1805055-011	SW06	EP071: C15 - C28 Fraction	----	100	µg/L	<100	<100	0.00	No Limit	
		EP071: C10 - C14 Fraction	----	50	µg/L	<50	<50	0.00	No Limit	
		EP071: C29 - C36 Fraction	----	50	µg/L	<50	<50	0.00	No Limit	
ES1805055-015	SW07	EP071: C15 - C28 Fraction	----	100	µg/L	<100	<100	0.00	No Limit	
		EP071: C10 - C14 Fraction	----	50	µg/L	<50	<50	0.00	No Limit	
		EP071: C29 - C36 Fraction	----	50	µg/L	<50	<50	0.00	No Limit	
<b>EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1442272)</b>										
ES1805055-001	SW16	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.00	No Limit	
ES1805055-008	SW03	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.00	No Limit	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 1438750)</b>										
ES1805055-011	SW06	EP071: >C10 - C16 Fraction	----	100	µg/L	<100	<100	0.00	No Limit	
		EP071: >C16 - C34 Fraction	----	100	µg/L	<100	<100	0.00	No Limit	
		EP071: >C34 - C40 Fraction	----	100	µg/L	<100	<100	0.00	No Limit	
ES1805055-015	SW07	EP071: >C10 - C16 Fraction	----	100	µg/L	<100	<100	0.00	No Limit	
		EP071: >C16 - C34 Fraction	----	100	µg/L	<100	<100	0.00	No Limit	
		EP071: >C34 - C40 Fraction	----	100	µg/L	<100	<100	0.00	No Limit	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 1442272)</b>										
ES1805055-001	SW16	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.00	No Limit	
ES1805055-008	SW03	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.00	No Limit	
<b>EP080: BTEXN (QC Lot: 1442272)</b>										
ES1805055-001	SW16	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit	
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit	
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit	
		EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	0.00	No Limit	
			106-42-3							
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit	
	91-20-3	5	µg/L	<5	<5	0.00	No Limit			





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

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

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 1446546)</b>									
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	109	83	129	
				<5	1000 mg/L	93.6	82	110	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 1446547)</b>									
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	129	83	129	
				<5	1000 mg/L	93.4	82	110	
<b>EA045: Turbidity (QCLot: 1439314)</b>									
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	100	91	105	
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 1440926)</b>									
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	98.0	85	114	
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	97.0	84	110	
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	96.8	85	111	
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	98.6	81	111	
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.1	83	111	
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	97.4	82	112	
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	104	81	117	
<b>EG035F: Dissolved Mercury by FIMS (QCLot: 1440927)</b>									
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	87.9	83	105	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1443292)</b>									
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	102	91	113	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1443287)</b>									
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	98.7	69	101	
				<0.1	1 mg/L	98.6	70	118	
				<0.1	5 mg/L	104	74	118	
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1443288)</b>									
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	100	71	101	
				<0.01	0.442 mg/L	108	72	108	
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1438750)</b>									
EP071: C10 - C14 Fraction	----	50	µg/L	<50	2000 µg/L	97.8	76	116	
EP071: C15 - C28 Fraction	----	100	µg/L	<100	3000 µg/L	88.8	83	109	
EP071: C29 - C36 Fraction	----	50	µg/L	<50	2000 µg/L	104	75	113	
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1442272)</b>									
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	79.5	75	127	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1438750)</b>									



Sub-Matrix: WATER

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
						LCS	Low	High
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1438750) - continued</b>								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	2500 µg/L	94.5	76	114
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	3500 µg/L	87.6	81	111
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	1500 µg/L	86.8	77	119
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1442272)</b>								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	80.3	75	127
<b>EP080: BTEXN (QCLot: 1442272)</b>								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	91.6	70	122
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	83.6	69	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	84.7	70	120
EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	10 µg/L	83.4	69	121
	106-42-3							
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	83.5	72	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	83.8	70	120

### Matrix Spike (MS) Report

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

Sub-Matrix: WATER

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery(%) MS	Recovery Limits (%)	
						Low	High
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 1440926)</b>							
ES1804869-005	Anonymous	EG020A-F: Arsenic	7440-38-2	1 mg/L	103	70	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	100	70	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	102	70	130
		EG020A-F: Copper	7440-50-8	1 mg/L	104	70	130
		EG020A-F: Lead	7439-92-1	1 mg/L	100	70	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	104	70	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	105	70	130
<b>EG035F: Dissolved Mercury by FIMS (QCLot: 1440927)</b>							
ES1804842-003	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	93.5	70	130
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1443292)</b>							
ES1804913-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	# Not Determined	70	130
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1443287)</b>							
ES1805055-002	SW17	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	96.5	70	130
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1443288)</b>							



Sub-Matrix: WATER

				Matrix Spike (MS) Report				
				Spike	SpikeRecovery(%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High	
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1443288) - continued</b>								
ES1805055-002	SW17	EK067G: Total Phosphorus as P	----	1 mg/L	112	70	130	
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1438750)</b>								
ES1805055-012	SW09	EP071: C10 - C14 Fraction	----	200 µg/L	122	74	150	
		EP071: C15 - C28 Fraction	----	300 µg/L	113	77	153	
		EP071: C29 - C36 Fraction	----	200 µg/L	126	67	153	
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1442272)</b>								
ES1805055-001	SW16	EP080: C6 - C9 Fraction	----	325 µg/L	75.4	70	130	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1438750)</b>								
ES1805055-012	SW09	EP071: >C10 - C16 Fraction	----	250 µg/L	114	74	150	
		EP071: >C16 - C34 Fraction	----	350 µg/L	110	77	153	
		EP071: >C34 - C40 Fraction	----	150 µg/L	122	67	153	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1442272)</b>								
ES1805055-001	SW16	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	77.7	70	130	
<b>EP080: BTEXN (QCLot: 1442272)</b>								
ES1805055-001	SW16	EP080: Benzene	71-43-2	25 µg/L	88.6	70	130	
		EP080: Toluene	108-88-3	25 µg/L	80.5	70	130	
		EP080: Ethylbenzene	100-41-4	25 µg/L	82.9	70	130	
		EP080: meta- & para-Xylene	108-38-3	25 µg/L	83.0	70	130	
			106-42-3					
		EP080: ortho-Xylene	95-47-6	25 µg/L	86.2	70	130	
	91-20-3	EP080: Naphthalene		25 µg/L	98.7	70	130	



## QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES1805055	Page	: 1 of 9
Client	: GHD PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MS JANE CURRAN	Telephone	: +61-2-8784 8555
Project	: 2316261	Date Samples Received	: 16-Feb-2018
Site	: ----	Issue Date	: 22-Feb-2018
Sampler	: LAIN LINDLEY, ROB WEBB	No. of samples received	: 16
Order number	: 2316261	No. of samples analysed	: 16

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

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

### Summary of Outliers

#### Outliers : Quality Control Samples

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

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

#### Outliers : Analysis Holding Time Compliance

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

#### Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers exist - please see following pages for full details.



### Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
<b>Matrix Spike (MS) Recoveries</b>							
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Ar	ES1804913--002	Anonymous	Nitrite + Nitrate as N	----	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

### Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
<b>Laboratory Control Samples (LCS)</b>					
Total Phosphorus as P By Discrete Analyser	2	20	10.00	15.00	NEPM 2013 B3 & ALS QC Standard

### Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>							
<b>Clear Plastic Bottle - Natural (EA025H)</b>							
SW16, SW15, SW13, SW02, SW01, SW06, SW05, SW07,	SW17, SW14, SW10, SW03, QC01, SW09, SW04, QC2	14-Feb-2018	----	----	----	21-Feb-2018	21-Feb-2018 ✓



Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
<b>EA045: Turbidity</b>							
<b>Clear Plastic Bottle - Natural (EA045)</b>							
SW16, SW15, SW13, SW02, SW01, SW06, SW05, SW07, SW17, SW14, SW10, SW03, QC01, SW09, SW04, QC2	14-Feb-2018	----	----	----	16-Feb-2018	16-Feb-2018	✓
<b>EG020F: Dissolved Metals by ICP-MS</b>							
<b>Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)</b>							
SW16, SW15, SW13, SW02, SW01, SW06, SW05, SW07, SW17, SW14, SW10, SW03, QC01, SW09, SW04, QC2	14-Feb-2018	----	----	----	19-Feb-2018	13-Aug-2018	✓
<b>EG035F: Dissolved Mercury by FIMS</b>							
<b>Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)</b>							
SW16, SW15, SW13, SW02, SW01, SW06, SW05, SW07, SW17, SW14, SW10, SW03, QC01, SW09, SW04, QC2	14-Feb-2018	----	----	----	19-Feb-2018	14-Mar-2018	✓
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>							
<b>Clear Plastic Bottle - Sulfuric Acid (EK059G)</b>							
SW16, SW15, SW13, SW02, SW01, SW06, SW05, SW07, SW17, SW14, SW10, SW03, QC01, SW09, SW04, QC2	14-Feb-2018	----	----	----	20-Feb-2018	14-Mar-2018	✓





Matrix: **WATER**

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>								
<b>Clear Plastic Bottle - Sulfuric Acid (EK061G)</b>								
SW16, SW15, SW13, SW02, SW01, SW06, SW05, SW07,	SW17, SW14, SW10, SW03, QC01, SW09, SW04, QC2	14-Feb-2018	20-Feb-2018	14-Mar-2018	✓	20-Feb-2018	14-Mar-2018	✓
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
<b>Clear Plastic Bottle - Sulfuric Acid (EK067G)</b>								
SW16, SW15, SW13, SW02, SW01, SW06, SW05, SW07,	SW17, SW14, SW10, SW03, QC01, SW09, SW04, QC2	14-Feb-2018	20-Feb-2018	14-Mar-2018	✓	20-Feb-2018	14-Mar-2018	✓
<b>EP080/071: Total Petroleum Hydrocarbons</b>								
<b>Amber Glass Bottle - Unpreserved (EP071)</b>								
SW16, SW15, SW10, SW03, QC01, SW09, SW04, QC2	SW17, SW13, SW02, SW01, SW06, SW05, SW07,	14-Feb-2018	16-Feb-2018	21-Feb-2018	✓	19-Feb-2018	28-Mar-2018	✓
<b>Amber VOC Vial - Sulfuric Acid (EP080)</b>								
SW16, SW15, SW13, SW02, SW01, SW06, SW05, SW07,	SW17, SW14, SW10, SW03, QC01, SW09, SW04, QC2	14-Feb-2018	20-Feb-2018	28-Feb-2018	✓	20-Feb-2018	28-Feb-2018	✓
<b>Clear Plastic Bottle - Natural (EP071)</b>								
SW14		14-Feb-2018	16-Feb-2018	21-Feb-2018	✓	19-Feb-2018	28-Mar-2018	✓



Matrix: **WATER**

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>								
<b>Amber Glass Bottle - Unpreserved (EP071)</b>								
SW16, SW15, SW10, SW03, QC01, SW09, SW04, QC2	SW17, SW13, SW02, SW01, SW06, SW05, SW07,	14-Feb-2018	16-Feb-2018	21-Feb-2018	✓	19-Feb-2018	28-Mar-2018	✓
<b>Amber VOC Vial - Sulfuric Acid (EP080)</b>								
SW16, SW15, SW13, SW02, SW01, SW06, SW05, SW07,	SW17, SW14, SW10, SW03, QC01, SW09, SW04, QC2	14-Feb-2018	20-Feb-2018	28-Feb-2018	✓	20-Feb-2018	28-Feb-2018	✓
<b>Clear Plastic Bottle - Natural (EP071)</b>								
SW14		14-Feb-2018	16-Feb-2018	21-Feb-2018	✓	19-Feb-2018	28-Mar-2018	✓
<b>EP080: BTEXN</b>								
<b>Amber VOC Vial - Sulfuric Acid (EP080)</b>								
SW16, SW15, SW13, SW02, SW01, SW06, SW05, SW07,	SW17, SW14, SW10, SW03, QC01, SW09, SW04, QC2	14-Feb-2018	20-Feb-2018	28-Feb-2018	✓	20-Feb-2018	28-Feb-2018	✓



## Quality Control Parameter Frequency Compliance

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

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Reaular	Actual	Expected	Evaluation	
<b>Laboratory Duplicates (DUP)</b>							
Dissolved Mercury by FIMS	EG035F	2	17	11.76	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	18	11.11	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	4	40	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	16	12.50	10.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	19	10.53	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	20	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
<b>Laboratory Control Samples (LCS)</b>							
Dissolved Mercury by FIMS	EG035F	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	4	40	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	20	15.00	15.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	10.00	15.00	✖	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	16	6.25	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
<b>Method Blanks (MB)</b>							
Dissolved Mercury by FIMS	EG035F	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	40	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	16	6.25	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	19	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
<b>Matrix Spikes (MS)</b>							
Dissolved Mercury by FIMS	EG035F	1	17	5.88	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	5.56	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	16	6.25	5.00	✔	NEPM 2013 B3 & ALS QC Standard

Page : 7 of 9  
 Work Order : ES1805055  
 Client : GHD PTY LTD  
 Project : 2316261



Matrix: **WATER**

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

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Regular	Actual	Expected	Evaluation	
<i>Analytical Methods</i>							
<b>Matrix Spikes (MS) - Continued</b>							
TRH Volatiles/BTEX	EP080	1	19	<b>5.26</b>	<b>5.00</b>	✔	NEPM 2013 B3 & ALS QC Standard



## Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of 'non-filterable' residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (2013) Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl <sub>2</sub> )(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl <sub>2</sub> which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NO <sub>x</sub> ) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO <sub>3</sub> - F. Combined oxidised Nitrogen (NO <sub>2</sub> +NO <sub>3</sub> ) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + No <sub>x</sub> ) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO <sub>3</sub> -. This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015A The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260B Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions



<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510B 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (2013) Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for sparging.

**CHAIN OF CUSTODY**  
ALS Laboratory:  
please tick →

DADELAIDE 21 Burma Road Forth SA 5045  
Ph: 08 8359 0900 E: adeelaide@alsglobal.com  
DUNEDIN 32 Stand Street Dunedin QLD 4013  
Ph: 07 3243 7227 E: samples.dunedin@alsglobal.com  
MELBOURNE 48 Cattle Brand Drive Clifton QLD 4680  
Ph: 07 211 6500 E: j.falstone@alsglobal.com

WAGGA 78 Harbour Road Mackay QLD 4740  
Ph: 07 4844 0177 E: mackay@alsglobal.com  
WARRIMOO 24 Westall Road Springvale VIC 3171  
Ph: 03 8510 0900 E: samples.warrimoo@alsglobal.com  
WYNDHAM 27 Sydney Road Wyndham NSW 2560  
Ph: 02 8372 0735 E: mudgee.mel@alsglobal.com

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TOWNSVILLE 14-15 Deane Court Brisbane QLD 4018  
Ph: 07 4756 0600 E: townsville@alsglobal.com  
WAGGA 99 Kenny Street Wollongong NSW 2500  
Ph: 02 4229 9125 E: portland@alsglobal.com

**CLIENT:** Nowra/Wollongong  
**OFFICE:** Nowra/Wollongong  
**PROJECT:** FB8 PC  
**ORDER NUMBER:** 2316261  
**PROJECT MANAGER:** Jane Curran  
**SAMPLER:** Iain Lindley, Rob Webb  
**COC emailed to ALS\* ( YES / NO )**  
Email Reports to (will default to PM if no other addresses are listed): jane.curran@ghd.com, stefan.charters@ghd.com  
Email Invoice to (will default to PM if no other addresses are listed): jane.curran@ghd.com

**TURNAROUND REQUIREMENTS:**  Standard TAT (list due date):  
 Non Standard or urgent TAT (list due date):  
Standard TAT may be longer for some tests e.g. Ultra Trace Organics  
**ALS QUOTE NO.:** SY/803/17A  
**COC SEQUENCE NUMBER (Circle)**  
COC: 1 2 3 4 5 6 7  
OR: 1 2 3 4 5 6 7

**RELINQUISHED BY:** I. Lindley  
DATE/TIME: 15/12/18 9AM  
**RECEIVED BY:**  
DATE/TIME: 16/12/18 09:30

**FOR LABORATORY USE ONLY (Circle)**  
 Analytical  
 Field  
 Reference  
 Sample  
 Other  
 Other

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE codes below)	TOTAL CONTAINERS	W-02 (Dissolved Metals)	EA045 (Turbidity)	TPH (TRH C6-C40)	NT-11 (Total Nitrogen, Total Phosphorus)	EA025H (Suspended Solids)	Additional Information	
1	SW16	14/02/2018	w		6	x	x	x	x	x	<p>Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.</p> <p>Metals are field filtered</p>	
2	SW17	14/02/2018	w		6	x	x	x	x	x		
3	SW15	14/02/2018	w		6	x	x	x	x	x		
4	SW14	14/02/2018	w		6	x	x	x	x	x		
5	SW13	14/02/2018	w		6	x	x	x	x	x		
6	SW10	14/02/2018	w		6	x	x	x	x	x		
7	SW02	14/02/2018	w		6	x	x	x	x	x		
8	SW03	14/02/2018	w		6	x	x	x	x	x		
9	SW01	14/02/2018	w		6	x	x	x	x	x		
10	QC01	14/02/2018	w		6	x	x	x	x	x		
11	SW02	14/02/2018	w		6	x	x	x	x	x		
12	SW06	14/02/2018	w		18	x	x	x	x	x		
					<b>TOTAL</b>	84						

**Water Container Codes:** P = Unpreserved Plastic; N = Nitrite Preserved Plastic; ORC = Nitrite Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic; V = VOA Via HCl Preserved; VB = VOA Via Sulfuric Preserved; VS = VOA Via Sulfuric Preserved; AV = Airfreight Unpreserved Vial; SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speculation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Solts; B = Unpreserved Bag.

Environmental Division  
Sydney  
Work Order Reference  
ES1805055  
Telephone: +61-2-8794 8655





## Attachment E - Calibration Certificates



AirMet Scientific P/L  
7-11 Ceylon Street  
Nunawading  
Victoria 3131, Australia

# Calibration Certificate

This document hereby certifies that this instrument detailed has been calibrated to the parameters listed below.

Certificate Print Date: 9 February, 2018  
Calibration Date: 8 February, 2018  
Next Calibration Due: 8 August, 2018

Call ID: 00214690  
Arrow Job Code: 227977

Customer:	GHD Pty Ltd	Type:	Water Meter
Model:	WATERMETER	Serial No:	13J100151
Description:	YSI Pro Plus Water Quality Meter		

Sensor	Serial No	Standard Solutions	Certified	Solution # (Bottle #)	Instrument Reading	Units
Dissolved Oxygen		0%		1612235007	0	%
EC		2.76 ms/cm		312321	2.76	ms/cm
Ph		pH 7.0		307926	7.02	pH
Ph		pH 4.0		307927	4.00	pH
Redox		231.58mV		305536/305538	231.6	mV
Temp		21.1°C		MultiTherm	21.1	°C

Completed by: Wentao Zhang	Signed: 
----------------------------	--

Australian Standard Alarm Levels

## Attachment F - Laboratory Quality Assurance and Quality Control Results

### *Field Program surface water*

Intra-laboratory duplicate samples were collected and analysed as part of the surface water sampling program and the relative percentage differences (RPD) were calculated. Intra-laboratory measures the reproducibility of measurements under a given set of conditions. The precision of the data is assessed by calculating the Relative Percent Difference (RPD) between duplicate sample pairs.

$$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where  $C_o$  = Analyte concentration of the original sample  
 $C_d$  = Analyte concentration of the duplicate sample

GHD adopts a nominal acceptance criterion of 30% RPD for field duplicates and splits for inorganics and a nominal acceptance criterion of 50% RPD for field duplicates and splits for organics, however it is noted that this may not always be achieved, particularly at low analyte concentrations. Surface water QA/QC results are presented as Table B2, Attachment B.

NO discrepancies in GHD's adopted criterion for RPDs calculated for the intra laboratory duplicate pairs for the analytes tested were detected.

### *Laboratory Program*

The NATA accredited laboratories utilised for this assessment (ALS) undertook their own quality assurance and quality control procedures for sample analysis. GHD has reviewed the internal laboratory control data provided within the laboratory reports, which are attached in the laboratory reports as Error! Reference source not found..

The laboratory provided the following summary of QA/QC Compliance Assessment:

- No method blank outliers occur
- No duplicate outliers occur
- No laboratory control outliers occur
- Matrix spike outliers exist: Matrix spike recovery could not be determined in a nitrite plus nitrate as N sample due to a background level greater than or equal to four times spike level.
- For all regular sample matrices, no surrogate recovery outliers occur
- No analysis holding time outliers exist.
- A quality control sample frequency outlier exists: A laboratory control sample (LCS) for Total Phosphorus as P had a quality control frequency just outside of specification.

All samples were noted to be correctly preserved. All samples were received within recommended holding times.

### *Summary of Quality Assurance / Quality Control Results*

Matrix Spike (MS) was not determined in Nitrite plus Nitrate as N (NOx) because background levels were greater than or equal to for times the spike level. This QA/QC results indicates sample matrix interference may be occurring for NOx and would therefore impact on reported Total Nitrogen results.

Remaining QA/QC results show that the samples collected have met the appropriate standards and therefore, the data was considered to be valid and of sufficient quality to meet the data quality objectives for the assessment.

## Attachment G - Field sheets



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME: 09:15  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW01

COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION ~~SWOT~~ OF ROAD, UNDER BRIDGE, SAMPLE TAKEN ABOVE RIPPLE IN CREEK

ENVIRONMENTAL OBSERVATIONS  
 WEATHER FINE  
 VEGETATION THICK GRASS, AND SHRUBS, SAMPLE UNDER BRIDGE  
 SLOPE SLOPE FROM ROAD EDGE  
 EROSION NIL.  
 OTHER SAMPLE TAKEN JUST ABOVE RIPPLE IN CREEK, CLEAR WATER

### FIELD MEASUREMENTS

SAMPLE		SW01	
TEMPERATURE (°C)	21.6	21.7	
CONDUCTIVITY (uS/cm)	146.2	146.1	
pH	7.22	7.12	
DO (ppm)	7.49	7.46	
REDOX (mV)	76.0	74.7	

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW01	2x (1L unpreserved, 2x pH in vinyl, purple, orange, red) = 12	using	QCI	DISSOLVED METALS

FIELD SUPERVISOR IL CHECKED (SIGN & DATE) I.L. 14/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME: 10:10  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW02

COORDINATES/GPS (If Applicable) -

SAMPLING METHOD (ie grab, bucket) Grab

DETAILED SAMPLE LOCATION DESCRIPTION DOWNSTREAM OF SW01, SAMPLE TAKEN BELOW WEIR, NEAR BUBBLES

## ENVIRONMENTAL OBSERVATIONS

WEATHER FINE, CLEAR  
 VEGETATION TREES, SHRUBS + THICK GRASS ALONG CREEK  
 SLOPE RELATIVELY FLAT  
 EROSION NIL  
 OTHER FAST FLOWING BELOW WEIR, CLEAR WATER

SW02

## FIELD MEASUREMENTS

SAMPLE	ADJACENT BUBBLES.	(JUST BELOW WEIR) FAST FLOWING	← 5min → (JUST BELOW WEIR) FAST FLOWING
TEMPERATURE (°C)	22.1	22.3	22.3
CONDUCTIVITY (uS/cm)	150.8	130.4	151.7
pH	7.05	6.89	6.87
DO (ppm)	7.0	7.3	7.33
REDOX (mV)	155.6	151.5	109.8

(Fluctuating around 110)

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW02	6	Various	-	SAMPLE TAKEN CENTRE OF CREEK BELOW WEIR NEAR BUBBLES.

FIELD SUPERVISOR IL. CHECKED (SIGN & DATE) I.L. 14/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME: 10:50  
 CLIENT: RMS SAMPLING OFFICERS: JL, RW  
 SITE: SW03  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION PROPERTY SITE, THROUGH FINE, FAST FLOWING RIPPLE SECTION OF CREEK

ENVIRONMENTAL OBSERVATIONS  
 WEATHER FINE, SUNNY  
 VEGETATION THICK GRASS, TREES, WETLANDS  
 SLOPE FLAT, WITH SLOPING BANKS  
 EROSION NIL  
 OTHER COW DUNG NOTICED NEAR SAMPLE LOCATION - ~~COWS~~, CLEAR WATER

FIELD MEASUREMENTS

SAMPLE	SW03		
TEMPERATURE (°C)	22.3		
CONDUCTIVITY (uS/cm)	147.9		
pH	6.81		
DO (ppm)	6.77		
REDOX (mV)	99.8		

HYDROLOGICAL DATA  
 FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW03	6	various	-	SAMPLE FROM RIPPLE

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) I.L. 14/2/18





# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
PROJECT NAME: FBB PC TIME: 13:00  
CLIENT: RMS SAMPLING OFFICERS: IL, RW  
SITE: SW04  
COORDINATES/GPS (If Applicable) -  
SAMPLING METHOD (ie grab, bucket) Grab  
DETAILED SAMPLE LOCATION DESCRIPTION BEHIND BED AND BREAKFAST - DEEPER SPOT

ENVIRONMENTAL OBSERVATIONS  
WEATHER SUNNY  
VEGETATION LOW SHRUBS, + TREES  
SLOPE STEEP FROM WATERS EDGE  
EROSION NIL  
OTHER CLEAR WATER,

FIELD MEASUREMENTS

SAMPLE	SW04		
TEMPERATURE (°C)	22.5		
CONDUCTIVITY (uS/cm)	82.9		
pH	6.70		
DO (ppm)	5.81		
REDOX (mV)	74.8		

HYDROLOGICAL DATA  
FLOW MEASUREMENT (or stream height if rating table available) -  
CROSS SECTION WIDTH (m) -  
DEPTH (m) -  
OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW04	18 (3 x 6)	Varying	-	TELESCOPIC FROM DEEPER SPOT.

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) I.L. 14/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME: 11:20  
 CLIENT: RMS SAMPLING OFFICERS: JL, RW  
 SITE: SW05  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION TANNERY ROAD, UNDER BRIDGE

## ENVIRONMENTAL OBSERVATIONS

WEATHER FINE, SUNNY  
 VEGETATION THICK BUSH ALONG CREEK  
 SLOPE STEEP EDGE DOWN TO WATER  
 EROSION SOME BANK EROSION  
 OTHER STILL WATER, CLEAR WATER

## FIELD MEASUREMENTS

SAMPLE	SW05		
TEMPERATURE (°C)	22.2		
CONDUCTIVITY (uS/cm)	146.3		
pH	6.67		
DO (ppm)	6.14		
REDOX (mV)	95.2		

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW05	6	varies	-	TELESCOPIC SAMPLER FROM EDGE

FIELD SUPERVISOR J.L. CHECKED (SIGN & DATE) J.L. 14/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME: 13:30  
 CLIENT: RMS SAMPLING OFFICERS: JL, RW  
 SITE: SW06  
 COORDINATES/GPS (If Applicable) —  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION NEXT TO FH OFFICE, POND NEAR BRIDGE

## ENVIRONMENTAL OBSERVATIONS

WEATHER SUNNY, HOT, > 30°C  
 VEGETATION THICK GRASS  
 SLOPE FLAT  
 EROSION NIL.  
 OTHER CLOSE TO FH SITE, STOCKPILED MATERIALS + CONSTRUCTION EQUIPMENT  
 algae, cloudy water, no flow (stagnant pond, decaying plant matter).

## FIELD MEASUREMENTS

SAMPLE		(2m from previous)	
TEMPERATURE (°C)	29.3	30.1	
CONDUCTIVITY (uS/cm)	255.1	254.7	
pH	8.87	8.90	
DO (ppm)	13.38	9.80	
REDOX (mV)	42.9	136.0	

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) —  
 CROSS SECTION WIDTH (m) —  
 DEPTH (m) —  
 OTHER —

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW06	18 (3x6)	Vanies	—	POND <del>CL</del>

FIELD SUPERVISOR JL CHECKED (SIGN & DATE) JL 14/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME: 14:05  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW07  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION BEHIND BOWLING CLUB

## ENVIRONMENTAL OBSERVATIONS

WEATHER SUNNY, HOT  
 VEGETATION CUT GRASS, THICK TREES  
 SLOPE GENTLY FROM CLUB  
 EROSION NIL.  
 OTHER CLEAR WATER, REEDS IN WATER, SLOW FLOW.

## FIELD MEASUREMENTS

SAMPLE			
TEMPERATURE (°C)	22.5	22.5	
CONDUCTIVITY (uS/cm)	85.7	85.7	
pH	6.95	6.86	
DO (ppm)	5.50	5.82	
REDOX (mV)	267.6	275.3	

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW07	24 (4x6)	Variety	QC2	IN FRONT OF LARGE TREE

FIELD SUPERVISOR IL CHECKED (SIGN & DATE) IL 14/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME: 15:40  
 CLIENT: RMS SAMPLING OFFICERS: J.L, R.W  
 SITE: SW # 08  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION RAWLEY LANE, PROPER M, END OF ROCKY CK.

ENVIRONMENTAL OBSERVATIONS

WEATHER SUNNY  
 VEGETATION SHRUBS, TREES,  
 SLOPE STEEP BANKS  
 EROSION NIL.  
 OTHER DRY. \* DID NOT SAMPLE \*

FIELD MEASUREMENTS

SAMPLE	TEMPERATURE (°C)	CONDUCTIVITY (uS/cm)	pH	DO (ppm)	REDOX (mV)

HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
-	0	-	-	-

FIELD SUPERVISOR J.L. CHECKED (SIGN & DATE) J.L 14/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18

PROJECT NAME: FBB PC TIME: 11:50

CLIENT: RMS SAMPLING OFFICERS: IL, RW

SITE: SW09

COORDINATES/GPS (If Applicable) -

SAMPLING METHOD (ie grab, bucket) Grab

DETAILED SAMPLE LOCATION DESCRIPTION NEAR FH OFFICE, DRIVE IN GRASS, UNDER BRIDGE  
ORANGE + GREEN ALGAE, SLIGHT OILY SHEEN

ENVIRONMENTAL OBSERVATIONS ON SURFACE, LOW FLOW

WEATHER SUNNY

VEGETATION THICK GRASS

SLOPE FLAT

EROSION NIL

OTHER GREEN ALGAE, SLIGHT RUSTY ORANGE COLOUR, SLIGHT OILY SHEEN, LOW FLOW

## FIELD MEASUREMENTS

SAMPLE	SW09		
TEMPERATURE (°C)	22.9		
CONDUCTIVITY (uS/cm)	273.2		
pH	6.40		
DO (ppm)	0.55		
REDOX (mV)	-3.0		

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -

CROSS SECTION WIDTH (m) -

DEPTH (m) -

OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW09	18 (3x6)	various	-	SAMPLE JUST ABOVE ROCKS NEAR REEDS.

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) I.L. 14/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME: 15:05  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW10

COORDINATES/GPS (If Applicable) —  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION BOTTOM OF STONE CREEK, RAWLINGS ROAD (ABOVE POND)

ENVIRONMENTAL OBSERVATIONS  
 WEATHER SUNNY, HOT  
 VEGETATION PASTURE, Paddock  
 SLOPE GENTLE SLOPE TO POND  
 EROSION SOME EROSION IN CHANNEL TO POND  
 OTHER ALGAE BLOOM (GREEN), STAGNANT POOL, NO FLOW, CLEAR DEAD ANIMAL SMELL

### FIELD MEASUREMENTS

SAMPLE	TEMPERATURE (°C)	CONDUCTIVITY (uS/cm)	pH	DO (ppm)	REDOX (mV)
	27.2	274.2	8.48	10.0	120.5

(fluctuating)

HYDROLOGICAL DATA  
 FLOW MEASUREMENT (or stream height if rating table available) —  
 CROSS SECTION WIDTH (m) —  
 DEPTH (m) —  
 OTHER —

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW10	18 (3x6)	None	—	SAMPLE FROM POND

FIELD SUPERVISOR IL CHECKED (SIGN & DATE) IL 14/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME: 6:15pm  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW11  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION end of George Street, channel

**ENVIRONMENTAL OBSERVATIONS**

WEATHER sunny  
 VEGETATION grass, scrubs + trees  
 SLOPE channel, flat  
 EROSION nil  
 OTHER small puddle, did not sample, no flow

**FIELD MEASUREMENTS**

SAMPLE	TEMPERATURE (°C)	CONDUCTIVITY (uS/cm)	pH	DO (ppm)	REDOX (mV)

**HYDROLOGICAL DATA**

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
-	0	-	-	-

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) I.L. 14/2/18





# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME: 15:50  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW12  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION SIDE OF ROAD, INSIDE METAL FENCE, GATE

## ENVIRONMENTAL OBSERVATIONS

WEATHER ~~NOT~~ SUNNY  
 VEGETATION THICK GRASS  
 SLOPE UNDULATING  
 EROSION NIL.  
 OTHER DRY & DID NOT SAMPLE \*

## FIELD MEASUREMENTS

SAMPLE			
TEMPERATURE (°C)			
CONDUCTIVITY (uS/cm)			
pH			
DO (ppm)			
REDOX (mV)			

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
-	0	-	-	- DRY.

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) I.L. 14/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME: 16:50  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW13

COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION ENTRANCE ROAD TO BUND LARE - SMALL CK.

**ENVIRONMENTAL OBSERVATIONS**  
 WEATHER SUNNY  
 VEGETATION CUT GRASS, TREES  
 SLOPE CHANNEL BANKS, REST FLAT  
 EROSION SOME EROSION OF BANKS  
 OTHER ALGAE, CLEAR WATER, LOW FLOW.

### FIELD MEASUREMENTS

SAMPLE			
TEMPERATURE (°C)	27.5		
CONDUCTIVITY (uS/cm)	460.6		
pH	8.63		
DO (ppm)	9.1		
REDOX (mV)	51.4		

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW13	6	Varing	-	ONE SAMPLE - SURF DRY

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) I.L. 14/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME: 17:15  
 CLIENT: RMS SAMPLING OFFICERS: 1L, RW  
 SITE: SW14  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION Rocky area up from SW15, shallow stagnant rock pool next to road

ENVIRONMENTAL OBSERVATIONS  
 WEATHER SUNNY  
 VEGETATION ROCKS, SHRUBS, GRASS  
 SLOPE STEEP DOWN FROM ROAD  
 EROSION NIL  
 OTHER ALGAE, CLEAR WATER, NO ODOUR.

### FIELD MEASUREMENTS

SAMPLE			
TEMPERATURE (°C)	22.5		
CONDUCTIVITY (uS/cm)	661.0		
pH	7.80		
DO (ppm)	5.06		
REDOX (mV)	42.7		

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW14	18 (3x6)	Various	-	FROM POOL

FIELD SUPERVISOR T.L. CHECKED (SIGN & DATE) T.L. 14/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME: 16:40  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW15  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION ACED CARE - BUPA, DOWN GRASS HILL, THROUGH FENCE, POND NEAR WILLOW TREE 20M FROM ROAD.

ENVIRONMENTAL OBSERVATIONS

WEATHER SUNNY  
 VEGETATION BUSHY, GRASSY  
 SLOPE SLOPING BANKS  
 EROSION NIL  
 OTHER ALWAYS, SLIGHTLY CLOUDY, POND, LOW - NO FLOW.

FIELD MEASUREMENTS

SAMPLE			
TEMPERATURE (°C)	22.8	22.8	
CONDUCTIVITY (uS/cm)	399.1	399.1	
pH		6.84	
DO (ppm)		0.45	
REDOX (mV)		-30.6	

HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW15	18 (6x3)	Uning	-	-

FIELD SUPERVISOR IL CHECKED (SIGN & DATE) IL 14/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME:  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW16  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION ~~ROUGH AREA UP FROM SW~~ UP SIDE OF BRIDGE FROM SW17

### ENVIRONMENTAL OBSERVATIONS

WEATHER SUNNY  
 VEGETATION SAME AS SW17  
 SLOPE " "  
 EROSION " "  
 OTHER " " NOT CONNECT DIRECTLY TO SW17. (SEPERATE "POND")  
 NO FLOW.

### FIELD MEASUREMENTS

SAMPLE			
TEMPERATURE (°C)	28.5	28.0	
CONDUCTIVITY (uS/cm)	298.0	296.2	
pH	6.74	6.72	
DO (ppm)	11.64	11.65	
REDOX (mV)	89.5	89.9	

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW16	18 13x6	Vary	-	SAMPLE ~ 5m FROM FENCE

FIELD SUPERVISOR LL CHECKED (SIGN & DATE) LL 14/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 14/2/18  
 PROJECT NAME: FBB PC TIME: 17:35  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW17  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION TELEPHONE LINE, POND UNDER BRIDGE

ENVIRONMENTAL OBSERVATIONS  
 WEATHER SUNNY - SAMPLE IN SHADE  
 VEGETATION LOW SHRUBS, WEEDS  
 SLOPE STEEP ROCK FILL EMBANKMENT  
 EROSION NIL  
 OTHER ALGAE, CLEAR WATER, NO ODOUR, NO FLOW

FIELD MEASUREMENTS

SAMPLE			
TEMPERATURE (°C)	21.1		
CONDUCTIVITY (uS/cm)	338.3		
pH	6.70		
DO (ppm)	5.80		
REDOX (mV)	76.0		

HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -

CROSS SECTION WIDTH (m) -

DEPTH (m) -

OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW17	18 (3x6)	Vanig	-	SAMPLE POND UNDER BRIDGE

FIELD SUPERVISOR T.C. CHECKED (SIGN & DATE) T.C. 14/2/18



28 May 2018

Ryan Whiddon  
Roads and Maritime Services  
PO Box 477  
Wollongong NSW 2500

Our ref: 23/16261  
Draft A

Dear Ryan,

## **Surface Water Monitoring – Post Construction Event 2 (Major Event 1)**

### **1 Scope and limitations**

In accordance with the Princes Highway upgrade for Foxground and Berry Bypass (FBB) - Water Monitoring Project Brief (*Contract No. 17.0000303651.0922*), GHD undertook surface water monitoring at 17 locations (SW01 to SW17) after a major rainfall event ( $\geq 50$  mm rain in a 24 hour period). During the operational phase, minor events are considered to have occurred when at least 15 mm of rainfall has fallen in the past 24 hours, and major events where at least 50 mm of rainfall in the past 24 hours has occurred.

Sampling locations have been selected based on their proximity to permanent water quality basins located along the FBB alignment and proximity to operational water control measures (such as sedimentation basins and vegetation swales). This report documents the second surface water sampling event (Event 2) undertaken since the completion of construction, which is also the first major surface water sampling event (Major Event 1) since operation began in October 2017. Limitations are provided in Section 5.

The objective of this monitoring event is to collect and assess upstream and downstream waterway data to contribute to their eventual certification. Certification of waterways as remediated has not occurred; therefore, all 17 locations were monitored during this event.

### **2 Field Program**

Surface water sampling was undertaken at all surface water sampling locations on the 26 February 2018; refer to Figure 1, Attachment A for sampling locations. This monthly surface water sampling event was conducted in accordance with the sampling program and protocols provided in:

- GHD 2014, Foxground to Berry Bypass Water Quality Management - Surface Water and Groundwater Sampling Protocol, prepared for Roads and Maritime Services.
- GHD 2016, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services
- GHD 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring Report, prepared for Roads and Maritime Services

Field parameters were measured during the monitoring event including temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), and reduction-oxidation potential (redox), and are provided in Table B1, Attachment B. Field sheets are provided in Attachment G.

Where 10% difference in field parameters is observed at a location, another two samples are collected at the location and its associated upstream or downstream location. During this event an additional two samples were collected from SW04, SW07, SW09, SW12 and SW13.

Water samples were submitted to a NATA certified testing laboratory (ALS) to be analysed for the following analysis:

- Turbidity
- Total suspended solids (TSS)
- Total recoverable hydrocarbons (TRH)
- Total Phosphorus and Total Nitrogen
- Heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn)

All locations had stream flow and were therefore able to be sampled.

### 3 Results and Discussion

This section presents control charts and discusses results in respect to exceedances of criteria or inconsistencies in the surface water results for Event 2 (Major Event 1) in accordance with:

- The limitations provided in Section 5.
- GHD 2016, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services.
- GHD 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring Report, prepared for Roads and Maritime Services.

#### 3.1 Control charts

The surface water locations have been grouped into separate control charts by the specific surface water bodies they are located within and whether they are up and down gradient of the FBB alignment. The upstream locations represent the ‘reference’ (un-impacted) sites while the down-stream locations represent the ‘test’ sites (impacted by operation). By comparing upstream water quality with down-stream water quality using the control chart methods it is expected that impacts will be able to be adequately characterised during operation. The groupings used for the control charts are summarised in Error! Reference source not found..

**Table 1 Surface water locations within specific surface water bodies**

Surface water location	Upstream of Alignment	Downstream of Alignment
Broughton Creek	SW01	SW02, SW03, SW05
Connelly’s Creek and Broughton Mill Creek and Bundewallah Creek	SW04, SW06	SW07, SW09
Bundewallah Creek and Connelly’s Creek	SW08	SW06
Town Creek (realigned)	SW10	SW11



Hitchcocks Lane Creek Tributary	SW12	SW13
Hitchcocks Lane Creek	SW14	SW15
Unnamed Tributary	SW16	SW17

The primary control chart indicators for assessing potential impacts associated with the FBB upgrade works during operation for Event 2 include pH, turbidity, TSS and heavy metals. The control charts for are presented in Attachment C.

Operational data has been compared against baseline data in the control charts to understand what changes may be occurring following the construction of the FBB. Final 80<sup>th</sup> percentile data and median data from baseline monitoring has been used for pH, turbidity and TSS and maximum baseline values have been used for heavy metal results as an upper threshold. Control charts for metals are unable to include 80<sup>th</sup> percentile or median data as concentrations are usually zero or very low. 80<sup>th</sup> Percentile and median data will become more accurate with more sampling events.

A review of Event 2 control charts is provided in Section 3.4.

### 3.2 Recorded rainfall event

The rainfall within Broughton Creek catchment and the surface water flows within Broughton Creek are presented in Figure 2, Attachment A. This information was obtained from the NSW Office of Water (NOW) website (<http://realtimedata.water.nsw.gov.au/water.stm>). The location of this gauge is on Broughton Mill Creek approximately 2 km upstream of SW04.

The data in Figure 2 illustrates a high correlation between rainfall and river flow, with a spike in rainfall coinciding with a spike in river flow. The surface water sampling events are also marked on Figure 2, Attachment A.

### 3.3 Surface water monitoring QA/QC

Surface water analytical results for the suite listed in Section 2, are tabulated against selected criteria (in accordance with the protocol documents detailed in Section 2) in Table B1 and B2 of Attachment B. Laboratory certificates are provided in Attachment D.

Sampling was completed as per the method outlined within the project WQMP. The water quality meter used during water quality monitoring is certified every six months and between certification, calibrated before each event. Evidence of calibration is provided in Attachment E.

A field quality control and laboratory control assessment of the results from this monthly monitoring round (Event 2 – Major Event 1) is provided in Attachment F. Sample SW10\_1 was overdue for laboratory analysis of Turbidity by one day. Visual field observations at this location (SW10) will assist in the review of turbidity results.

### 3.4 Discussion of Results

The field and laboratory analytical results are summarised in Attachment B. The adopted assessment criteria are also included in these tables. Laboratory reports are included in Attachment D. Exceedances of assessment criteria in samples analysed are highlighted in these tables and exceedances reported for Event 2 are discussed in the following sections.

### **3.4.1 pH (field)**

Exceedances of assessment criteria in samples analysed in the field included:

Upstream locations:

- The operational 80<sup>th</sup> percentile for SW14 exceeded the baseline 80<sup>th</sup> percentile
- SW16 exceeded the ADWG 2015 Aesthetic guidelines although did not exceed the ANZECC criteria.

Downstream locations:

- SW17 exceeded the ADWG 2015 Aesthetic guidelines although did not exceed the ANZECC criteria which is consistent with the associated upstream location SW16
- The operational pH median was above the baseline median values for SW06, SW13 and SW15
- The pH 80<sup>th</sup> percentile value was exceeded at location SW06 where SW08 is the 80<sup>th</sup> percentile suggesting impacts may be occurring downstream of SW08. SW06 also exceeded the baseline 80<sup>th</sup> percentile value for SW08.
- pH median for downstream location SW07 was above the 80<sup>th</sup> Percentile for SW04 which is one of its reference sites but below the 80<sup>th</sup> percentile for SW06 which is a secondary reference site. This may suggest water flowing at SW07 is predominantly sourced from the waterway containing SW06 (Bundewallah and Connelly's Creek).

No results were outside the selected ANZECC 2000 – Lowland Rivers (NSW rivers) guidelines.

pH results have been graphed in control charts available in Attachment C.

### **3.4.2 Turbidity and Total Suspended Solids (TSS)**

Exceedances in samples analysed for Turbidity and TSS include the following:

Downstream:

- Turbidity exceeded ANZECC criteria at location SW15 with a value of 112 mg/L located in the Hitchcocks Lane Creek. SW15 is downstream of SW14 which did not have an exceedance. The control charts for this waterway indicate the median value is below the 80<sup>th</sup> percentile therefore exceedances may be part of background variation at this site.
- TSS for SW06 was above the 80<sup>th</sup> percentile for its reference site SW08.
- TSS for SW13 was above the 80<sup>th</sup> percentile for its reference site SW12.
- TSS for SW15 was slightly above the 80<sup>th</sup> percentile for its reference site SW14.
- Location SW09 median for turbidity was above the 80<sup>th</sup> percentile for its reference site SW06.

No TSS exceedances occurred against the ANZECC criteria for any of the sampling locations.

Results have been graphed in control charts against baseline 80<sup>th</sup> percentile and median values. These charts can be found in Attachment C.

### **3.4.3 Electrical Conductivity (field)**

The following exceedances were identified for Electrical Conductivity:

Upstream:

- Electrical Conductivity (EC) ANZECC 2000 criteria exceedances occurred SW14.

Downstream:

- EC ANZECC criteria was exceeded at locations SW13 and SW15. SW15 upstream location is SW14 which also have an EC exceedance indicating background variation. SW13 reference site SW12 had high EC values although they were just within the ANZECC criteria.

#### **3.4.4 Nitrogen and Phosphorus**

Exceedances in samples analysed for Nitrogen and Phosphorus include the following:

Upstream:

- All upstream locations had Nitrogen exceedances against the ANZECC guidelines.
- All upstream locations had Phosphorus exceedances against the ANZECC guidelines other than SW04.
- The highest Total Nitrogen exceedance was in SW10 with 3 mg/L.
- Due to upstream locations having both nitrogen and phosphorus exceedances, suggests background variation is occurring.

Downstream:

- All downstream locations had Nitrogen exceedances against the ANZECC guidelines. Upstream locations also had exceedances suggesting background variation is contributing to results.
- All downstream locations had Phosphorus exceedances against the ANZECC guidelines including SW07 the downstream location of SW04 which did not have an exceedance. SW07 also receives water from another sources which has likely contributed to this exceedance.
- The highest Total Phosphorus exceedance was in SW11 with 1.2 mg/L.

#### **3.4.5 TRH**

No TRH's were detected above Limit of Reporting (LOR) during this event. No oily sheen was observed within creeks sampled during sampling Event 2 which is consistent with laboratory results. .

#### **3.4.6 Heavy Metals**

The concentrations for dissolved heavy metals (with detectable concentrations) were plotted in time series to assess the changes before and after construction and identify any emergence of trends. Control charts have not been included as the metals data generally have a high percentage of values below detection limits. This resulted in identified exceedances in the control charts that were associated with statistical issues rather than trends in the data. Time series graphs of the results were created for the following metals:

- Copper
- Zinc.

The results graphs for Event 2 are presented in Attachment F and are summarised below.

##### **Copper**

Concentrations of copper are similar to those detected during baseline pre-construction monitoring.

The following exceedances against the ANZECC (2000) 95% Freshwater guidelines occurred:

Upstream:

- All locations had copper exceedances other than location SW04.

- The maximum copper baseline value was exceeded at locations, SW08, SW12 and SW14.

Downstream:

- All downstream locations had copper exceedances
- The maximum copper baseline value was exceeded at locations SW05, SW09, SW11 and SW13.

### **Zinc**

The following exceedances against criteria and baseline maximum values were detected:

Upstream:

- All upstream locations exceeded criteria other than locations SW08 which was just below criteria.

Downstream:

- All downstream locations exceeded criteria other than locations SW03 and SW09. Associated upstream locations had zinc exceedances suggesting background variation is occurring.
- Associated downstream locations for detected exceedances in upstream were not above selected criteria or above maximum values detected during baseline monitoring.
- Exceedances in SW05 and SW11 were slightly above the baseline maximum value. SW06, SW13 and SW17 had exceedances above their baseline maximum value.

### **Chromium (III +VI)**

Chromium exceedances against the ANZECC 2000 95% fresh water criteria were detected during Event 2 monitoring. The following exceedances occurred:

Upstream:

- Location SW04, SW10 and SW12 detected exceedances for Chromium.

Downstream:

- No locations detected exceedances other than location SW13 which also had an upstream exceedance.

## **4 Conclusion**

Upstream exceedances in Nitrogen, Phosphorus and metals at locations suggest background variation may be occurring within a number of catchments along the FBB alignment which is consistent with baseline monitoring. A number of downstream locations have zinc concentrations above the maximum value recorded during baseline monitoring. Further sampling should clarify if this is an emerging trend.

pH control charts for location SW08 and SW06 suggest impacts may be occurring from operation in this waterway. A large stockpile of material is located near SW06 within the construction compound and may be contributing to this result.

Total suspended solids control charts indicate impacts may be occurring at SW06, SW13 and SW15 although results did not exceed ANZECC criteria. Further sampling should indicate if this is an emerging trend at these locations.

Turbidity control charts for SW09 suggest turbidity impacts are occurring upstream of this location and near location SW06, although ANZECC criteria was not exceeded. This may be due to the nearby stockpiled soil material at the site compound.

Further sampling should clarify if pH, TSS and turbidity exceedances are suggesting residual impact remains.

## **5 Limitations**

This report has been prepared by GHD Pty Ltd (GHD) for Roads and Maritime Services (RMS) and may only be used and relied on by RMS for the purpose agreed between GHD and RMS as set out in Section 1 of this report.

GHD otherwise disclaims responsibility to any person other than RMS arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Roads and Maritime Services and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

Please contact the undersigned if you have any questions or require further information.

Sincerely,

GHD Pty Ltd

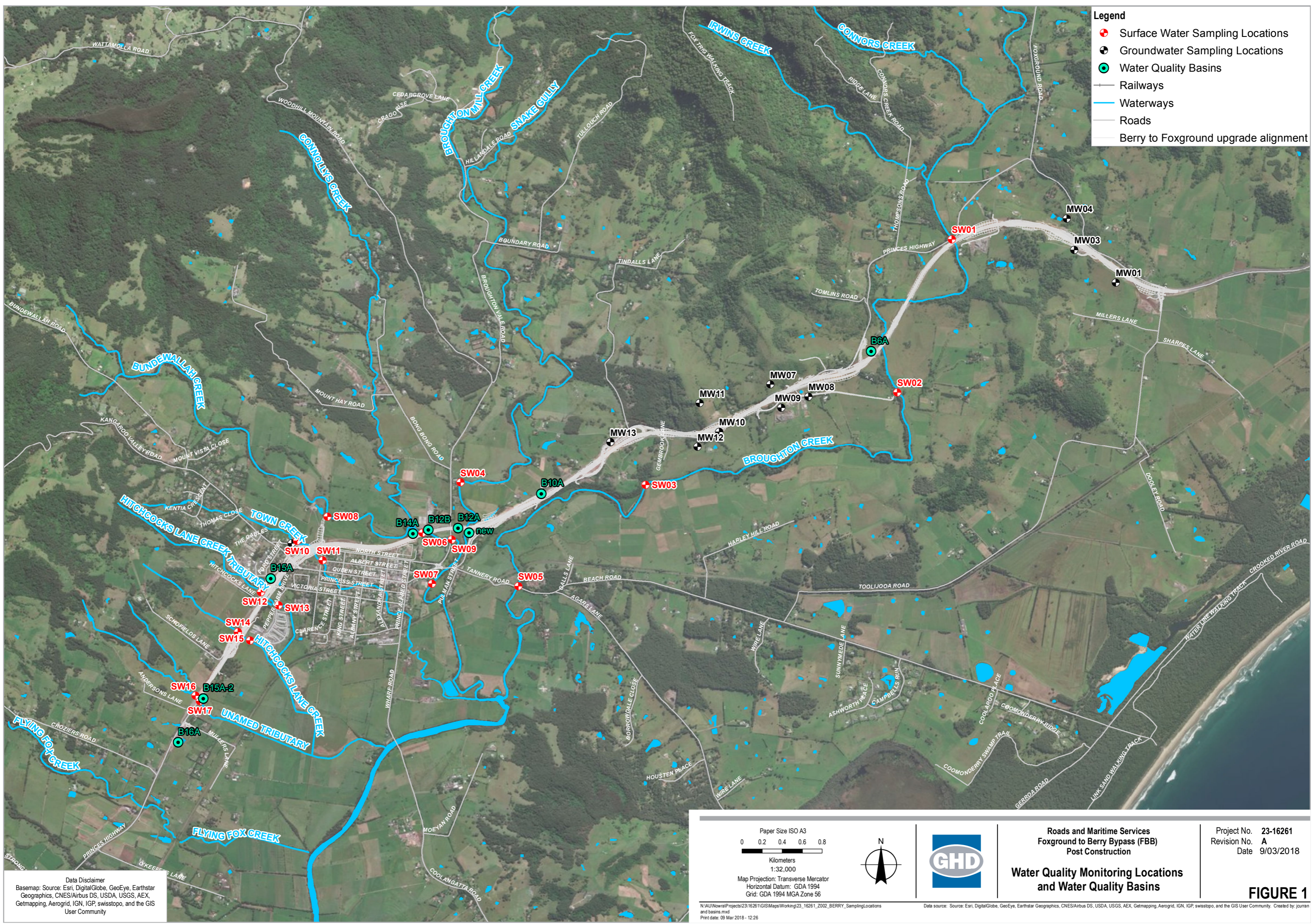
A handwritten signature in cursive script, appearing to read 'Jane Curran', written in black ink.

**Jane Curran**

Environmental Scientist

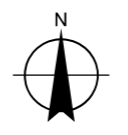
02 4424 4960

## Attachment A - Figures



- Legend**
- + Surface Water Sampling Locations
  - + Groundwater Sampling Locations
  - Water Quality Basins
  - Railways
  - Waterways
  - Roads
  - Berry to Foxground upgrade alignment

Paper Size ISO A3  
 0 0.2 0.4 0.6 0.8  
 Kilometers  
 1:32,000  
 Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 56



Roads and Maritime Services  
 Foxground to Berry Bypass (FBB)  
 Post Construction

**Water Quality Monitoring Locations  
 and Water Quality Basins**

Project No. 23-16261  
 Revision No. A  
 Date 9/03/2018

**FIGURE 1**

**Data Disclaimer**  
 Basemap: Source: Esri, DigitalGlobe, GeoEye, Earthstar  
 Geographics, CNES/Airbus DS, USDA, USGS, AEX,  
 Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS  
 User Community

N:\AU\Nowra\Projects\23-16261\GIS\Maps\Working\23\_16261\_2002\_BERRY\_SamplingLocations  
 and basins.mxd  
 Print date: 09 Mar 2018 - 12:26

Data source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community. Created by: jcurran



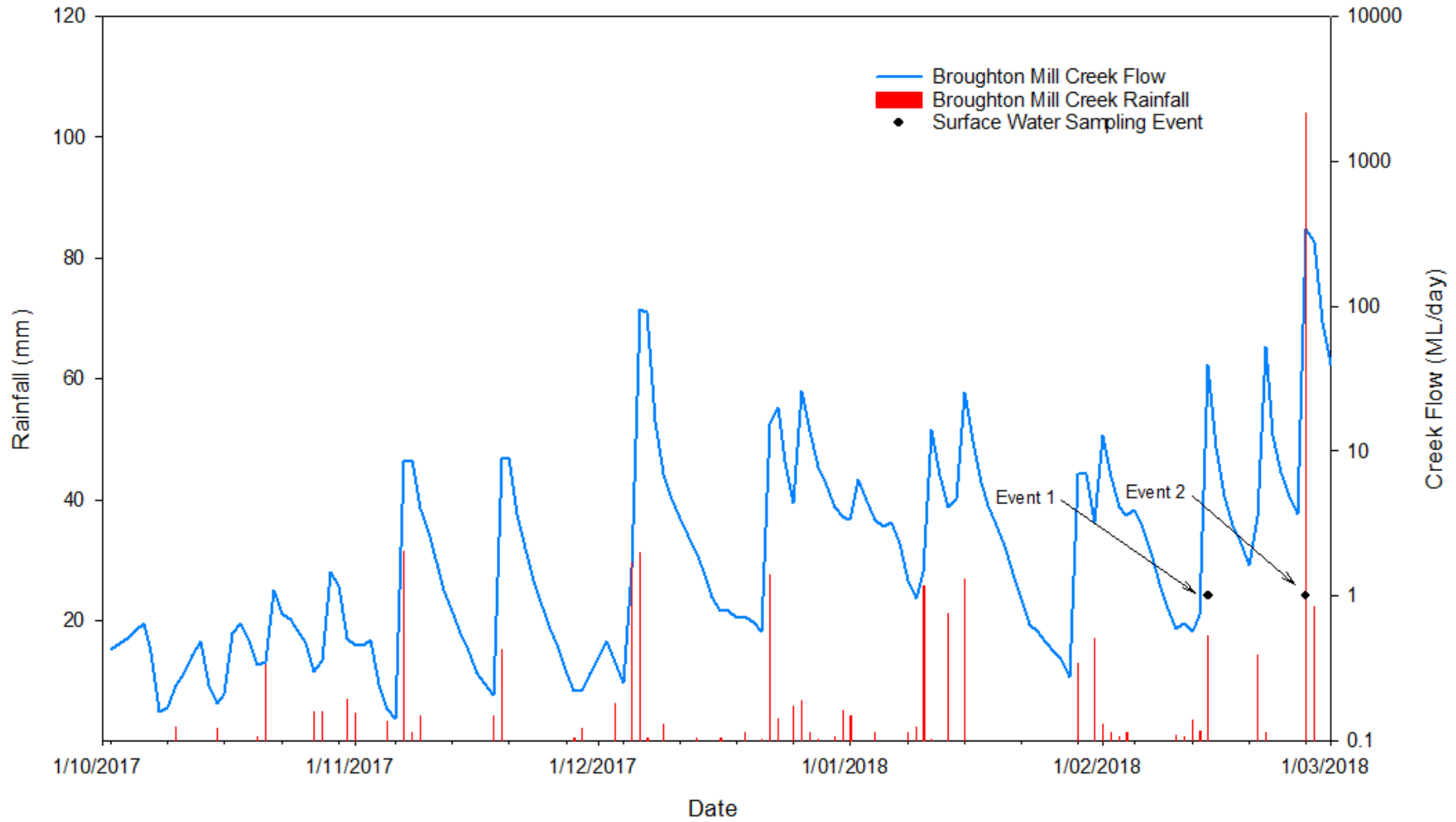


Figure 2 Rainfall vs Flow within Broughton Mill Creek

## Attachment B - Tabulated Results



**Attachment B  
Table B1  
Surface Water Sampling Results - Event 2**

RMS  
Foxground to Berry Bypass (FBB)  
Post-construction Monitoring

	Field Parameters				
	DO (mg/L) (Field)	Electrical conductivity (field)	pH (Field)	Redox (Field)	Temperature (Field)
	mg/L	µS/cm	pH Units	mV	°C
<b>ADWG 2015 Aesthetic</b>			<b>6.5-8.5</b>		
<b>ANZECC 2000 - Lowland Rivers (NSW rivers)</b>		<b>300</b>	<b>6.5-9</b>		
<b>ANZECC 2000 FW 95%</b>					

Sampled Date	Field ID	DO (mg/L)	Electrical conductivity (µS/cm)	pH	Redox (mV)	Temperature (°C)
26/02/2018	SW01_1	8.54	83.5	6.62	132.5	17.6
26/02/2018	SW01_2	8.5	82.8	6.54	137.9	17.6
26/02/2018	SW01_3	8.38	82.2	6.53	131	17.6
26/02/2018	SW02_1	8.37	88.2	6.6	153.7	17.7
26/02/2018	SW02_2	8.33	87.8	6.6	146.2	17.7
26/02/2018	SW02_3	8.4	87.8	6.6	141.1	17.7
26/02/2018	SW03_1	8.12	94.7	6.69	175.4	17.9
26/02/2018	SW03_2	8.04	94.4	6.67	144.7	17.9
26/02/2018	SW03_3	8.1	94.1	6.67	137	17.9
26/02/2018	SW04_1	8.17	79.4	6.68	33.7	17.7
26/02/2018	SW04_2	7.89	80.3	6.64	32.8	17.7
26/02/2018	SW04_3	8.12	79.1	6.69	27.6	17.7
26/02/2018	SW05	7.69	100.8	6.7	147.8	18.3
26/02/2018	SW06_1	6.65	151.6	6.56	138.1	18.6
26/02/2018	SW06_2	6.74	151.6	6.55	137.8	18.6
26/02/2018	SW06_3	7.1	151.8	6.55	136.6	18.6
26/02/2018	SW07_1	7.34	99.5	6.58	131.9	18.2
26/02/2018	SW07_2	7.23	98.9	6.61	128.1	18.2
26/02/2018	SW07_3	7.18	100.2	6.57	122.8	18.2
26/02/2018	SW08	7.32	156.1	6.7	132.6	18.7
26/02/2018	SW09_1	7.43	153.6	6.59	162.8	18.5
26/02/2018	SW09_2	7.41	154	6.55	139.2	18.6
26/02/2018	SW09_3	7.39	154.1	6.55	136.1	18.6
26/02/2018	SW10_1	6.15	130	6.65	122.2	20.5
26/02/2018	SW10_2	6.11	130.3	6.64	122.8	20.6
26/02/2018	SW10_3	6.12	130.5	6.63	122.7	20.6
26/02/2018	SW11_1	3.28	262.1	6.59	128.8	22
26/02/2018	SW11_2	3.25	262.4	6.58	125.7	22.1
26/02/2018	SW11_3	3.11	262.3	6.54	122.8	22.1
26/02/2018	SW12_1	5.1	284.8	6.93	100.3	19.8
26/02/2018	SW12_2	5.02	280.6	6.94	94.4	19.8
26/02/2018	SW12_3	4.97	278.4	6.94	92.3	19.8
26/02/2018	SW13_1	6.59	<b>338.9</b>	7.16	78.1	20.3
26/02/2018	SW13_2	6.67	<b>333.7</b>	7.15	73.3	20.3
26/02/2018	SW13_3	6.58	<b>338.1</b>	7.16	72.1	20.3
26/02/2018	SW14	4.97	<b>340.7</b>	7.07	92.7	22.3
26/02/2018	SW15_1	5.88	<b>323.5</b>	7.05	99.2	21.5
26/02/2018	SW15_2	5.9	<b>329.4</b>	7.04	87.2	21.5
26/02/2018	SW15_3	5.95	<b>335.5</b>	6.82	79.7	21.5
26/02/2018	SW16	6.68	212.8	<b>6.42</b>	117.2	19.2
26/02/2018	SW17	6.96	215.8	<b>6.44</b>	124.4	19.2





**Attachment B**  
**Table B3**  
**Surface Water Sampling QA/QC results - Event 2**

RMS  
Foxground to Berry Bypass (FBB)  
Post-construction Monitoring

Field Duplicates (water)  
Filter: SDG in('ALSE-Sydney 28-Feb-18')

SDG Field ID Sampled Date/Time	ALSE-Sydney 28-Feb-18 SW01_1 26/02/2018 15:00	ALSE-Sydney 28-Feb-18 QC1 26/02/2018 15:00	RPD	ALSE-Sydney 28-Feb-18 SW09_1 26/02/2018 15:00	ALSE-Sydney 28-Feb-18 QC2 26/02/2018 15:00	RPD
--------------------------------------	---	--	-----	---	--	-----

Chem_Group	ChemName	Units	EQL						
Inorganics	Total Suspended Solids	mg/l	5	8	10	22	<5	<5	0
	Turbidity	NTU	0.1	14.3	14.3	0	10.3	9.7	6
Metals	Arsenic (Filtered)	mg/l	0.001	<0.001	0.001	0	<0.001	<0.001	0
	Cadmium (Filtered)	mg/l	0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	0
	Chromium (III+VI) (Filtered)	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Copper (Filtered)	mg/l	0.001	0.002	0.002	0	0.001	0.002	67
	Lead (Filtered)	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Mercury (Filtered)	mg/l	0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	0
	Nickel (Filtered)	mg/l	0.001	<0.001	<0.001	0	<0.001	<0.001	0
	Zinc (Filtered)	mg/l	0.005	0.008	<0.005	46	0.006	<0.005	18
PAHs	Naphthalene	µg/L	5	<5	<5	0	<5	<5	0
TRH - NEPM 2013	C6-C10 minus BTEX (F1)	µg/L	20	<20	<20	0	<20	<20	0
	C6-C10 Fraction	µg/L	20	<20	<20	0	<20	<20	0
	>C10-C16 minus Naphthalene (F2)	µg/L	100	<100	<100	0	<100	<100	0
	>C10-C16 Fraction	µg/L	100	<100	<100	0	<100	<100	0
	>C16-C34 Fraction (F3)	µg/L	100	<100	<100	0	<100	<100	0
	>C34-C40 Fraction (F4)	µg/L	100	<100	<100	0	<100	<100	0
	>C10-C40 (Sum of Total)	µg/L	100	<100	<100	0	<100	<100	0
TRH - NEPM 1999	C6-C9 Fraction	µg/L	20	<20	<20	0	<20	<20	0
	C10-C14 Fraction	µg/L	50	<50	<50	0	<50	<50	0
	C15-C28 Fraction	µg/L	100	<100	<100	0	<100	<100	0
	C29-C36 Fraction	µg/L	50	<50	<50	0	<50	<50	0
	C10-C36 (Sum of Total)	µg/L	50	<50	<50	0	<50	<50	0
BTEXN	Benzene	µg/L	1	<1	<1	0	<1	<1	0
	Toluene	µg/L	2	<2	<2	0	<2	<2	0
	Ethylbenzene	µg/L	2	<2	<2	0	<2	<2	0
	Xylene (o)	µg/L	2	<2	<2	0	<2	<2	0
	Xylene (m & p)	µg/L	2	<2	<2	0	<2	<2	0
	Xylene Total	µg/L	2	<2	<2	0	<2	<2	0
	BTEX (Sum of Total) - Lab Calc	µg/L	1	<1	<1	0	<1	<1	0
Nutrients	Total Kjeldahl Nitrogen	mg/l	0.1	0.5	0.5	0	0.5	0.4	22
	Nitrate + Nitrite as N	mg/l	0.01	0.14	0.15	7	1.16	1.16	0
	Nitrogen (Total)	mg/l	0.1	0.6	0.6	0	1.7	1.6	6
	Phosphorus (Total)	mg/l	0.01	0.09	0.08	12	0.08	0.08	0

\*RPDs have only been considered where a concentration is greater than 1 times the EQL.

\*\*High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 200 (1-10 x EQL); 50 (10-30 x EQL); 50 (> 30 x EQL) )

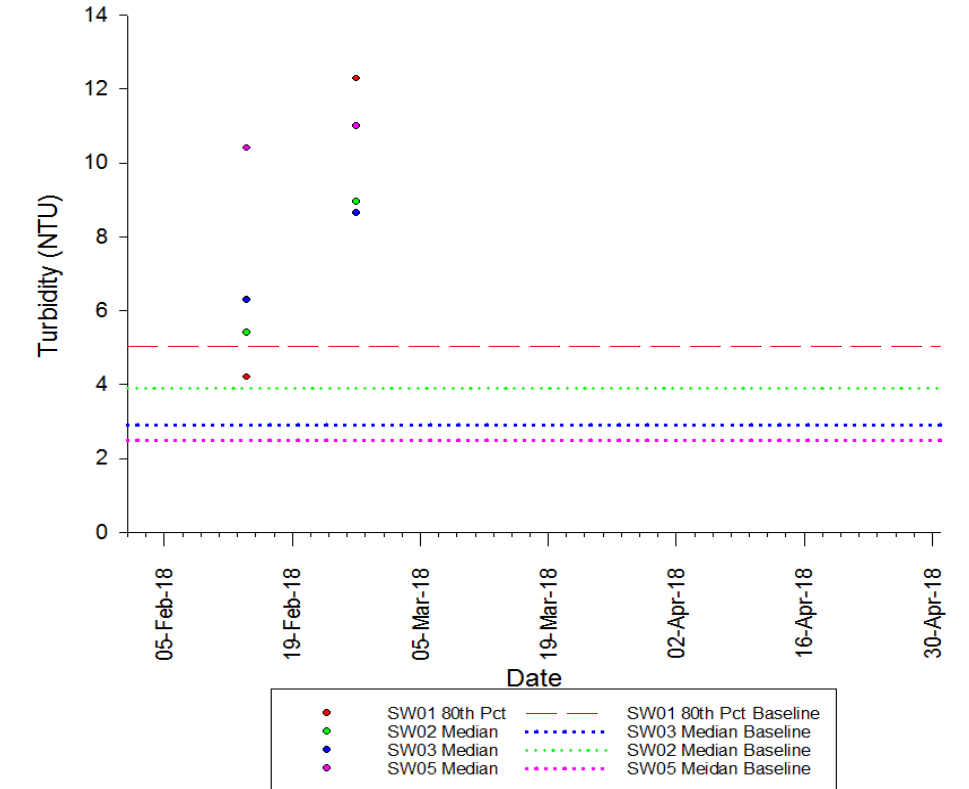
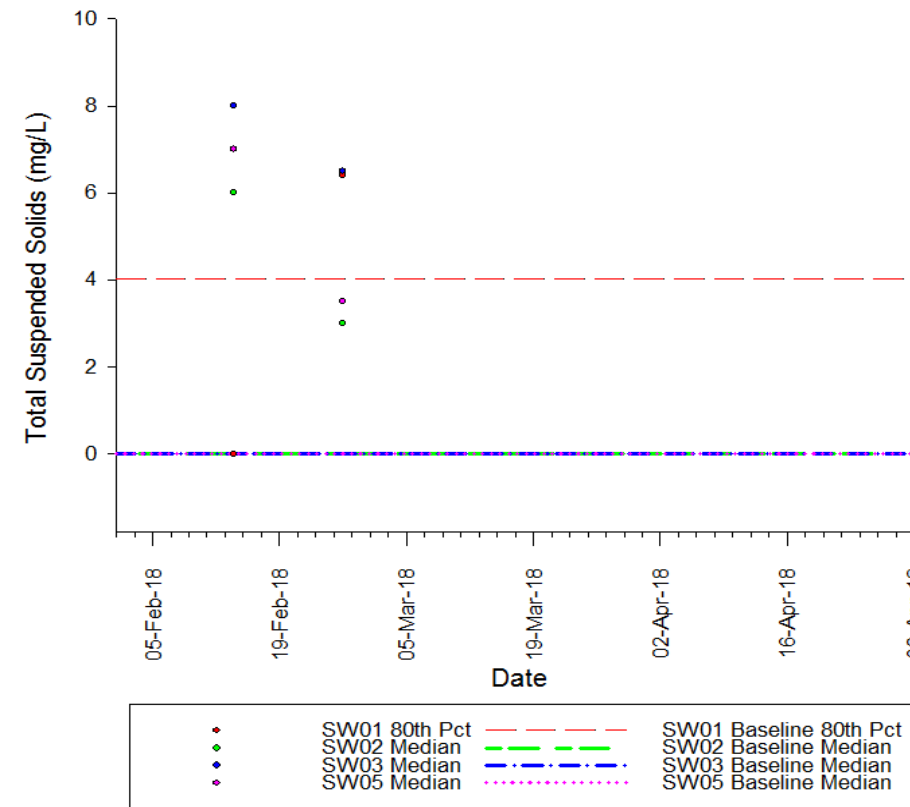
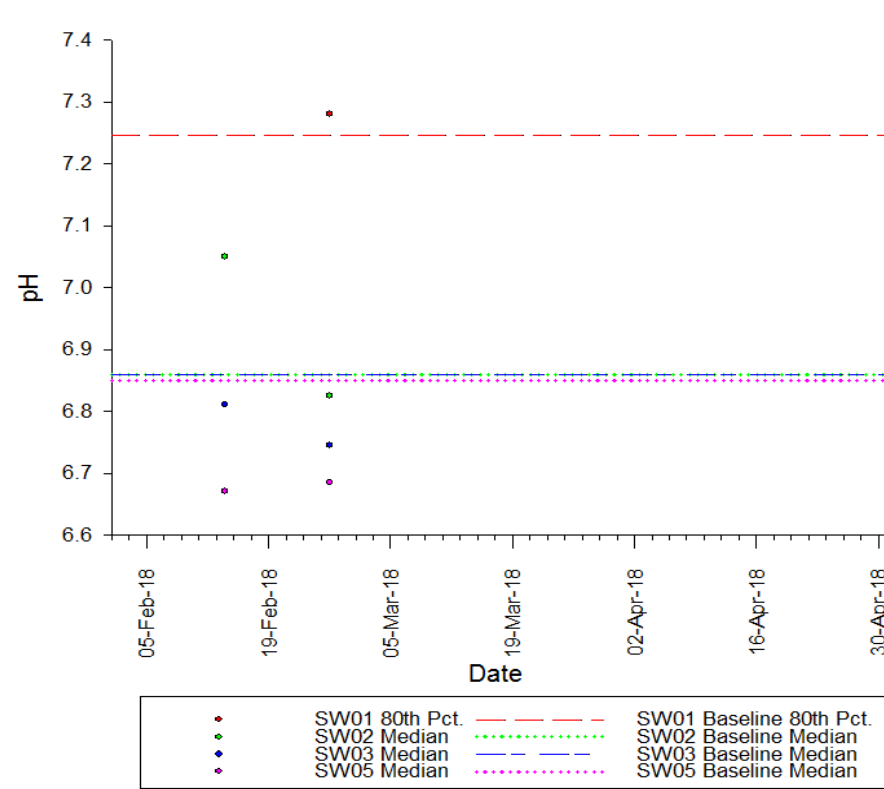
\*\*\*Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

## Attachment C - Control Charts

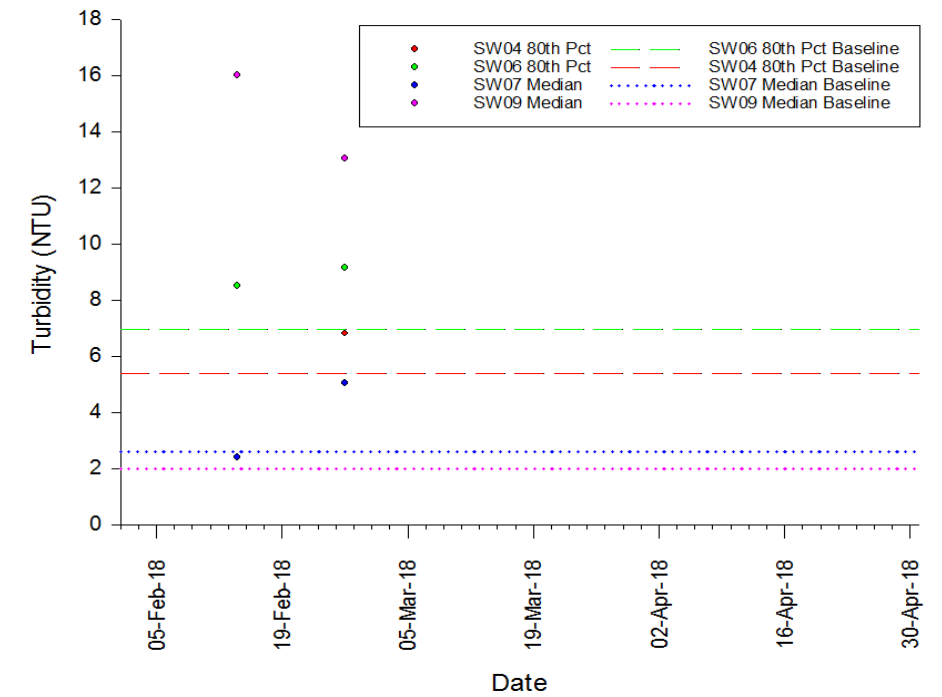
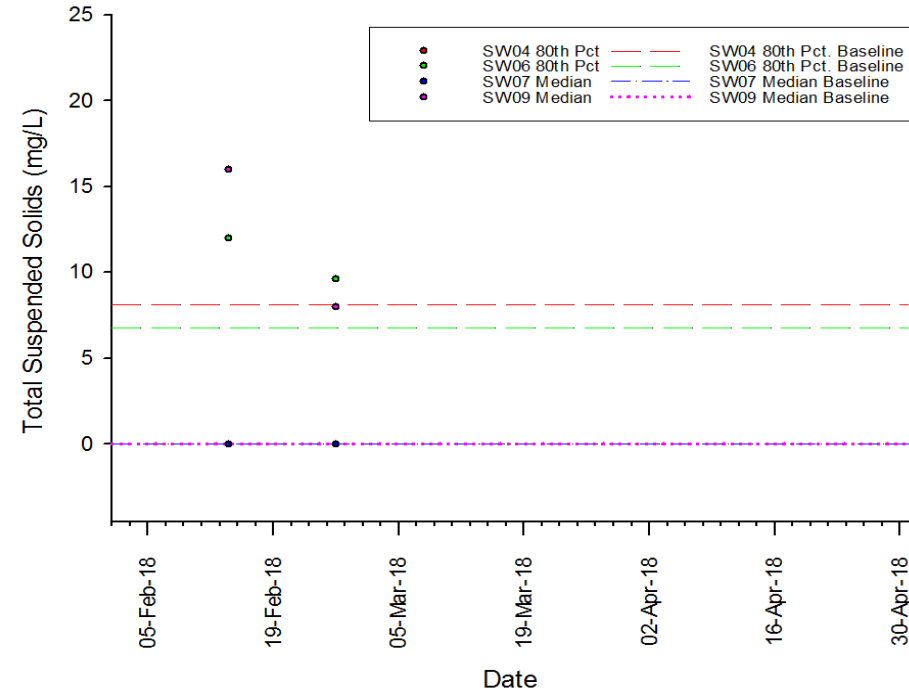
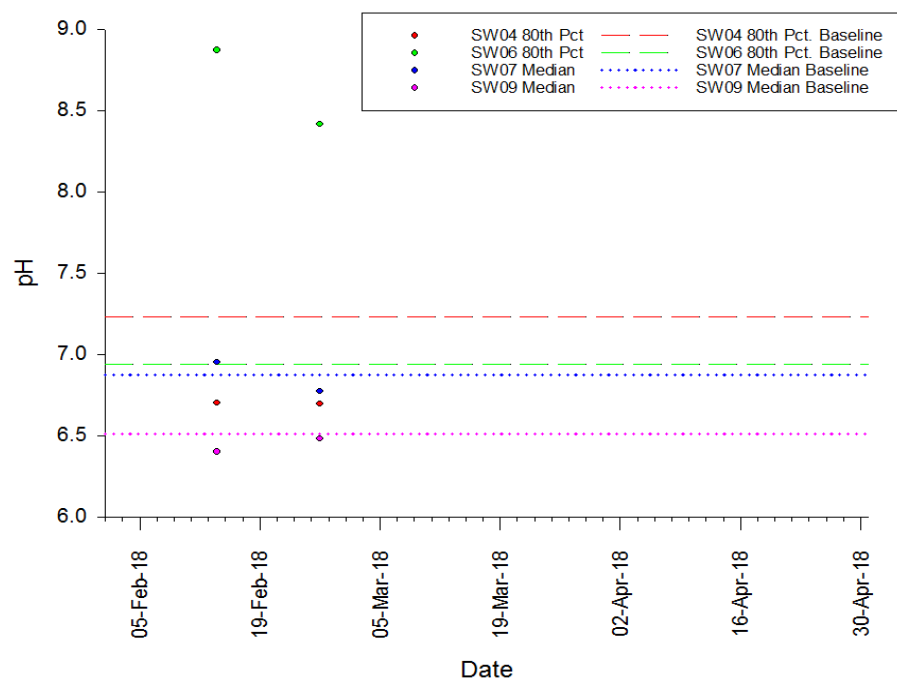


Event 2 - Attachment E  
Control Charts -pH, TSS, Turbidity

1. Broughton Creek



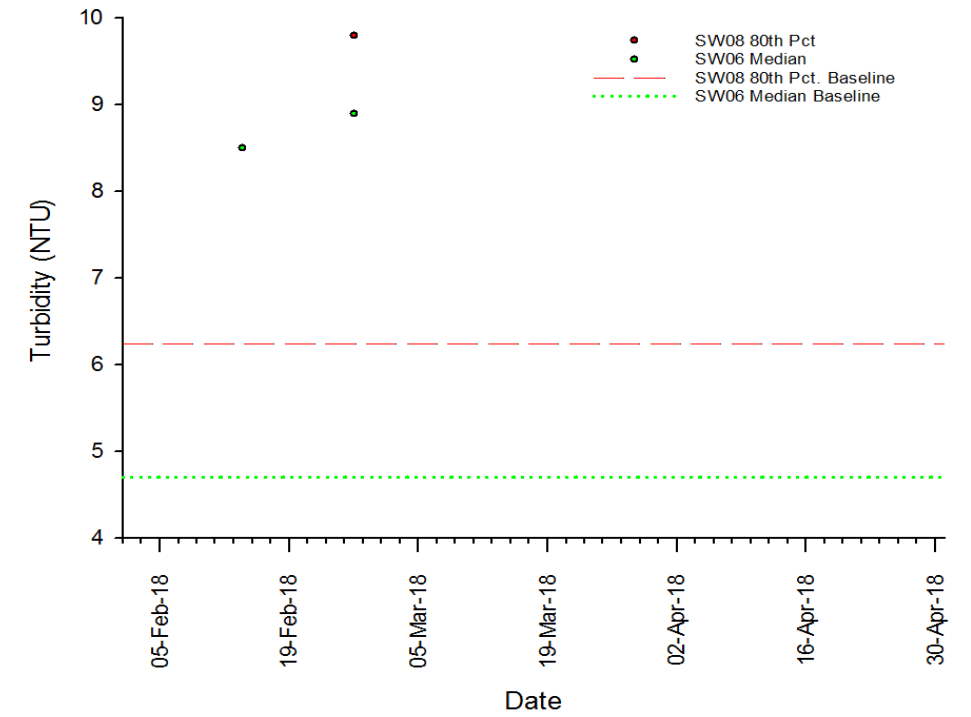
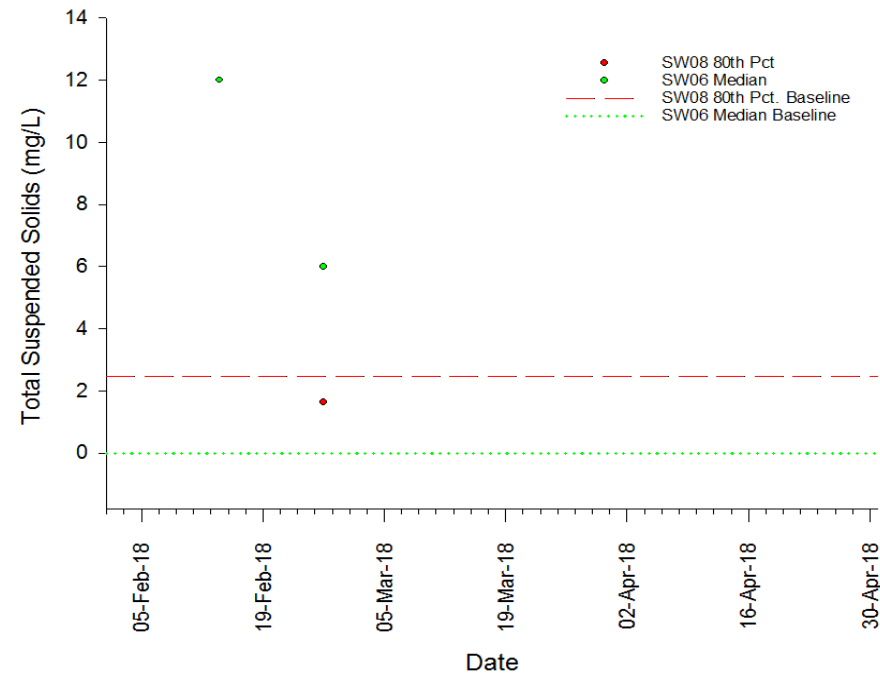
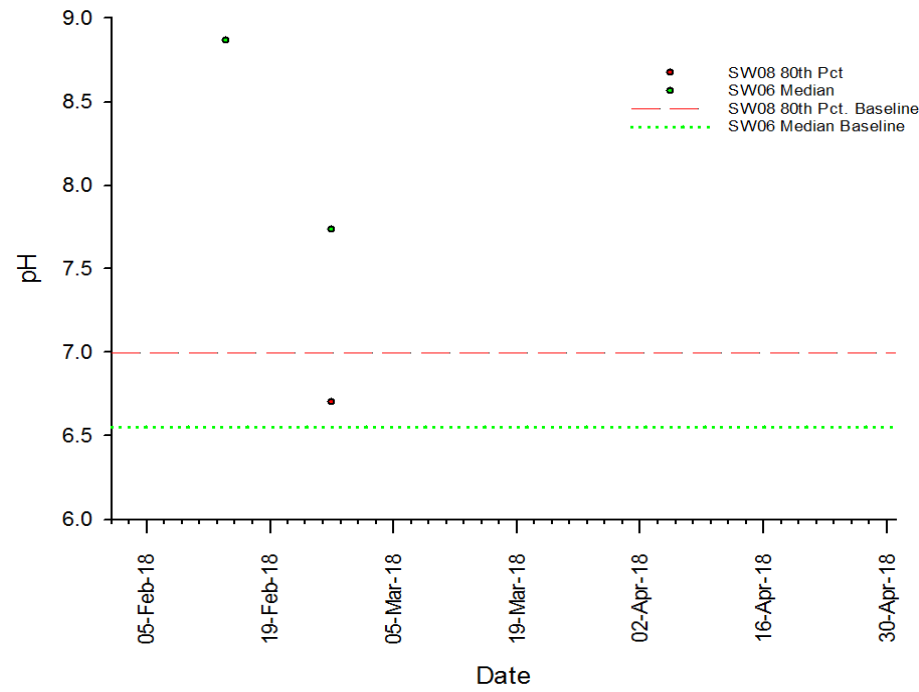
2. Connelly's Creek and Broughton Mill Creek and Bundewallah Creek



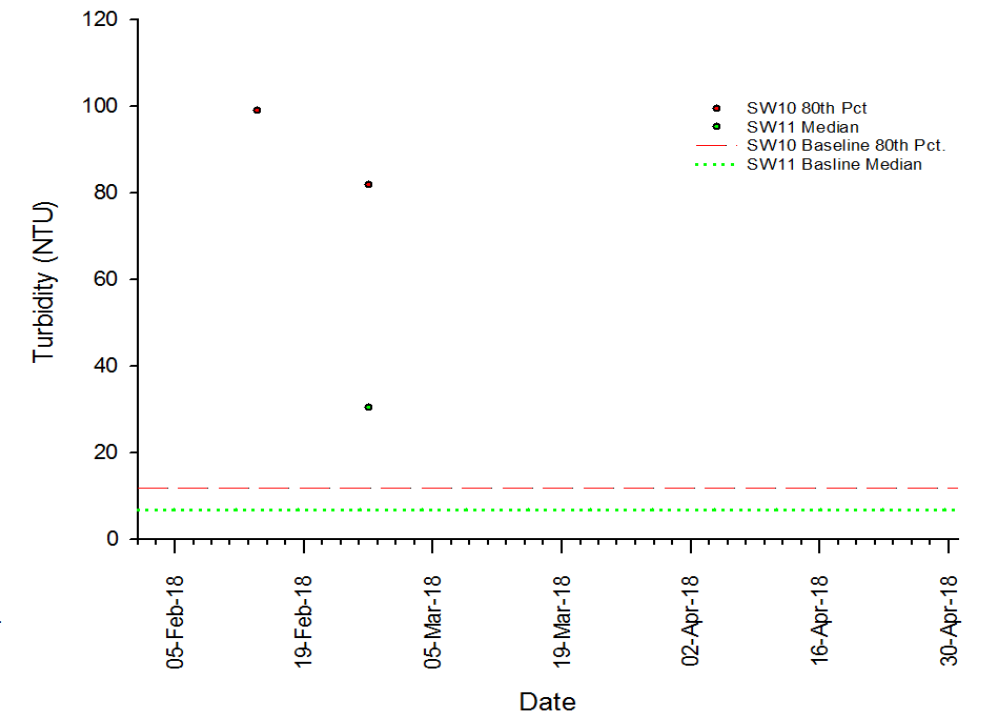
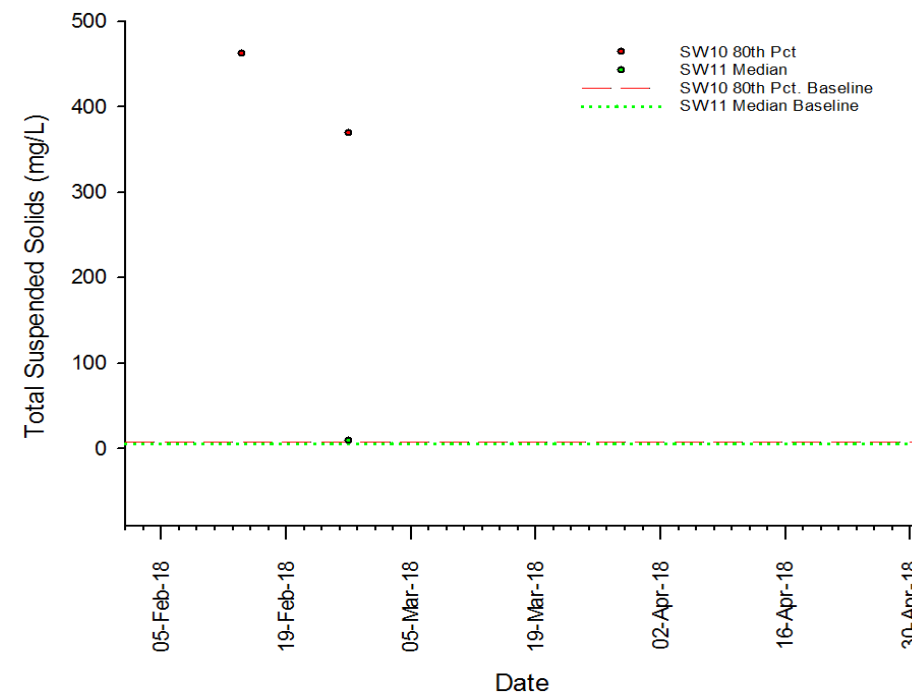
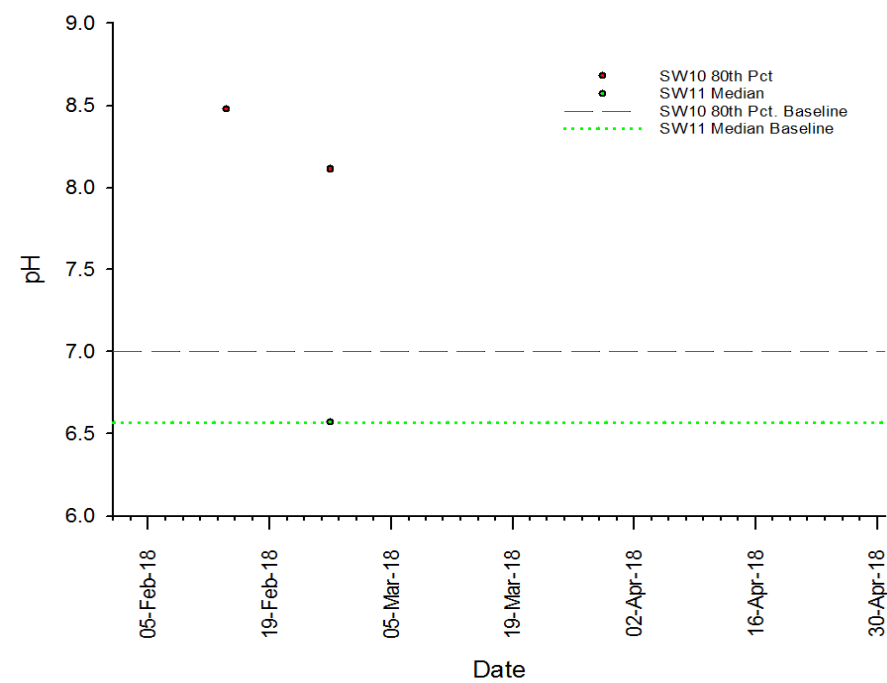


### Event 2 - Attachment E Control Charts -pH, TSS, Turbidity

#### 3. Bundewallah Creek and Connelly's Creek



#### 4. Town Creek

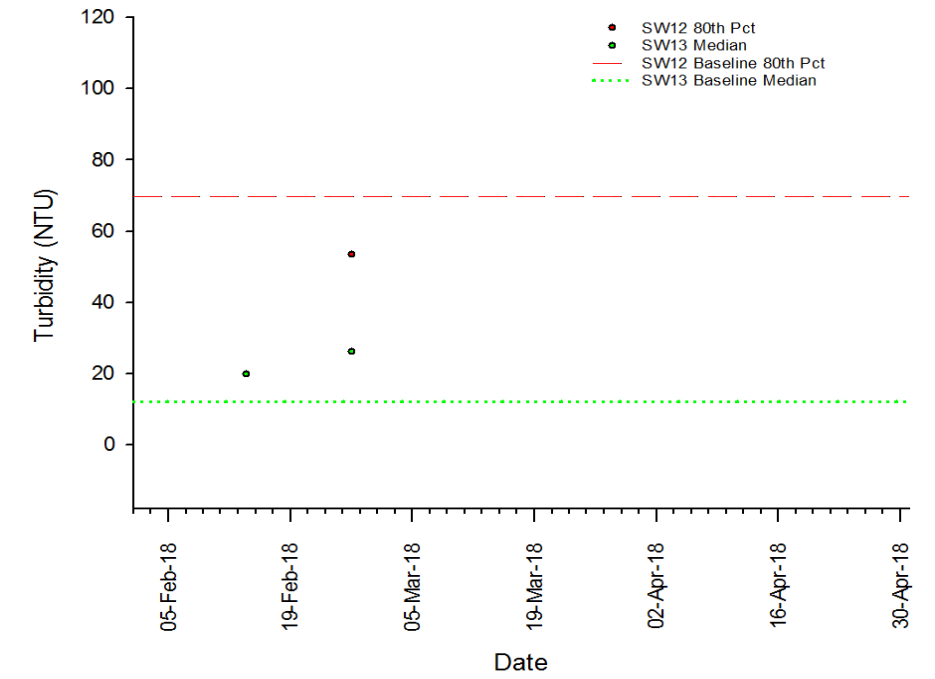
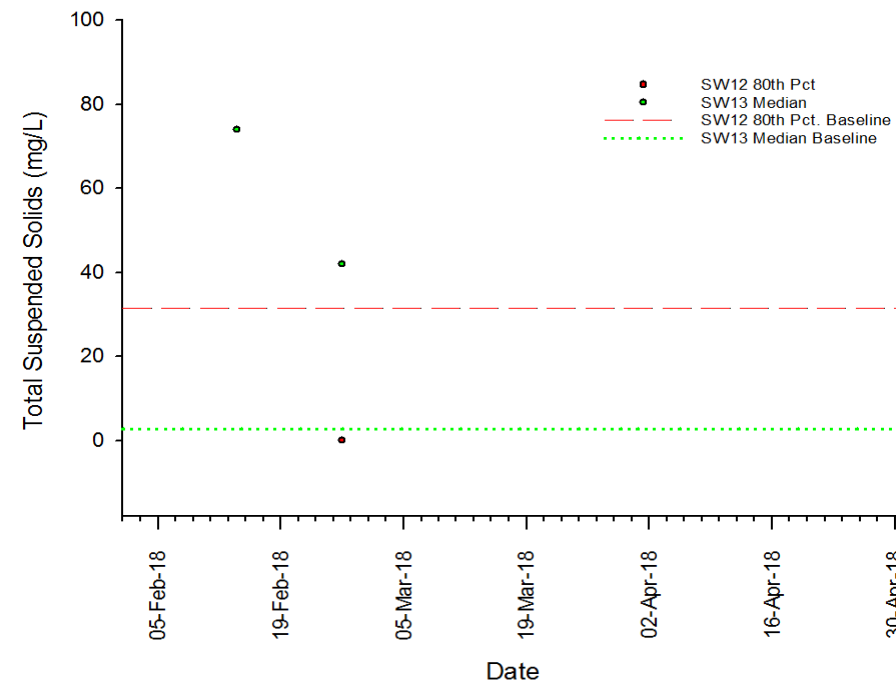
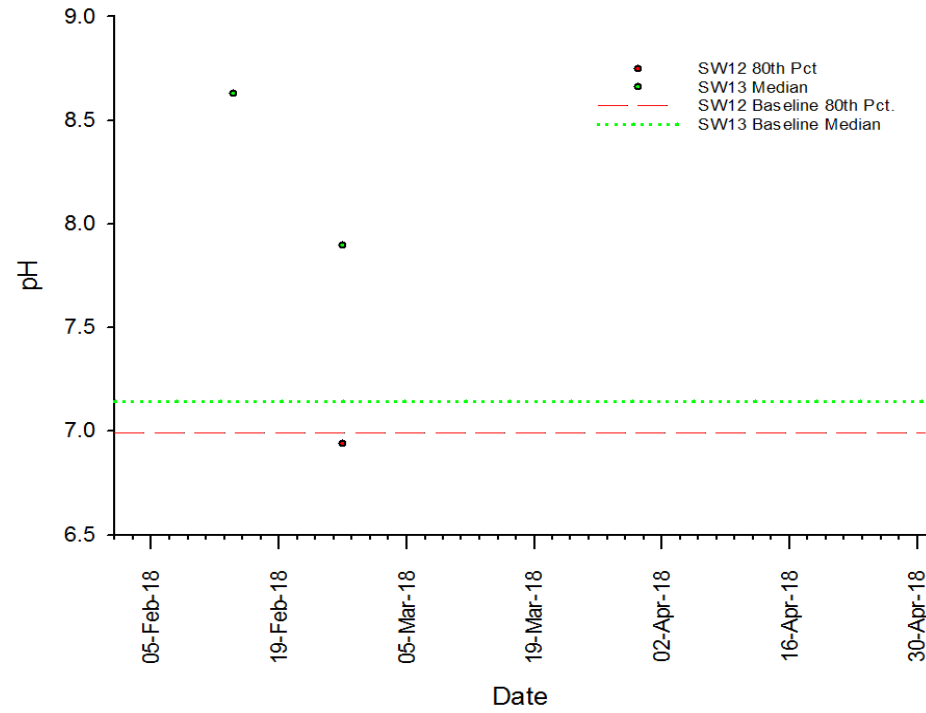




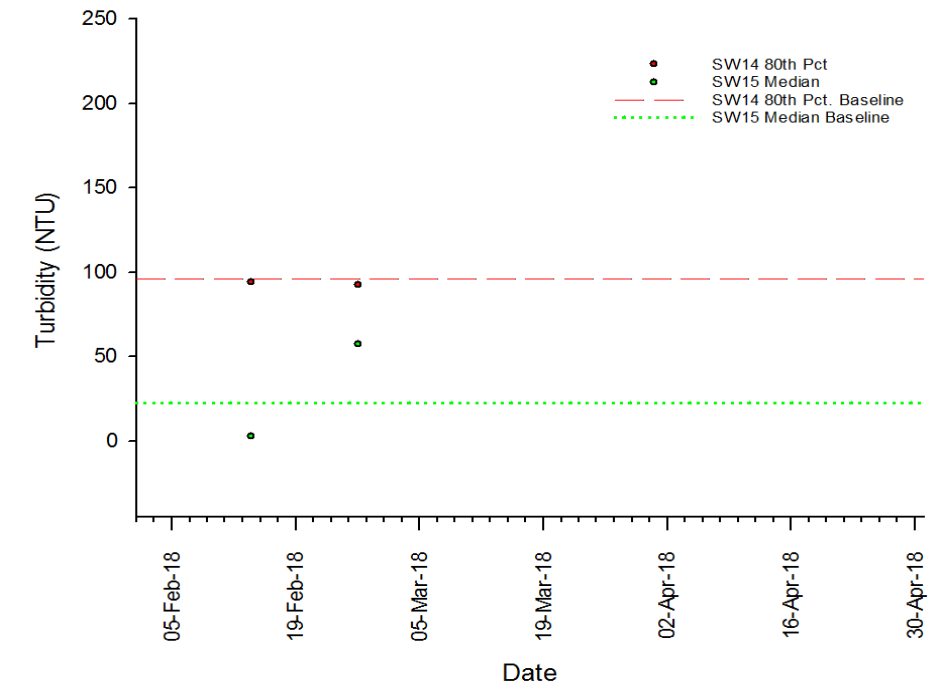
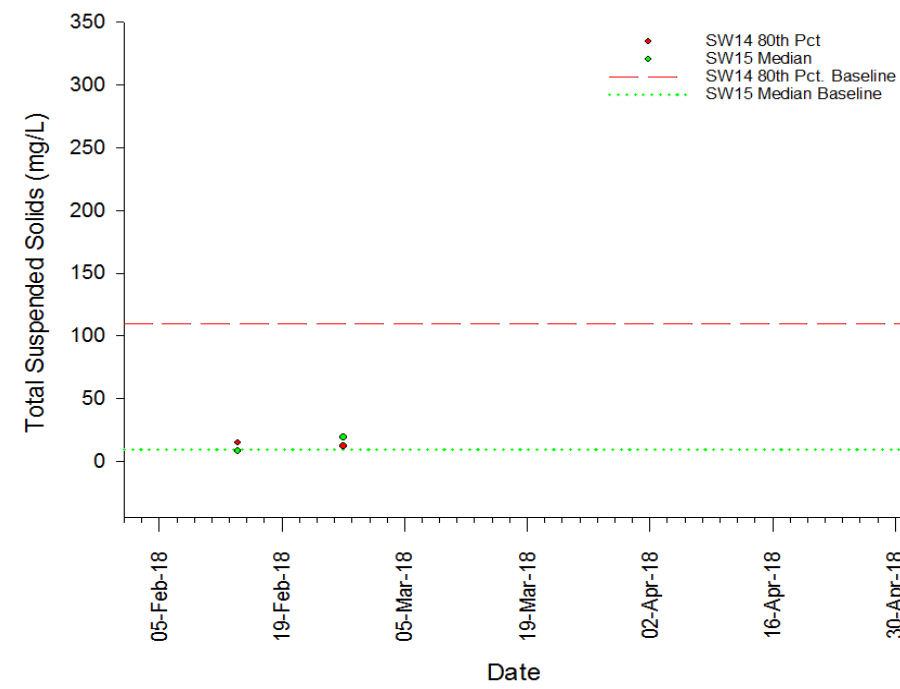
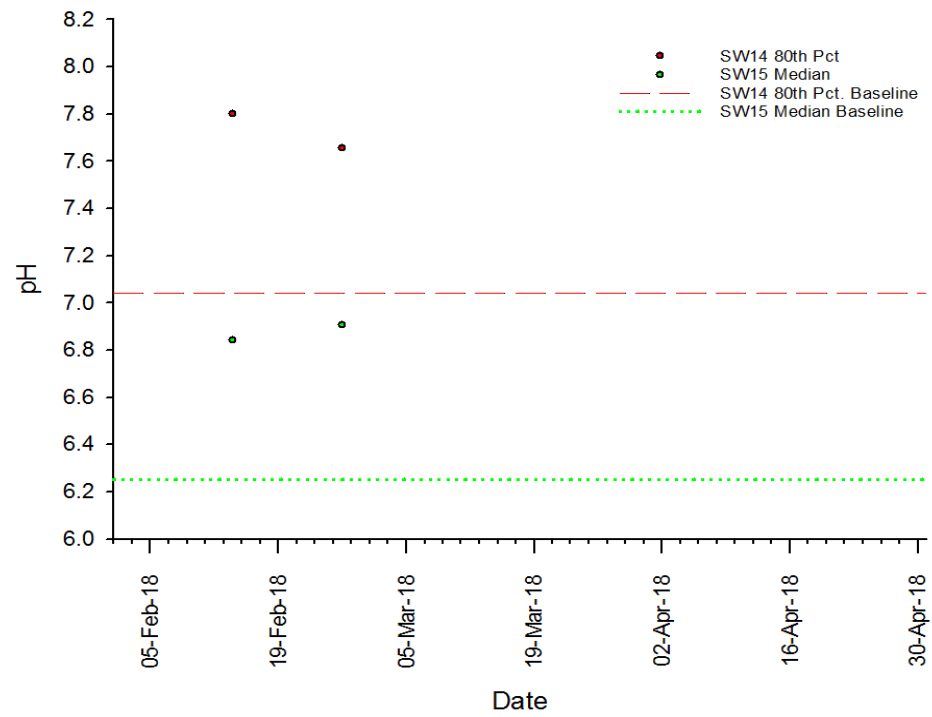


# Event 2 - Attachment E Control Charts -pH, TSS, Turbidity

## 5. Hitchcocks Lane Creek Tributary



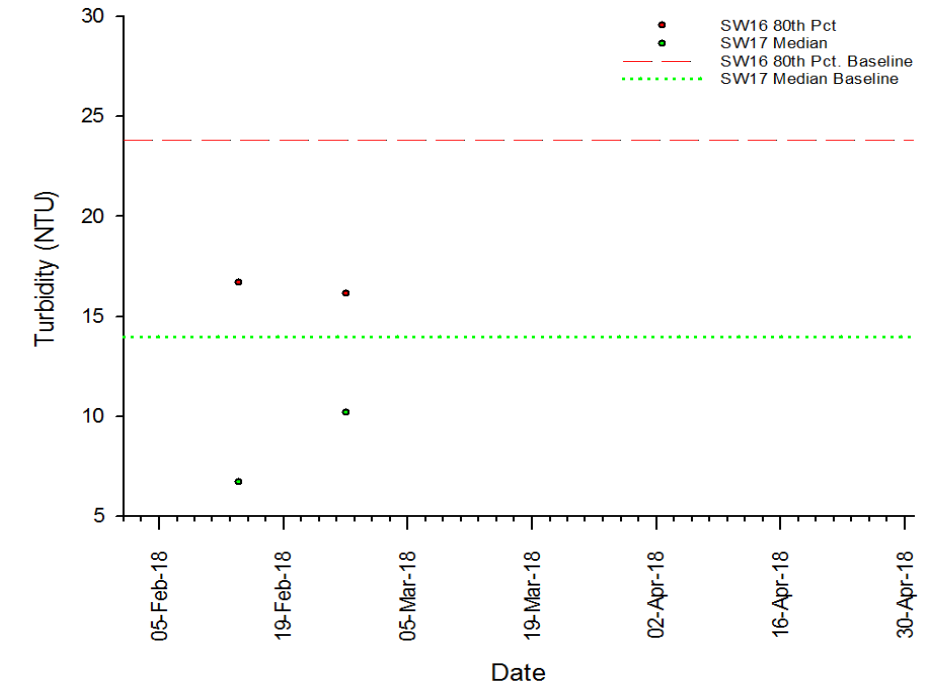
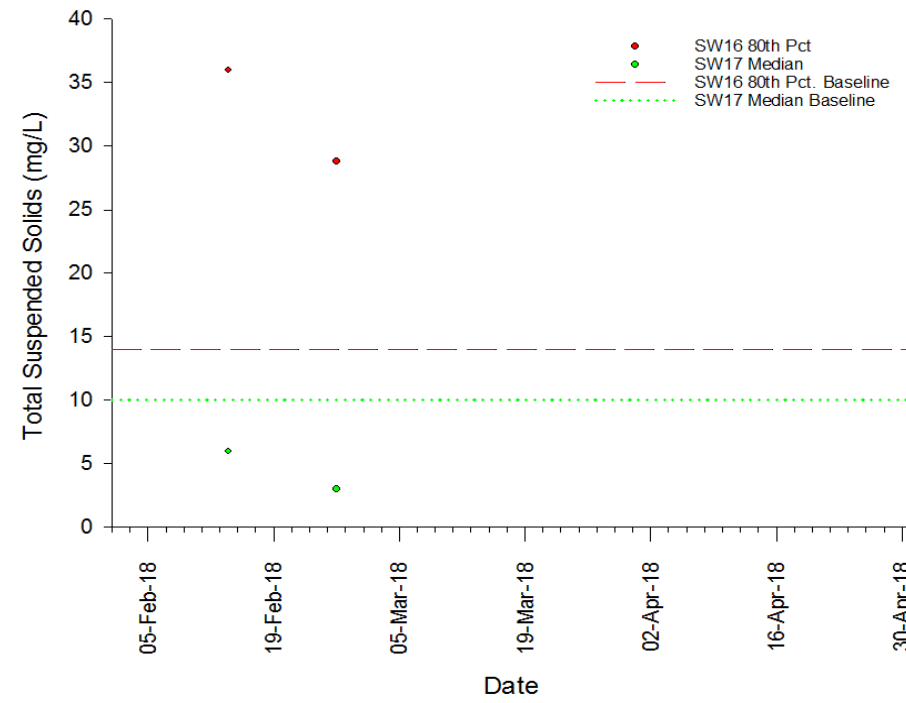
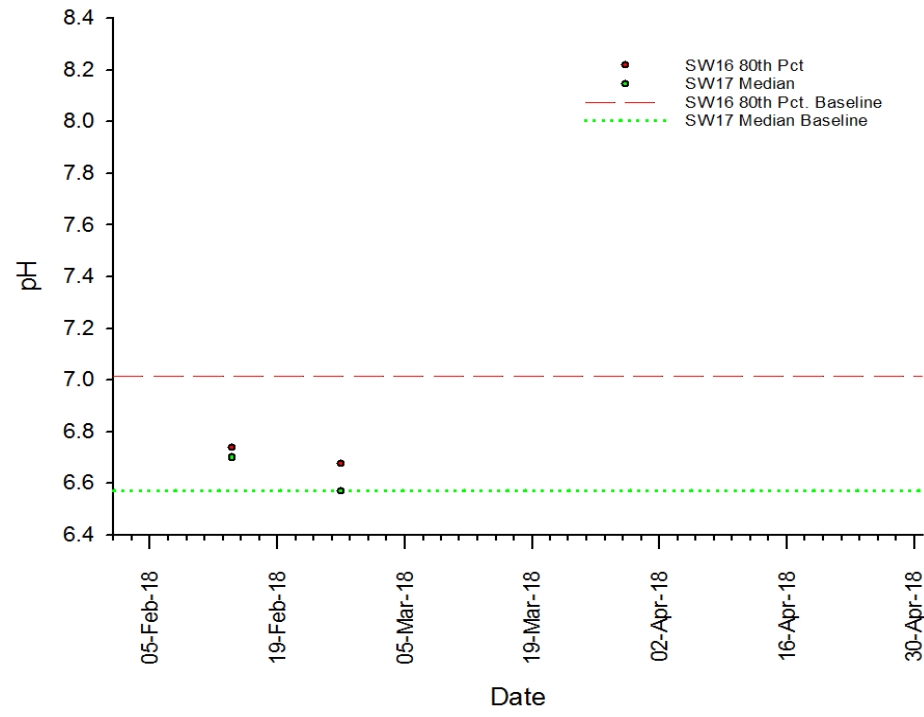
## 6. Hitchcocks Lane Creek





# Event 2 - Attachment E Control Charts -pH, TSS, Turbidity

## 7. Unnamed Tributary

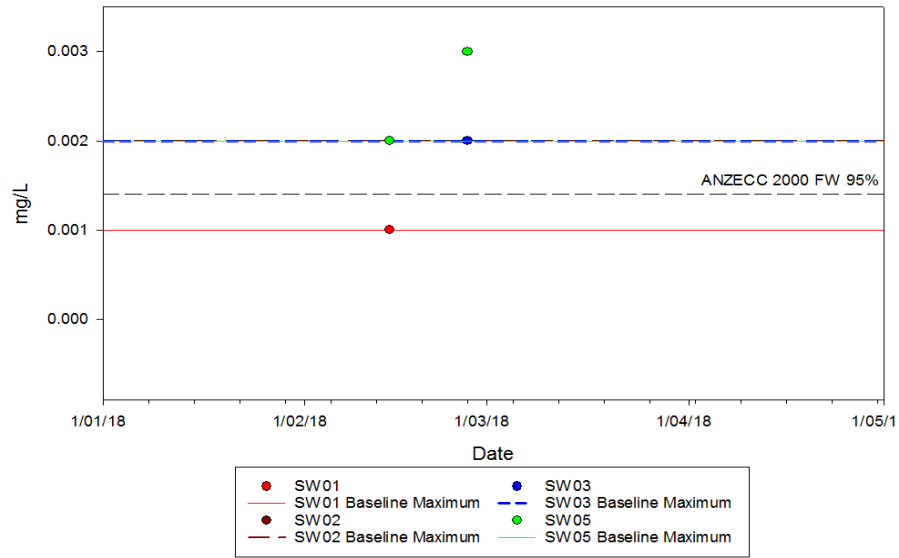




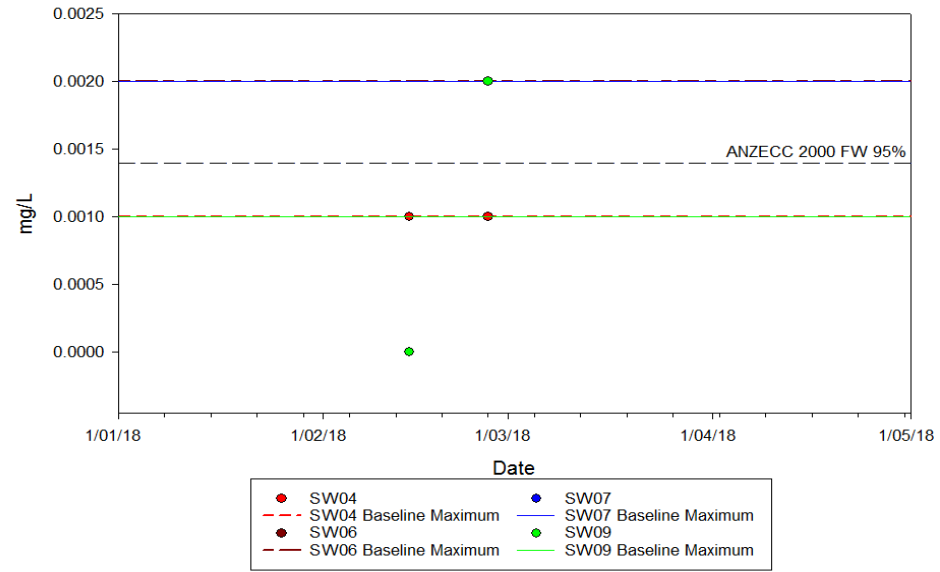
# Attachment E Control Charts - Heavy Metals

## Copper

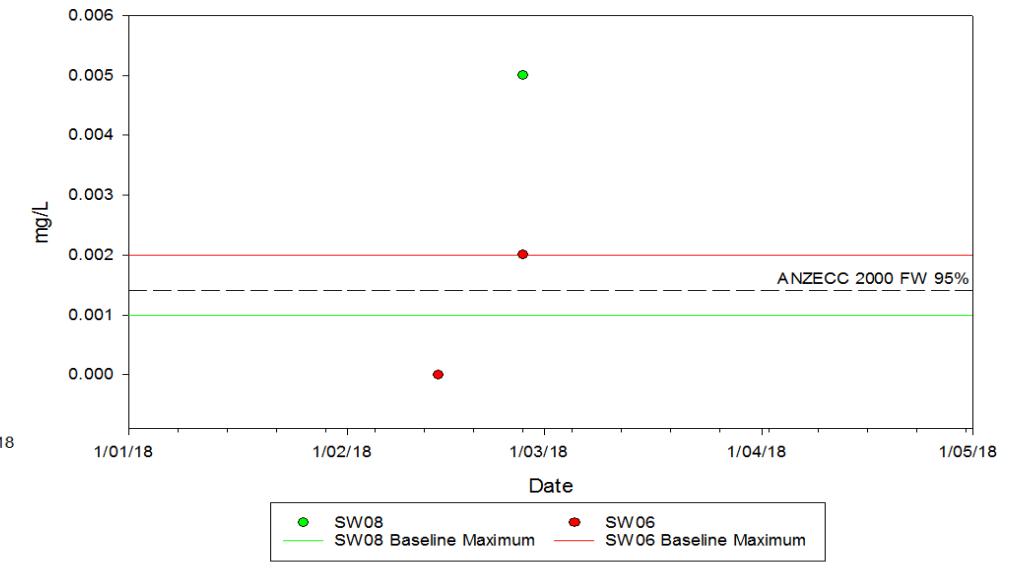
Copper Concentration Broughton Creek



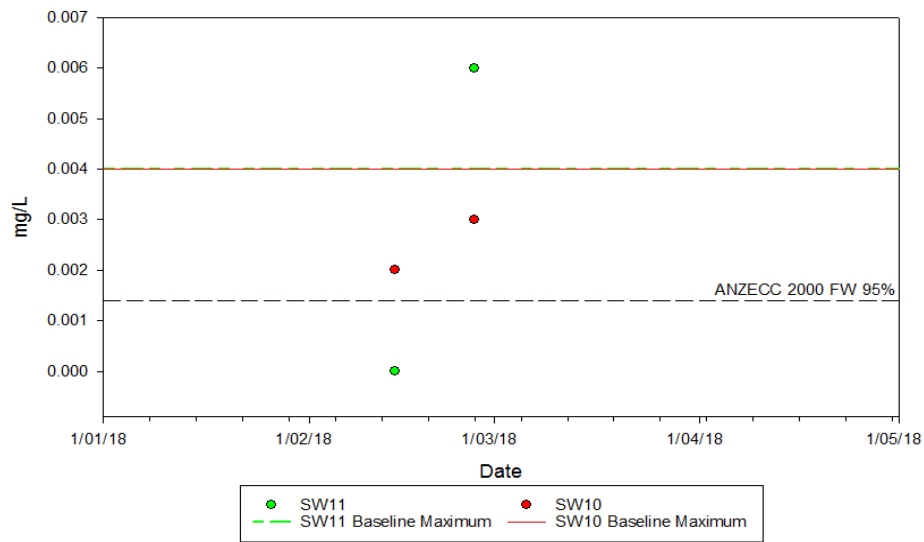
Copper Concentration Connelly's Creek, Broughton Mill Creek and Bundewallah Creek



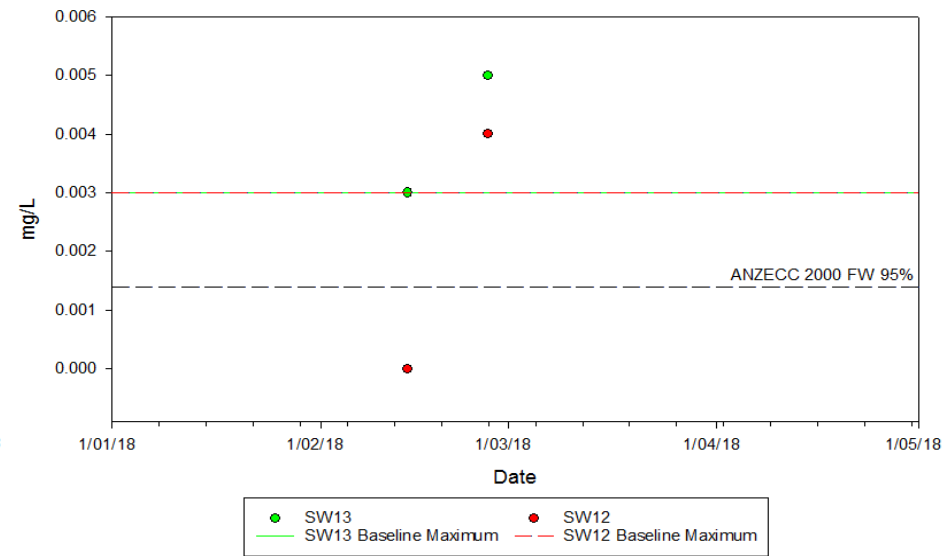
Copper Concentration Bundewallah Creek and Connelly's Creek



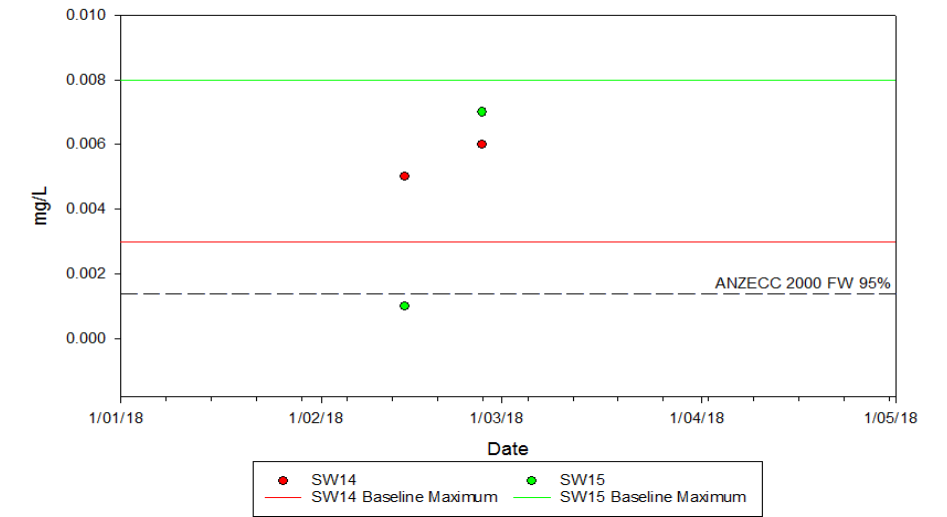
Copper Concentration Town Creek



Copper Concentration Hitchcocks Lane Creek Tributary



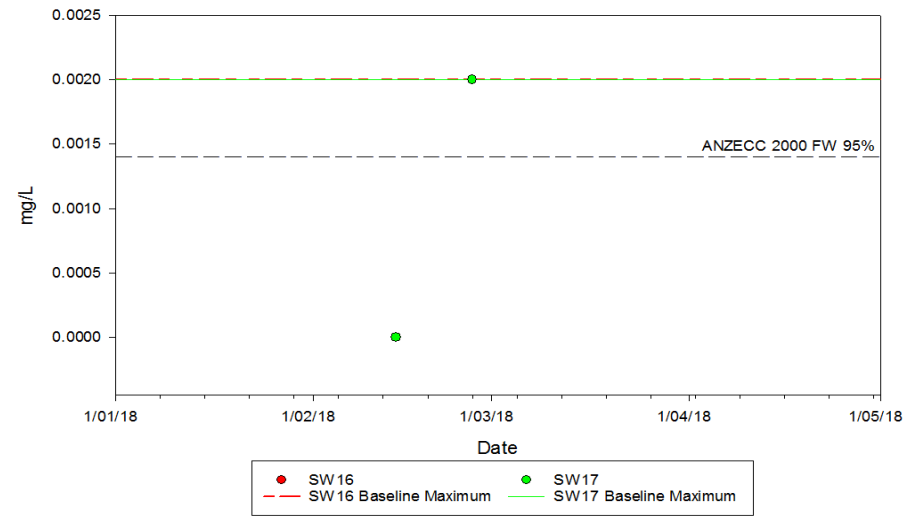
Copper Concentration Hitchcocks Lane Creek Tributary





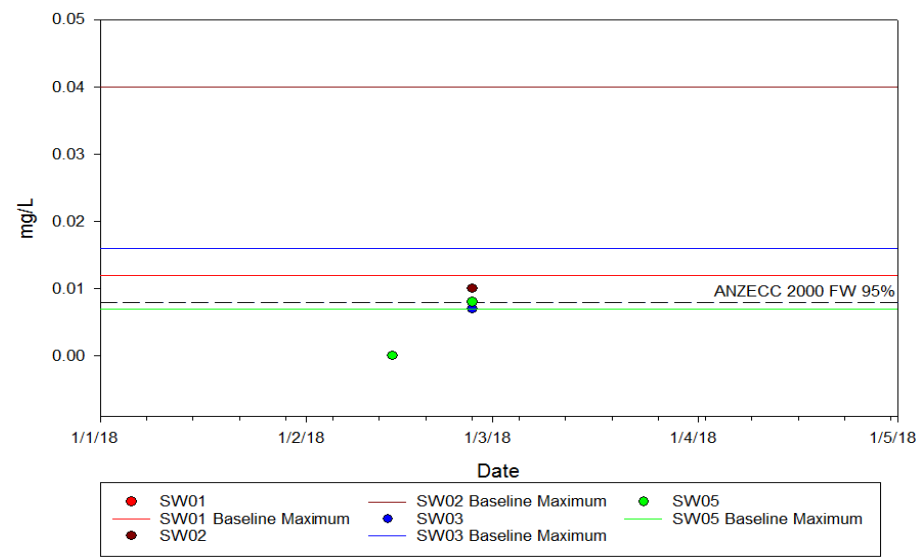
## Attachment E Control Charts - Heavy Metals

Copper Concentration Unnamed Tributary

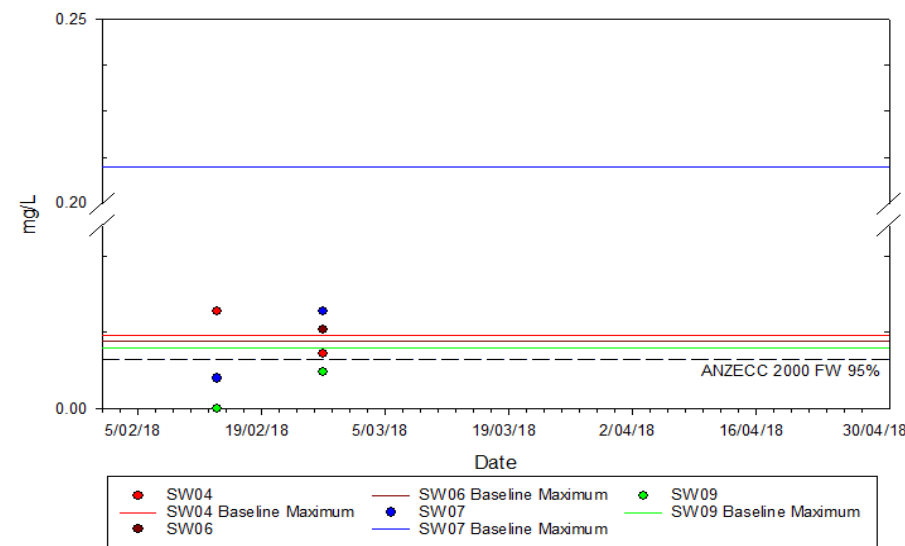


## Zinc

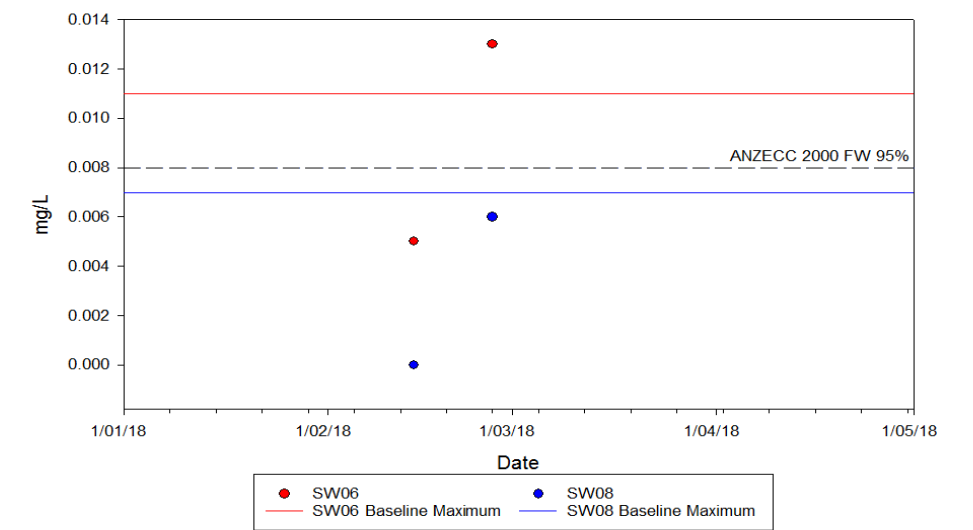
Zinc Concentration Broughton Creek



Zinc Concentration Connelly's Creek, Broughton Mill Creek and Bundewallah Creek



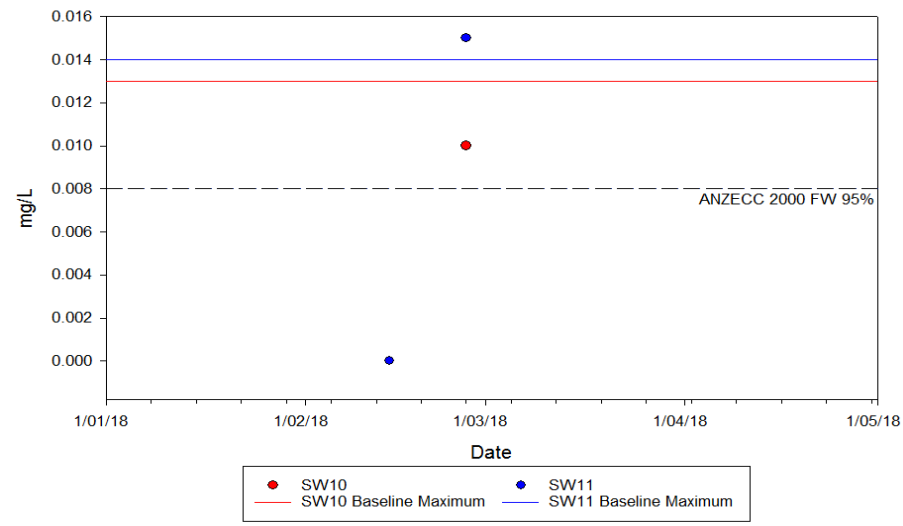
Zinc Concentration Bundewallah Creek and Connelly's Creek



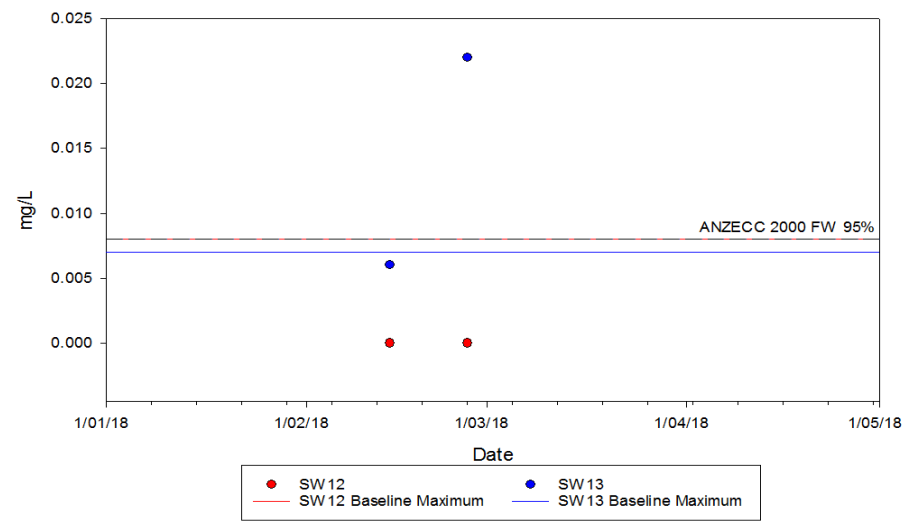


# Attachment E Control Charts - Heavy Metals

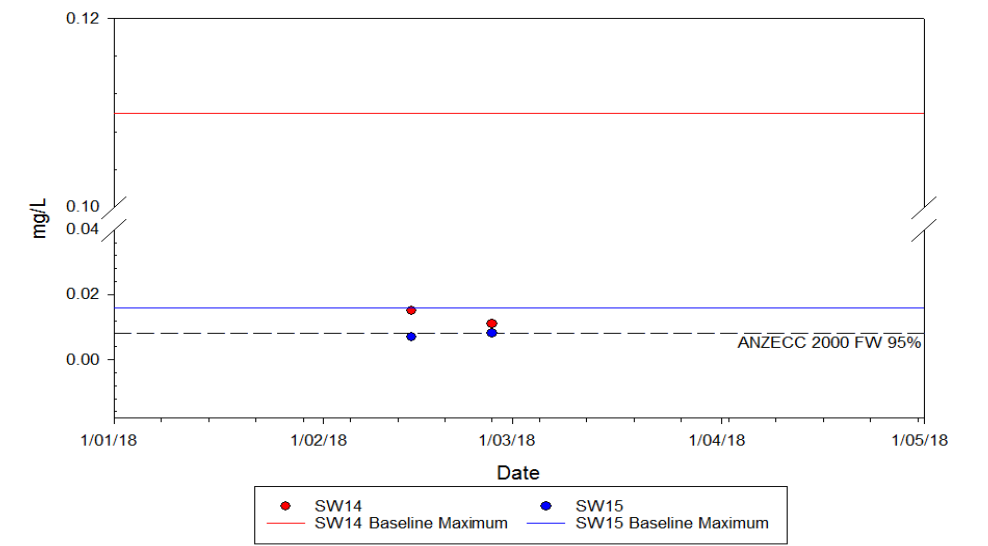
### Zinc Concentration Town Creek



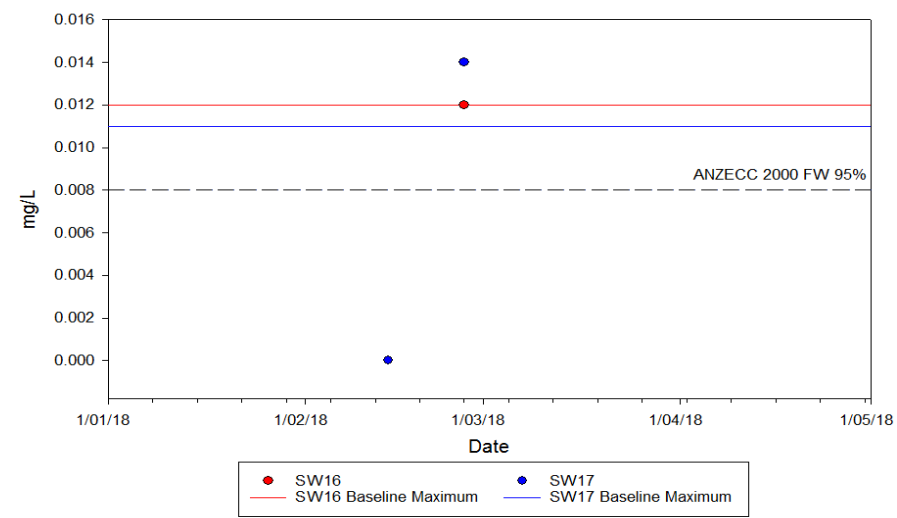
### Zinc Concentration Hitchcock Lane Creek Tributary



### Zinc Concentration Hitchcocks Lane Creek



### Zinc Concentration Unamed Tributary



## Attachment D - Laboratory Certificates

## CERTIFICATE OF ANALYSIS

**Work Order** : **ES1806300**  
**Client** : **GHD PTY LTD**  
**Contact** : MS JANE CURRAN  
**Address** : 1/51 GRAHAM STREET  
 NOWRA NSW, AUSTRALIA 2541  
**Telephone** : +61 02 9239 7100  
**Project** : 2316261  
**Order number** : 2316261  
**C-O-C number** : ----  
**Sampler** : Iain Lindley, Rob Webb  
**Site** : FBB PC  
**Quote number** : SY/603/17 A  
**No. of samples received** : 43  
**No. of samples analysed** : 31

**Page** : 1 of 16  
**Laboratory** : Environmental Division Sydney  
**Contact** : Customer Services ES  
**Address** : 277-289 Woodpark Road Smithfield NSW Australia 2164  
**Telephone** : +61-2-8784 8555  
**Date Samples Received** : 28-Feb-2018 08:45  
**Date Analysis Commenced** : 28-Feb-2018  
**Issue Date** : 07-Mar-2018 16:29



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW



## General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
LOR = Limit of reporting  
^ = This result is computed from individual analyte detections at or above the level of reporting  
ø = ALS is not NATA accredited for these tests.  
~ = Indicates an estimated value.





## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW01_1	QC1	SW02_1	SW03_1	SW04_1
Client sampling date / time				26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1806300-001	ES1806300-002	ES1806300-005	ES1806300-008	ES1806300-011	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	8	10	<5	5	<5	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	14.3	14.3	12.5	11.0	7.5	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.002	0.002	<0.001	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	0.008	<0.005	0.010	0.007	0.008	
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	0.14	0.15	0.17	0.21	0.43	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	0.5	0.4	0.4	0.3	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L	0.6	0.6	0.6	0.6	0.7	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L	0.09	0.08	0.08	0.06	0.03	
<b>EP080/071: Total Petroleum Hydrocarbons</b>									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	<50	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW01_1	QC1	SW02_1	SW03_1	SW04_1	
Client sampling date / time				26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00		
Compound	CAS Number	LOR	Unit	ES1806300-001	ES1806300-002	ES1806300-005	ES1806300-008	ES1806300-011		
				Result	Result	Result	Result	Result		
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>										
^ >C10 - C40 Fraction (sum)				----	100	µg/L	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)				----	100	µg/L	<100	<100	<100	<100
<b>EP080: BTEXN</b>										
Benzene				71-43-2	1	µg/L	<1	<1	<1	<1
Toluene				108-88-3	2	µg/L	<2	<2	<2	<2
Ethylbenzene				100-41-4	2	µg/L	<2	<2	<2	<2
meta- & para-Xylene				108-38-3	106-42-3	2	µg/L	<2	<2	<2
ortho-Xylene				95-47-6	2	µg/L	<2	<2	<2	<2
^ Total Xylenes				----	2	µg/L	<2	<2	<2	<2
^ Sum of BTEX				----	1	µg/L	<1	<1	<1	<1
Naphthalene				91-20-3	5	µg/L	<5	<5	<5	<5
<b>EP080S: TPH(V)/BTEX Surrogates</b>										
1,2-Dichloroethane-D4				17060-07-0	2	%	90.4	86.3	90.3	92.6
Toluene-D8				2037-26-5	2	%	102	100	101	104
4-Bromofluorobenzene				460-00-4	2	%	98.2	96.5	96.5	98.9



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW04_2	SW04_3	SW05	SW06_1	SW08
Client sampling date / time				26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1806300-012	ES1806300-013	ES1806300-014	ES1806300-015	ES1806300-018	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	7.0	9.3	11.6	9.3	9.8	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	0.001	<0.001	0.003	0.002	0.005	
Nickel	7440-02-0	0.001	mg/L	0.002	<0.001	<0.001	<0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	0.006	0.009	0.008	0.013	0.006	
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	0.45	0.40	0.24	1.30	0.78	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	0.3	0.4	0.5	0.7	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L	0.8	0.7	0.6	1.8	1.5	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L	0.03	0.03	0.07	0.11	0.18	
<b>EP080/071: Total Petroleum Hydrocarbons</b>									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	<50	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW04_2	SW04_3	SW05	SW06_1	SW08		
Client sampling date / time				26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00			
Compound	CAS Number	LOR	Unit	ES1806300-012	ES1806300-013	ES1806300-014	ES1806300-015	ES1806300-018			
				Result	Result	Result	Result	Result			
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>											
^ >C10 - C40 Fraction (sum)				----	100	µg/L	<100	<100	<100	<100	
^ >C10 - C16 Fraction minus Naphthalene (F2)				----	100	µg/L	<100	<100	<100	<100	
<b>EP080: BTEXN</b>											
Benzene				71-43-2	1	µg/L	<1	<1	<1	<1	
Toluene				108-88-3	2	µg/L	<2	<2	<2	<2	
Ethylbenzene				100-41-4	2	µg/L	<2	<2	<2	<2	
meta- & para-Xylene				108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	
ortho-Xylene				95-47-6	2	µg/L	<2	<2	<2	<2	
^ Total Xylenes				----	2	µg/L	<2	<2	<2	<2	
^ Sum of BTEX				----	1	µg/L	<1	<1	<1	<1	
Naphthalene				91-20-3	5	µg/L	<5	<5	<5	<5	
<b>EP080S: TPH(V)/BTEX Surrogates</b>											
1,2-Dichloroethane-D4				17060-07-0	2	%	89.1	99.8	91.4	89.3	90.4
Toluene-D8				2037-26-5	2	%	101	115	105	103	105
4-Bromofluorobenzene				460-00-4	2	%	96.3	107	98.9	97.1	97.8



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW09_1	QC2	SW09_2	SW09_3	SW10_1
Client sampling date / time				26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1806300-019	ES1806300-020	ES1806300-021	ES1806300-022	ES1806300-023	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	10.3	9.7	9.7	10.3	12.5	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	0.001	
Copper	7440-50-8	0.001	mg/L	0.001	0.002	0.001	0.002	0.003	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.001	0.002	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	0.006	<0.005	<0.005	<0.005	0.010	
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	1.16	1.16	1.17	1.17	0.29	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	0.4	0.4	0.4	0.7	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L	1.7	1.6	1.6	1.6	1.0	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L	0.08	0.08	0.08	0.10	0.21	
<b>EP080/071: Total Petroleum Hydrocarbons</b>									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	<50	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW09_1	QC2	SW09_2	SW09_3	SW10_1	
Client sampling date / time				26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00		
Compound	CAS Number	LOR	Unit	ES1806300-019	ES1806300-020	ES1806300-021	ES1806300-022	ES1806300-023		
				Result	Result	Result	Result	Result		
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>										
^ >C10 - C40 Fraction (sum)				----	100	µg/L	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)				----	100	µg/L	<100	<100	<100	<100
<b>EP080: BTEXN</b>										
Benzene				71-43-2	1	µg/L	<1	<1	<1	<1
Toluene				108-88-3	2	µg/L	<2	<2	<2	<2
Ethylbenzene				100-41-4	2	µg/L	<2	<2	<2	<2
meta- & para-Xylene				108-38-3	106-42-3	2	µg/L	<2	<2	<2
ortho-Xylene				95-47-6	2	µg/L	<2	<2	<2	<2
^ Total Xylenes				----	2	µg/L	<2	<2	<2	<2
^ Sum of BTEX				----	1	µg/L	<1	<1	<1	<1
Naphthalene				91-20-3	5	µg/L	<5	<5	<5	<5
<b>EP080S: TPH(V)/BTEX Surrogates</b>										
1,2-Dichloroethane-D4				17060-07-0	2	%	89.3	90.9	90.4	90.2
Toluene-D8				2037-26-5	2	%	104	106	107	106
4-Bromofluorobenzene				460-00-4	2	%	98.2	99.5	98.0	98.0



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW07_1	SW07_2	SW07_3	SW11_1	SW12_1
Client sampling date / time				26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1806300-024	ES1806300-025	ES1806300-026	ES1806300-027	ES1806300-028	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	----	7	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	7.6	7.5	7.9	----	30.1	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	----	0.002	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	----	0.002	
Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.001	----	0.003	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.002	----	0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	<0.001	
Zinc	7440-66-6	0.005	mg/L	0.014	0.009	0.016	----	0.008	
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	<0.0001	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	0.52	0.51	0.54	----	1.20	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.4	0.3	0.4	----	0.6	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L	0.9	0.8	0.9	----	1.8	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L	0.05	0.05	0.07	----	0.09	
<b>EP080/071: Total Petroleum Hydrocarbons</b>									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	----	<20	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	----	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	----	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	----	<50	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	----	<50	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	----	<20	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	----	<20	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	----	<100	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	----	<100	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	----	<100	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW07_1	SW07_2	SW07_3	SW11_1	SW12_1			
Client sampling date / time				26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00				
Compound	CAS Number	LOR	Unit	ES1806300-024	ES1806300-025	ES1806300-026	ES1806300-027	ES1806300-028				
				Result	Result	Result	Result	Result				
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>												
^ >C10 - C40 Fraction (sum)				----	100	µg/L	<100	<100	<100	----	<100	
^ >C10 - C16 Fraction minus Naphthalene (F2)				----	100	µg/L	<100	<100	<100	----	<100	
<b>EP080: BTEXN</b>												
Benzene				71-43-2	1	µg/L	<1	<1	<1	----	<1	
Toluene				108-88-3	2	µg/L	<2	<2	<2	----	<2	
Ethylbenzene				100-41-4	2	µg/L	<2	<2	<2	----	<2	
meta- & para-Xylene				108-38-3	106-42-3	2	µg/L	<2	<2	<2	----	<2
ortho-Xylene				95-47-6	2	µg/L	<2	<2	<2	----	<2	
^ Total Xylenes				----	2	µg/L	<2	<2	<2	----	<2	
^ Sum of BTEX				----	1	µg/L	<1	<1	<1	----	<1	
Naphthalene				91-20-3	5	µg/L	<5	<5	<5	----	<5	
<b>EP080S: TPH(V)/BTEX Surrogates</b>												
1,2-Dichloroethane-D4				17060-07-0	2	%	90.0	92.1	92.2	89.3	94.5	
Toluene-D8				2037-26-5	2	%	106	106	108	107	106	
4-Bromofluorobenzene				460-00-4	2	%	98.4	100	99.6	98.0	98.7	





## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW12_2	SW12_3	SW13_1	SW13_2	SW13_3
Client sampling date / time				26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1806300-029	ES1806300-030	ES1806300-031	ES1806300-032	ES1806300-033	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	5	8	8	14	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	27.8	30.1	32.0	31.2	34.4	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Arsenic	7440-38-2	0.001	mg/L	0.002	0.003	0.002	0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	0.001	0.001	0.002	0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	0.004	0.003	0.005	0.004	0.004	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.002	0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	0.017	<0.005	0.022	0.017	0.022	
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	1.15	1.24	1.20	1.28	1.30	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.6	0.6	0.6	0.5	0.5	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L	1.8	1.8	1.8	1.8	1.8	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L	0.09	0.09	0.07	0.06	0.08	
<b>EP080/071: Total Petroleum Hydrocarbons</b>									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	<50	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW12_2	SW12_3	SW13_1	SW13_2	SW13_3	
Client sampling date / time				26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00		
Compound	CAS Number	LOR	Unit	ES1806300-029	ES1806300-030	ES1806300-031	ES1806300-032	ES1806300-033		
				Result	Result	Result	Result	Result		
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>										
^ >C10 - C40 Fraction (sum)				----	100	µg/L	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)				----	100	µg/L	<100	<100	<100	<100
<b>EP080: BTEXN</b>										
Benzene				71-43-2	1	µg/L	<1	<1	<1	<1
Toluene				108-88-3	2	µg/L	<2	<2	<2	<2
Ethylbenzene				100-41-4	2	µg/L	<2	<2	<2	<2
meta- & para-Xylene				108-38-3	106-42-3	2	µg/L	<2	<2	<2
ortho-Xylene				95-47-6	2	µg/L	<2	<2	<2	<2
^ Total Xylenes				----	2	µg/L	<2	<2	<2	<2
^ Sum of BTEX				----	1	µg/L	<1	<1	<1	<1
Naphthalene				91-20-3	5	µg/L	<5	<5	<5	<5
<b>EP080S: TPH(V)/BTEX Surrogates</b>										
1,2-Dichloroethane-D4				17060-07-0	2	%	87.2	103	103	107
Toluene-D8				2037-26-5	2	%	95.6	113	113	120
4-Bromofluorobenzene				460-00-4	2	%	90.1	104	104	109



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW14	SW15_1	SW16	SW17	SW11_2
Client sampling date / time				26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1806300-034	ES1806300-035	ES1806300-038	ES1806300-039	ES1806300-042	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	30	<5	<5	9	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	23.5	112	14.0	13.7	30.5	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	0.006	0.007	0.002	0.002	0.006	
Nickel	7440-02-0	0.001	mg/L	0.002	0.001	0.001	0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	0.011	0.008	0.012	0.014	0.015	
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	0.24	0.61	0.55	0.57	2.21	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.7	0.8	0.4	0.4	0.8	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L	0.9	1.4	1.0	1.0	3.0	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L	0.06	0.14	0.09	0.08	0.08	
<b>EP080/071: Total Petroleum Hydrocarbons</b>									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	<50	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW14	SW15_1	SW16	SW17	SW11_2
Client sampling date / time					26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00	26-Feb-2018 00:00
Compound	CAS Number	LOR	Unit		ES1806300-034	ES1806300-035	ES1806300-038	ES1806300-039	ES1806300-042
					Result	Result	Result	Result	Result
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>									
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	<100	<100	<100
<b>EP080: BTEXN</b>									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ Total Xylenes	----	2	µg/L		<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
<b>EP080S: TPH(V)/BTEX Surrogates</b>									
1,2-Dichloroethane-D4	17060-07-0	2	%		106	104	104	105	103
Toluene-D8	2037-26-5	2	%		113	108	111	112	114
4-Bromofluorobenzene	460-00-4	2	%		104	102	103	105	105



### Analytical Results

Sub-Matrix: <b>WATER</b> (Matrix: <b>WATER</b> )				Client sample ID	SW11_3	----	----	----	----
Client sampling date / time				26-Feb-2018 00:00	----	----	----	----	
Compound	CAS Number	LOR	Unit	ES1806300-043	-----	-----	-----	-----	
				Result	----	----	----	----	
<b>EP080S: TPH(V)/BTEX Surrogates</b>									
<b>1,2-Dichloroethane-D4</b>	17060-07-0	2	%	<b>103</b>	----	----	----	----	
<b>Toluene-D8</b>	2037-26-5	2	%	<b>110</b>	----	----	----	----	
<b>4-Bromofluorobenzene</b>	460-00-4	2	%	<b>104</b>	----	----	----	----	



## Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
<b>EP080S: TPH(V)/BTEX Surrogates</b>			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

## QUALITY CONTROL REPORT

<b>Work Order</b>	: <b>ES1806300</b>	Page	: 1 of 10
<b>Client</b>	: <b>GHD PTY LTD</b>	<b>Laboratory</b>	: Environmental Division Sydney
<b>Contact</b>	: MS JANE CURRAN	<b>Contact</b>	: Customer Services ES
<b>Address</b>	: 1/51 GRAHAM STREET NOWRA NSW, AUSTRALIA 2541	<b>Address</b>	: 277-289 Woodpark Road Smithfield NSW Australia 2164
<b>Telephone</b>	: +61 02 9239 7100	<b>Telephone</b>	: +61-2-8784 8555
<b>Project</b>	: 2316261	<b>Date Samples Received</b>	: 28-Feb-2018
<b>Order number</b>	: 2316261	<b>Date Analysis Commenced</b>	: 28-Feb-2018
<b>C-O-C number</b>	: ----	<b>Issue Date</b>	: 07-Mar-2018
<b>Sampler</b>	: Iain Lindley, Rob Webb		
<b>Site</b>	: FBB PC		
<b>Quote number</b>	: SY/603/17 A		
<b>No. of samples received</b>	: 43		
<b>No. of samples analysed</b>	: 31		



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

This Quality Control Report contains the following information:

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW



## General Comments

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

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

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

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

## Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 1471293)</b>									
ES1806062-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.00	No Limit
ES1806300-001	SW01_1	EA025H: Suspended Solids (SS)	----	5	mg/L	8	7	13.8	No Limit
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 1471294)</b>									
ES1806300-019	SW09_1	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.00	No Limit
ES1806300-029	SW12_2	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	6	18.2	No Limit
<b>EA045: Turbidity (QC Lot: 1463564)</b>									
ES1806300-001	SW01_1	EA045: Turbidity	----	0.1	NTU	14.3	13.8	3.56	0% - 20%
ES1806300-018	SW08	EA045: Turbidity	----	0.1	NTU	9.8	9.9	1.32	0% - 20%
<b>EA045: Turbidity (QC Lot: 1463565)</b>									
ES1806300-030	SW12_3	EA045: Turbidity	----	0.1	NTU	30.1	30.0	0.333	0% - 20%
ES1806300-043	SW11_3	EA045: Turbidity	----	0.1	NTU	26.8	27.7	3.30	0% - 20%
<b>EA045: Turbidity (QC Lot: 1465723)</b>									
ES1806273-008	Anonymous	EA045: Turbidity	----	0.1	NTU	27.8	28.0	0.717	0% - 20%
ES1806310-001	Anonymous	EA045: Turbidity	----	0.1	NTU	2.2	2.2	0.00	0% - 20%
<b>EG020F: Dissolved Metals by ICP-MS (QC Lot: 1468445)</b>									
ES1806033-006	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.00	No Limit
ES1806300-018	SW08	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit





Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
<b>EG020F: Dissolved Metals by ICP-MS (QC Lot: 1468445) - continued</b>									
ES1806300-018	SW08	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.005	0.004	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.006	0.006	0.00	No Limit
<b>EG020F: Dissolved Metals by ICP-MS (QC Lot: 1468447)</b>									
ES1806300-028	SW12_1	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.001	<0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.008	0.006	26.9	No Limit
ES1806300-042	SW11_2	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.006	0.005	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.015	0.012	15.6	No Limit		
<b>EG035F: Dissolved Mercury by FIMS (QC Lot: 1468446)</b>									
ES1806300-002	QC1	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
ES1806300-018	SW08	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
<b>EG035F: Dissolved Mercury by FIMS (QC Lot: 1468448)</b>									
ES1806300-030	SW12_3	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
ES1806300-042	SW11_2	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 1467216)</b>									
ES1806300-001	SW01_1	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.14	0.14	0.00	0% - 50%
ES1806300-018	SW08	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.78	0.80	2.41	0% - 20%
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 1467217)</b>									
ES1806300-029	SW12_2	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	1.15	1.29	11.2	0% - 20%
ES1806300-042	SW11_2	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	2.21	2.20	0.00	0% - 20%
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 1467212)</b>									
ES1806300-001	SW01_1	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	0.5	0.00	No Limit
ES1806300-019	SW09_1	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	0.4	0.00	No Limit
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 1467214)</b>									
ES1806300-029	SW12_2	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.6	0.6	0.00	No Limit
ES1806300-043	SW11_3	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.0	0.8	19.6	0% - 50%
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 1467213)</b>									



Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)	
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 1467213) - continued</b>										
ES1806300-001	SW01_1	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.09	0.10	0.00	No Limit	
ES1806300-019	SW09_1	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.08	0.08	12.8	No Limit	
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 1467215)</b>										
ES1806300-029	SW12_2	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.09	0.09	0.00	No Limit	
ES1806300-043	SW11_3	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.07	0.06	0.00	No Limit	
<b>EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1466105)</b>										
ES1806300-001	SW01_1	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.00	No Limit	
ES1806300-019	SW09_1	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.00	No Limit	
<b>EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1467817)</b>										
ES1806177-001	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	30	30	0.00	No Limit	
ES1806300-034	SW14	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.00	No Limit	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 1466105)</b>										
ES1806300-001	SW01_1	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.00	No Limit	
ES1806300-019	SW09_1	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.00	No Limit	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 1467817)</b>										
ES1806177-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	30	30	0.00	No Limit	
ES1806300-034	SW14	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.00	No Limit	
<b>EP080: BTEXN (QC Lot: 1466105)</b>										
ES1806300-001	SW01_1	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit	
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit	
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit	
		EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	0.00	No Limit	
			106-42-3							
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit	
ES1806300-019	SW09_1	EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.00	No Limit	
		EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit	
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit	
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit	
		EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	0.00	No Limit	
			106-42-3							
ES1806177-001	Anonymous	EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit	
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.00	No Limit	
		EP080: Benzene	71-43-2	1	µg/L	11	10	0.00	0% - 50%	
		EP080: Toluene	108-88-3	2	µg/L	4	4	0.00	No Limit	
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit	
ES1806177-001	Anonymous	EP080: meta- & para-Xylene	108-38-3	2	µg/L	2	2	0.00	No Limit	
			106-42-3							
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit	

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 Client : GHD PTY LTD  
 Project : 2316261



Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
<b>EP080: BTEXN (QC Lot: 1467817) - continued</b>									
ES1806177-001	Anonymous	EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.00	No Limit
ES1806300-034	SW14	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	0.00	No Limit
			106-42-3						
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.00	No Limit



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

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

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 1471293)</b>									
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	104	83	129	
				<5	1000 mg/L	92.2	82	110	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 1471294)</b>									
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	93.3	83	129	
				<5	1000 mg/L	92.6	82	110	
<b>EA045: Turbidity (QCLot: 1463564)</b>									
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	99.5	91	105	
<b>EA045: Turbidity (QCLot: 1463565)</b>									
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	99.8	91	105	
<b>EA045: Turbidity (QCLot: 1465723)</b>									
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	94.0	91	105	
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 1468445)</b>									
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	94.6	85	114	
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	91.5	84	110	
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	92.4	85	111	
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	90.1	81	111	
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	94.6	83	111	
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	96.0	82	112	
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	98.1	81	117	
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 1468447)</b>									
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	92.9	85	114	
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	94.6	84	110	
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	92.4	85	111	
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	93.4	81	111	
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	94.1	83	111	
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	91.4	82	112	
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	90.1	81	117	
<b>EG035F: Dissolved Mercury by FIMS (QCLot: 1468446)</b>									
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	87.9	83	105	
<b>EG035F: Dissolved Mercury by FIMS (QCLot: 1468448)</b>									
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	88.9	83	105	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1467216)</b>									
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	97.8	91	113	



Sub-Matrix: WATER

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike	Spike Recovery (%)		Recovery Limits (%)	
					Concentration	LCS	Low	High	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1467217)</b>									
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	99.2	91	113	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1467212)</b>									
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	74.9	69	101	
				<0.1	1 mg/L	73.0	70	118	
				<0.1	5 mg/L	83.1	74	118	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1467214)</b>									
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	77.8	69	101	
				<0.1	1 mg/L	75.1	70	118	
				<0.1	5 mg/L	84.9	74	118	
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1467213)</b>									
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	92.1	71	101	
				<0.01	0.442 mg/L	85.6	72	108	
				<0.01	1 mg/L	102	78	118	
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1467215)</b>									
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	98.9	71	101	
				<0.01	0.442 mg/L	99.6	72	108	
				<0.01	1 mg/L	105	78	118	
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1464569)</b>									
EP071: C10 - C14 Fraction	----	50	µg/L	<50	2000 µg/L	87.7	76	116	
EP071: C15 - C28 Fraction	----	100	µg/L	<100	3000 µg/L	104	83	109	
EP071: C29 - C36 Fraction	----	50	µg/L	<50	2000 µg/L	104	75	113	
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1464570)</b>									
EP071: C10 - C14 Fraction	----	50	µg/L	<50	2000 µg/L	88.7	76	116	
EP071: C15 - C28 Fraction	----	100	µg/L	<100	3000 µg/L	88.3	83	109	
EP071: C29 - C36 Fraction	----	50	µg/L	<50	2000 µg/L	83.7	75	113	
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1465041)</b>									
EP071: C10 - C14 Fraction	----	50	µg/L	<50	2000 µg/L	89.2	76	116	
EP071: C15 - C28 Fraction	----	100	µg/L	<100	3000 µg/L	87.4	83	109	
EP071: C29 - C36 Fraction	----	50	µg/L	<50	2000 µg/L	103	75	113	
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1466105)</b>									
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	89.6	75	127	
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1467817)</b>									
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	86.7	75	127	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1464569)</b>									
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	2500 µg/L	81.4	76	114	
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	3500 µg/L	98.6	81	111	
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	1500 µg/L	108	77	119	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1464570)</b>									



Sub-Matrix: WATER

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report				
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1464570) - continued</b>									
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	2500 µg/L	96.2	76	114	
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	3500 µg/L	97.7	81	111	
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	1500 µg/L	98.4	77	119	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1465041)</b>									
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	2500 µg/L	88.0	76	114	
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	3500 µg/L	93.3	81	111	
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	1500 µg/L	106	77	119	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1466105)</b>									
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	92.0	75	127	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1467817)</b>									
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	90.0	75	127	
<b>EP080: BTEXN (QCLot: 1466105)</b>									
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	99.4	70	122	
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	98.3	69	123	
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	98.7	70	120	
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	99.4	69	121	
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	100	72	122	
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	108	70	120	
<b>EP080: BTEXN (QCLot: 1467817)</b>									
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	103	70	122	
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	94.6	69	123	
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	93.2	70	120	
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	90.3	69	121	
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	92.6	72	122	
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	91.9	70	120	

### Matrix Spike (MS) Report

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

Sub-Matrix: WATER

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report				
				Spike Concentration	Spike Recovery(%)		Recovery Limits (%)	
					MS	Low	High	
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 1468445)</b>								
ES1806300-005	SW02_1	EG020A-F: Arsenic	7440-38-2	1 mg/L	89.0	70	130	
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	92.6	70	130	



Sub-Matrix: WATER

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 1468445) - continued</b>							
ES1806300-005	SW02_1	EG020A-F: Chromium	7440-47-3	1 mg/L	97.2	70	130
		EG020A-F: Copper	7440-50-8	1 mg/L	92.9	70	130
		EG020A-F: Lead	7439-92-1	1 mg/L	95.6	70	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	92.9	70	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	95.6	70	130
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 1468447)</b>							
ES1806300-029	SW12_2	EG020A-F: Arsenic	7440-38-2	1 mg/L	91.0	70	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	95.2	70	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	97.9	70	130
		EG020A-F: Copper	7440-50-8	1 mg/L	93.2	70	130
		EG020A-F: Lead	7439-92-1	1 mg/L	95.4	70	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	94.2	70	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	95.2	70	130
<b>EG035F: Dissolved Mercury by FIMS (QCLot: 1468446)</b>							
ES1806300-001	SW01_1	EG035F: Mercury	7439-97-6	0.01 mg/L	84.8	70	130
<b>EG035F: Dissolved Mercury by FIMS (QCLot: 1468448)</b>							
ES1806300-031	SW13_1	EG035F: Mercury	7439-97-6	0.01 mg/L	80.8	70	130
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1467216)</b>							
ES1806300-001	SW01_1	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	88.8	70	130
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1467217)</b>							
ES1806300-029	SW12_2	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	106	70	130
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1467212)</b>							
ES1806300-002	QC1	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	79.4	70	130
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1467214)</b>							
ES1806300-030	SW12_3	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	72.5	70	130
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1467213)</b>							
ES1806300-002	QC1	EK067G: Total Phosphorus as P	----	1 mg/L	98.3	70	130
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1467215)</b>							
ES1806300-030	SW12_3	EK067G: Total Phosphorus as P	----	1 mg/L	91.3	70	130
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1466105)</b>							
ES1806300-001	SW01_1	EP080: C6 - C9 Fraction	----	325 µg/L	84.6	70	130
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1467817)</b>							
ES1806177-001	Anonymous	EP080: C6 - C9 Fraction	----	325 µg/L	75.5	70	130
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1466105)</b>							
ES1806300-001	SW01_1	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	86.9	70	130



Sub-Matrix: WATER

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1467817)</b>							
ES1806177-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	79.7	70	130
<b>EP080: BTEXN (QCLot: 1466105)</b>							
ES1806300-001	SW01_1	EP080: Benzene	71-43-2	25 µg/L	85.1	70	130
		EP080: Toluene	108-88-3	25 µg/L	90.2	70	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	96.5	70	130
		EP080: meta- & para-Xylene	108-38-3	25 µg/L	96.5	70	130
		EP080: ortho-Xylene	106-42-3	25 µg/L	97.9	70	130
		EP080: Naphthalene	95-47-6	25 µg/L	108	70	130
<b>EP080: BTEXN (QCLot: 1467817)</b>							
ES1806177-001	Anonymous	EP080: Benzene	71-43-2	25 µg/L	85.9	70	130
		EP080: Toluene	108-88-3	25 µg/L	87.3	70	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	94.5	70	130
		EP080: meta- & para-Xylene	108-38-3	25 µg/L	91.6	70	130
		EP080: ortho-Xylene	106-42-3	25 µg/L	96.1	70	130
		EP080: Naphthalene	95-47-6	25 µg/L	107	70	130



## QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES1806300	Page	: 1 of 13
Client	: GHD PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MS JANE CURRAN	Telephone	: +61-2-8784 8555
Project	: 2316261	Date Samples Received	: 28-Feb-2018
Site	: FBB PC	Issue Date	: 07-Mar-2018
Sampler	: Iain Lindley, Rob Webb	No. of samples received	: 43
Order number	: 2316261	No. of samples analysed	: 31

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

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

### Summary of Outliers

#### Outliers : Quality Control Samples

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

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

#### Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

#### Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers exist - please see following pages for full details.



### Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
Container / Client Sample ID(s)						
<b>EA045: Turbidity</b>						
Clear Plastic Bottle - Natural SW10_1	----	----	----	01-Mar-2018	28-Feb-2018	1

### Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
<b>Laboratory Duplicates (DUP)</b>					
TRH - Semivolatile Fraction	0	37	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
<b>Matrix Spikes (MS)</b>					
TRH - Semivolatile Fraction	0	37	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

### Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>							
Clear Plastic Bottle - Natural (EA025H)							



Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C - Continued</b>								
SW01_1, QC1, SW02_1, SW03_1, SW04_1, SW04_2, SW04_3, SW05, SW06_1, SW08, SW09_1, QC2, SW09_2, SW09_3, SW10_1, SW07_1, SW07_2, SW07_3, SW12_1, SW12_2, SW12_3, SW13_1, SW13_2, SW13_3, SW14, SW15_1, SW16, SW17, SW11_2	26-Feb-2018	----	----	----	05-Mar-2018	05-Mar-2018	✓	
<b>EA045: Turbidity</b>								
<b>Clear Plastic Bottle - Natural (EA045)</b>								
SW01_1, QC1, SW02_1, SW03_1, SW04_1, SW04_2, SW04_3, SW05, SW06_1, SW08, SW09_1, QC2, SW09_2, SW09_3, SW07_1, SW07_2, SW07_3, SW12_1, SW12_2, SW12_3, SW13_1, SW13_2, SW13_3, SW14, SW15_1, SW16	26-Feb-2018	----	----	----	28-Feb-2018	28-Feb-2018	✓	
<b>Clear Plastic Bottle - Natural (EA045)</b> SW10_1	26-Feb-2018	----	----	----	01-Mar-2018	28-Feb-2018	*	
<b>Clear Plastic Bottle - Natural (EA045)</b> SW17,	26-Feb-2018	----	----	----	28-Feb-2018	28-Feb-2018	✓	



Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
<b>EG020F: Dissolved Metals by ICP-MS</b>							
<b>Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)</b>							
SW01_1, QC1,	26-Feb-2018	----	----	----	02-Mar-2018	25-Aug-2018	✓
SW02_1, SW03_1,							
SW04_1, SW04_2,							
SW04_3, SW05,							
SW06_1, SW08,							
SW09_1, QC2,							
SW09_2, SW09_3,							
SW10_1, SW07_1,							
SW07_2, SW07_3,							
SW12_1, SW12_2,							
SW12_3, SW13_1,							
SW13_2, SW13_3,							
SW14, SW15_1,							
SW16, SW17,							
SW11_2							
<b>EG035F: Dissolved Mercury by FIMS</b>							
<b>Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)</b>							
SW01_1, QC1,	26-Feb-2018	----	----	----	02-Mar-2018	26-Mar-2018	✓
SW02_1, SW03_1,							
SW04_1, SW04_2,							
SW04_3, SW05,							
SW06_1, SW08,							
SW09_1, QC2,							
SW09_2, SW09_3,							
SW10_1, SW07_1,							
SW07_2, SW07_3,							
SW12_1, SW12_2,							
SW12_3, SW13_1,							
SW13_2, SW13_3,							
SW14, SW15_1,							
SW16, SW17,							
SW11_2							



Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>							
<b>Clear Plastic Bottle - Sulfuric Acid (EK059G)</b>							
SW01_1, QC1, SW02_1, SW03_1, SW04_1, SW04_2, SW04_3, SW05, SW06_1, SW08, SW09_1, QC2, SW09_2, SW09_3, SW10_1, SW07_1, SW07_2, SW07_3, SW12_1, SW12_2, SW12_3, SW13_1, SW13_2, SW13_3, SW14, SW15_1, SW16, SW17, SW11_2	26-Feb-2018	----	----	----	02-Mar-2018	26-Mar-2018	✓
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>							
<b>Clear Plastic Bottle - Sulfuric Acid (EK061G)</b>							
SW01_1, QC1, SW02_1, SW03_1, SW04_1, SW04_2, SW04_3, SW05, SW06_1, SW08, SW09_1, QC2, SW09_2, SW09_3, SW10_1, SW07_1, SW07_2, SW07_3, SW12_1, SW12_2, SW12_3, SW13_1, SW13_2, SW13_3, SW14, SW15_1, SW16, SW17, SW11_2	26-Feb-2018	02-Mar-2018	26-Mar-2018	✓	02-Mar-2018	26-Mar-2018	✓



Matrix: **WATER**

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>								
<b>Clear Plastic Bottle - Sulfuric Acid (EK067G)</b>								
SW01_1, SW02_1, SW04_1, SW04_3, SW06_1, SW09_1, SW09_2, SW10_1, SW07_2, SW12_1, SW12_3, SW13_2, SW14, SW16, SW11_2	QC1, SW03_1, SW04_2, SW05, SW08, QC2, SW09_3, SW07_1, SW07_3, SW12_2, SW13_1, SW13_3, SW15_1, SW17,	26-Feb-2018	02-Mar-2018	26-Mar-2018	✓	02-Mar-2018	26-Mar-2018	✓



Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EP080/071: Total Petroleum Hydrocarbons</b>								
<b>Amber Glass Bottle - Unpreserved (EP071)</b>								
SW12_3, SW13_2, SW14, SW16, SW11_2	SW13_1, SW13_3, SW15_1, SW17,	26-Feb-2018	01-Mar-2018	05-Mar-2018	✓	05-Mar-2018	10-Apr-2018	✓
<b>Amber Glass Bottle - Unpreserved (EP071)</b>								
SW10_1		26-Feb-2018	01-Mar-2018	05-Mar-2018	✓	06-Mar-2018	10-Apr-2018	✓
<b>Amber Glass Bottle - Unpreserved (EP071)</b>								
SW01_1, SW02_1, SW04_1, SW04_3, SW06_1, SW09_1, SW09_2, SW07_1, SW07_3, SW12_2	QC1, SW03_1, SW04_2, SW05, SW08, QC2, SW09_3, SW07_2, SW12_1,	26-Feb-2018	02-Mar-2018	05-Mar-2018	✓	04-Mar-2018	11-Apr-2018	✓
<b>Amber VOC Vial - Sulfuric Acid (EP080)</b>								
SW01_1, SW02_1, SW04_1, SW04_3, SW06_1, SW09_1, SW09_2, SW10_1, SW07_2, SW12_1, SW12_3, SW13_2, SW14, SW16, SW11_2	QC1, SW03_1, SW04_2, SW05, SW08, QC2, SW09_3, SW07_1, SW07_3, SW12_2, SW13_1, SW13_3, SW15_1, SW17,	26-Feb-2018	05-Mar-2018	12-Mar-2018	✓	05-Mar-2018	12-Mar-2018	✓



Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>								
<b>Amber Glass Bottle - Unpreserved (EP071)</b> SW12_3, SW13_2, SW14, SW16, SW11_2	SW13_1, SW13_3, SW15_1, SW17,	26-Feb-2018	01-Mar-2018	05-Mar-2018	✓	05-Mar-2018	10-Apr-2018	✓
<b>Amber Glass Bottle - Unpreserved (EP071)</b> SW10_1		26-Feb-2018	01-Mar-2018	05-Mar-2018	✓	06-Mar-2018	10-Apr-2018	✓
<b>Amber Glass Bottle - Unpreserved (EP071)</b> SW01_1, SW02_1, SW04_1, SW04_3, SW06_1, SW09_1, SW09_2, SW07_1, SW07_3, SW12_2	QC1, SW03_1, SW04_2, SW05, SW08, QC2, SW09_3, SW07_2, SW12_1,	26-Feb-2018	02-Mar-2018	05-Mar-2018	✓	04-Mar-2018	11-Apr-2018	✓
<b>Amber VOC Vial - Sulfuric Acid (EP080)</b> SW01_1, SW02_1, SW04_1, SW04_3, SW06_1, SW09_1, SW09_2, SW10_1, SW07_2, SW12_1, SW12_3, SW13_2, SW14, SW16, SW11_2	QC1, SW03_1, SW04_2, SW05, SW08, QC2, SW09_3, SW07_1, SW07_3, SW12_2, SW13_1, SW13_3, SW15_1, SW17,	26-Feb-2018	05-Mar-2018	12-Mar-2018	✓	05-Mar-2018	12-Mar-2018	✓





Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
<b>EP080: BTEXN</b>							
<b>Amber VOC Vial - Sulfuric Acid (EP080)</b>							
SW01_1, QC1,	26-Feb-2018	05-Mar-2018	12-Mar-2018	✓	05-Mar-2018	12-Mar-2018	✓
SW02_1, SW03_1,							
SW04_1, SW04_2,							
SW04_3, SW05,							
SW06_1, SW08,							
SW09_1, QC2,							
SW09_2, SW09_3,							
SW10_1, SW07_1,							
SW07_2, SW07_3,							
SW12_1, SW12_2,							
SW12_3, SW13_1,							
SW13_2, SW13_3,							
SW14, SW15_1,							
SW16, SW17,							
SW11_2							



## Quality Control Parameter Frequency Compliance

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

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

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaular	Actual	Expected	Evaluation	
<b>Analytical Methods</b>							
<b>Laboratory Duplicates (DUP)</b>							
Dissolved Mercury by FIMS	EG035F	4	29	13.79	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	4	38	10.53	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	4	29	13.79	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	4	39	10.26	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	4	29	13.79	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	4	29	13.79	10.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	37	0.00	10.00	✖	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	4	40	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	6	58	10.34	10.00	✔	NEPM 2013 B3 & ALS QC Standard
<b>Laboratory Control Samples (LCS)</b>							
Dissolved Mercury by FIMS	EG035F	2	29	6.90	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	38	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	29	6.90	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	4	39	10.26	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	6	29	20.69	15.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	6	29	20.69	15.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	3	37	8.11	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	40	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	3	58	5.17	5.00	✔	NEPM 2013 B3 & ALS QC Standard
<b>Method Blanks (MB)</b>							
Dissolved Mercury by FIMS	EG035F	2	29	6.90	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	38	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	29	6.90	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	39	5.13	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	29	6.90	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	29	6.90	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	3	37	8.11	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	40	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	3	58	5.17	5.00	✔	NEPM 2013 B3 & ALS QC Standard
<b>Matrix Spikes (MS)</b>							
Dissolved Mercury by FIMS	EG035F	2	29	6.90	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	38	5.26	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	29	6.90	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	29	6.90	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	29	6.90	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	37	0.00	5.00	✖	NEPM 2013 B3 & ALS QC Standard

Page : 11 of 13  
 Work Order : ES1806300  
 Client : GHD PTY LTD  
 Project : 2316261



Matrix: **WATER**

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

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaular	Actual	Expected	Evaluation	
<i>Analytical Methods</i>							
<b>Matrix Spikes (MS) - Continued</b>							
TRH Volatiles/BTEX	EP080	2	40	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard



## Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of 'non-filterable' residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (2013) Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl <sub>2</sub> )(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl <sub>2</sub> which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NO <sub>x</sub> ) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO <sub>3</sub> - F. Combined oxidised Nitrogen (NO <sub>2</sub> +NO <sub>3</sub> ) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO <sub>3</sub> -. This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015A The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260B Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)
Preparation Methods	Method	Matrix	Method Descriptions



<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510B 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (2013) Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for sparging.

## Julia Fracala

---

**From:** Jane Curran <Jane.Curran@ghd.com>  
**Sent:** Thursday, 1 March 2018 9:18 AM  
**To:** Julia Fracala  
**Subject:** FW: SRN for ALS Workorder : ES1806300 | Your Reference: 2316261  
**Attachments:** ES1806300\_0\_SRN\_180228195555.pdf; ES1806300\_ESRN\_ESDAT\_0.Header.xml; ES1806300\_COC.pdf

Hi Julia,

Can you please analyse SW10\_1 and dispose of SW10\_2 and SW10\_3. Can you analyse SW11\_2 and dispose of SW11\_1 and SW\_3 so you have enough vials to do the full analysis seeing as one was broken in the SW11\_1 pair. Because the all secondary vials are broken for the SW13 samples (SW13\_1, SW13\_2 and SW13\_3) what will this mean for getting results from this location?

Thanks

Kind regards,

**Jane Curran**  
**Environmental Scientist**

### GHD

T: 61 2 4424 4960 | V: 234960 | M 0400 450 005 | E: jane.curran@ghd.com  
Level 2, 57 Graham Street (PO Box 621) Nowra NSW 2541 Australia | [www.ghd.com](http://www.ghd.com)

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**From:** angel-no-reply@alsglobal.com [mailto:angel-no-reply@alsglobal.com]

**Sent:** Wednesday, 28 February 2018 7:56 PM

**To:** Jane Curran <Jane.Curran@ghd.com>

**Subject:** SRN for ALS Workorder : ES1806300 | Your Reference: 2316261



## Deliverables for ALS Workorder ES1806300

# Project: 2316261

Dear JANE CURRAN,

Please find enclosed the following deliverables for **ES1806300**:

- ES1806300\_0\_SRN\_180228195555.pdf
- ES1806300\_ESRN\_ESDAT\_0.Header.xml
- ES1806300\_COC.pdf

## Report Recipients

- JANE CURRAN
  - ES1806300\_0\_SRN\_180228195555.pdf (Email)
  - ES1806300\_ESRN\_ESDAT\_0.Header.xml (Email)
  - ES1806300\_COC.pdf (Email)
- GHD LAB REPORTS
  - ES1806300\_0\_SRN\_180228195555.pdf (Email)
  - ES1806300\_ESRN\_ESDAT\_0.Header.xml (Email)
  - ES1806300\_COC.pdf (Email)
- STEFAN CHARTERIS
  - ES1806300\_0\_SRN\_180228195555.pdf (Email)
  - ES1806300\_ESRN\_ESDAT\_0.Header.xml (Email)
  - ES1806300\_COC.pdf (Email)

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LABORATORY: ALS Laboratory  
Ph: 07 3243 7222 E: sammas@alslab.com  
Ph: 07 3243 7222 E: sammas@alslab.com  
Ph: 07 3243 7222 E: sammas@alslab.com

LABORATORY: ALS Laboratory  
Ph: 07 3243 7222 E: sammas@alslab.com  
Ph: 07 3243 7222 E: sammas@alslab.com  
Ph: 07 3243 7222 E: sammas@alslab.com

LABORATORY: ALS Laboratory  
Ph: 07 3243 7222 E: sammas@alslab.com  
Ph: 07 3243 7222 E: sammas@alslab.com  
Ph: 07 3243 7222 E: sammas@alslab.com

LABORATORY: ALS Laboratory  
Ph: 07 3243 7222 E: sammas@alslab.com  
Ph: 07 3243 7222 E: sammas@alslab.com  
Ph: 07 3243 7222 E: sammas@alslab.com

CLIENT: GHID      TURNAROUND REQUIREMENTS:  Standard TAT (List due date);  Non Standard or urgent TAT (List due date);

OFFICE:  Ultra Trace Organics      ALS QUOTE NO.: SY/60317A

PROJECT: FBB PC      ORDER NUMBER: 2316261      CONTACT PH: 040045005

PROJECT MANAGER: Jane Curran      SAMPLER MOBILE:      RELINQUISHED BY: *lain Lindley*      RECEIVED BY: *Kim*

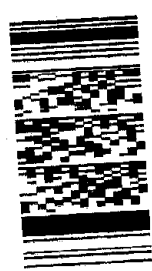
SAMPLER: Iain Lindley, Rob Webb      EDD FORMAT (or default):      DATE/TIME: *28/2/18*      DATE/TIME: *8:45am*

COC emailed to ALS? (YES / NO)      Email Reports to (will default to PM if no other addresses are listed): jane.curran@ghid.com, stefan.charteris@ghid.com

Email invoice to (will default to PM if no other addresses are listed): jane.curran@ghid.com

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE codes below)	(refer to	TOTAL CONTAINERS	W-02 (Dissolved Metals)	EA045 (Turbidity)	TPH (TRH C6-C40)	NT-11 (Total Nitrogen, Total Phosphorus)	EA025H (Suspended Solids)	RECEIVED BY:	DATE/TIME:
1	SW01_1	26/02/2018	W	P, N, AG, V, H		6	X	X	X	X	X		
2	QC1	26/02/2018	W			6	X	X	X	X	X		
3	SW01_2	26/02/2018	W			6							
4	SW01_3	26/02/2018	W			6							
5	SW02_1	26/02/2018	W			6	X	X	X	X	X		
6	SW02_2	26/02/2018	W			6							
7	SW02_3	26/02/2018	W			6							
8	SW03_1	26/02/2018	W			6	X	X	X	X	X		
9	SW03_2	26/02/2018	W			6							
10	SW03_3	26/02/2018	W			6							
11	SW04_1	26/02/2018	W			6	X	X	X	X	X		
12	SW04_2	26/02/2018	W			6	X	X	X	X	X		
<b>URGENT</b>						TOTAL	72						



Environmental Division  
York Order Reference  
**EST1806300**

Telephone: +61-2-8794-8555

Telephone: +61-2-8794-8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; OSG = Nitric Preserved ORC; SH = Sodium Hydroxide/Cl Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airflight Unpreserved Plastic; V = VOA Via HCl Preserved; VB = VOA Via Sodium Bisulfate Preserved; VS = VOA Via Sulfuric Preserved; AV = Airflight Unpreserved Via SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Specialisation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag





# CHAIN OF CUSTODY

ALS Laboratory  
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ALCULAUDE 21, Burns Road, Penrith, SA 5096  
Ph: 08 8350 6690 E: aliculau@als.com.au  
2805/18 222 E: samples@als.com.au  
2805/18 222 E: samples@als.com.au  
2805/18 222 E: samples@als.com.au  
2805/18 222 E: samples@als.com.au

MACONRY 78, Macdonald Street, Langney QLD 4170  
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2805/18 222 E: samples@als.com.au  
2805/18 222 E: samples@als.com.au

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2805/18 222 E: samples@als.com.au  
2805/18 222 E: samples@als.com.au

SYDNEY 27/78, Ascot Road, Northmead NSW 2164  
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2805/18 222 E: samples@als.com.au  
2805/18 222 E: samples@als.com.au  
2805/18 222 E: samples@als.com.au

CLIENT: GHD  
OFFICE: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)  Standard TAT (list due date)  Non Standard or urgent TAT (list due date)

PROJECT: FBB PC  
ORDER NUMBER: 2316261  
PROJECT MANAGER: Jane Curran  
CONTACT PH: 0400450005  
SAMPLER: Iain Lindley, Rob Webb  
SAMPLER MOBILE: EDD FORMAT (or default):

ALC QUOTE NO.: SY/803917A  
RELINQUISHED BY: DATE/TIME: RECEIVED BY: DATE/TIME: RECEIVED BY: DATE/TIME:

COC emailed to ALS? ( YES / NO )  
Email Reports to (will default to PM if no other addresses are listed): jane.curran@ghd.com, stehan.charters@ghd.com  
Email Invoice to (will default to PM if no other addresses are listed): jane.curran@ghd.com

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:  
RELINQUISHED BY: DATE/TIME: RECEIVED BY: DATE/TIME:

## CONTAINER INFORMATION

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (codes below)	TOTAL CONTAINERS	W-02 (Dissolved Metals)	EA045 (Turbidity)	TPH (TRH C6-C40)	NT-11 (Total Nitrogen, Total Phosphorus)	EA025H (Suspended Solids)	Additional Information
13	SW04_3	28/02/2018	W		6	X	X	X	X	X	dispose
14	SW05	28/02/2018	W		6	X	X	X	X	X	dispose
15	SW06_1	28/02/2018	W		6	X	X	X	X	X	dispose
16	SW06_2	28/02/2018	W		6	X	X	X	X	X	dispose
17	SW06_3	28/02/2018	W		6	X	X	X	X	X	dispose
18	SW08	28/02/2018	W		6	X	X	X	X	X	dispose
19	SW09_1	28/02/2018	W		6	X	X	X	X	X	dispose
20	QC2	28/02/2018	W		6	X	X	X	X	X	dispose
21	SW09_2	28/02/2018	W		6	X	X	X	X	X	dispose
22	SW09_3	28/02/2018	W		6	X	X	X	X	X	dispose
23	SW10_1	28/02/2018	W		6	X	X	X	X	X	dispose
24	SW07_1	28/02/2018	W		6	X	X	X	X	X	dispose
<b>URGENT</b>					TOTAL	72					

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide Preserved Plastic; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved AP - Airfreight Unpreserved Plastic  
 V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;  
 Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag

**ALS**  
**CHAIN OF CUSTODY**  
 ALS Laboratory:  
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JLABELAO: 21 Bruce Street, North Sydney, NSW 1585  
 Ph: 02 9559 2600 E: admin@als.com.au  
 JLABELAS: 120 Sturt Street, Sturt, SA 5093  
 Ph: 08 8347 2222 E: sturt@als.com.au  
 JLABELAS: 40-42 Canning Street, Perth, WA 6008  
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JLABELAO: 78 Horrocks Road, Kingsley, QLD 4730  
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JLABELAO: 277-285 Woodlark Road, Smithfield, NSW 2168  
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 JLABELAO: 11-15 Danks Court, North Sydney, NSW 2060  
 Ph: 02 4766 0800 E: northsydney@als.com.au  
 JLABELAO: 34-36 Sturt Street, Warragamba, NSW 2530  
 Ph: 02 9206 8100 E: warragamba@als.com.au

**CLIENT:** GHD

**OFFICE:** [Blank]

**PROJECT:** FBB PC

**ORDER NUMBER:** 2316261

**PROJECT MANAGER:** Jane Curran

**SAMPLER:** Iain Lindley, Rob Webb

**COC emailed to ALS?** (YES / NO)

**EMAIL REPORTS TO:** (will default to PM if no other addresses are listed): jane.curran@ghd.com, steфан.charteris@ghd.com

**EMAIL INVOICE TO:** (will default to PM if no other addresses are listed): jane.curran@ghd.com

**COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:**

**TURNAROUND REQUIREMENTS:**  Standard TAT (List due date):  
 (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)  Non Standard or urgent TAT (List due date):

**ALS QUOTE NO.:** SY60317A

**RELINQUISHED BY:** [Blank]

**RECEIVED BY:** Kim

**DATE/TIME:** 28.2.18 8.45am

**COC SEQUENCE NUMBER (Circle):**

COC:	1	2	3	4	5	6	7
OF:	1	2	3	4	5	6	7

**FOR LABORATORY USE ONLY (Circle):**

Customer's calibration?	Yes	No
Reference from calibration present for receipt?	Yes	No
Random Sample Sampled (if not receipt)	Yes	No
Other comments:		

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE codes below	TOTAL CONTAINERS	ANALYSIS REQUIRED INCLUDING SUITES (NB: Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).					Additional Information
						W-02 (Dissolved Metals)	EA045 (Turbidity)	TPH (TRH C6-C40)	NT-11 (Total Nitrogen, Total Phosphorus)	EA025H (Suspended Solids)	
2C	SW07_2	26/02/2018	W		6	X	X	X	X	X	
26	SW07_3	26/02/2018	W		6	X	X	X	X	X	
27	SW11_1	26/02/2018	W		6	X	X	X	X	X	
28	SW12_1	26/02/2018	W		6	X	X	X	X	X	
29	SW12_2	26/02/2018	W		6	X	X	X	X	X	
30	SW12_3	26/02/2018	W		6	X	X	X	X	X	
31	SW13_1	26/02/2018	W		6	X	X	X	X	X	
32	SW13_2	26/02/2018	W		6	X	X	X	X	X	
33	SW13_3	26/02/2018	W		6	X	X	X	X	X	
34	SW14	26/02/2018	W		6	X	X	X	X	X	
35	SW15_1	26/02/2018	W		6	X	X	X	X	X	
36	SW15_2	26/02/2018	W		6	X	X	X	X	X	dispose
<b>URGENT</b>											
<b>TOTAL</b>					72						

**Water Container Codes:** P = Unpreserved Plastic; N = Nitric Preserved Plastic; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airflight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Via Sodium Sulphate Preserved; VS = VOA Via Sulfuric Preserved; AV = Airflight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Specimen bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Solids; B = Unpreserved Bag.



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Ph: 08 8350 2050 E: jade@als.com.au  
JERRISDALE 32 Stuart Street, Adelaide SA 5000  
Ph: 07 3243 2222 E: jerris@als.com.au  
JULIANSVILLE 46 Callin Road, Onkaparinga SA 5206  
Ph: 07 4471 1600 E: julian@als.com.au

JYAOCAY 78 Hambour Road, Hindley SA 5012  
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Ph: 02 4424 7000 E: noy@als.com.au  
JNORP 111 Doherty Way, Berrara SA 5096  
Ph: 08 8350 2050 E: norp@als.com.au  
JONGNG 277 250 McCook Road, Smithfield NSW 2164  
Ph: 02 9724 6555 E: jongng@als.com.au  
JTRANGS 1111 E. 168th Street, Irvine CA 92618  
Ph: 07 4736 0050 E: trangs@als.com.au  
JWCH 1 CONGOING 69 Kenny Street, Wollongong NSW 2500  
Ph: 07 4226 3125 E: wch@als.com.au

**CLIENT:** GHD  
**OFFICE:**  
**PROJECT:** FBB PC  
**ORDER NUMBER:** 2316261  
**PROJECT MANAGER:** Jane Curran  
**SAMPLER:** Iain Lindley, Rob Webb  
**COC emailed to ALS? (YES / NO):**  
**Email Reports to (will default to PM if no other addresses are listed):** jane.curran@ghd.com, iain.lindley@ghd.com, stefan.charlens@ghd.com  
**Email invoice to (will default to PM if no other addresses are listed):** jane.curran@ghd.com

**TURNAROUND REQUIREMENTS:**  
 Standard TAT (List due date):  
 Non Standard or urgent TAT (List due date):  
**ALS QUOTE NO.:** SY/603/17A  
**COC SEQUENCE NUMBER (Circle):**  
COC: 1 2 3 4 5 6 7  
OF: 1 2 3 4 5 6 7  
**RECEIVED BY:** Kim  
**DATE/TIME:** 28.2.18 8.45am

**FOR LABORATORY USE ONLY (Circle):**  

Order/Seal checked?	Yes	No	N/A
Free Ice (frozen) boxes present upon receipt?	Yes	No	N/A
Refrigerated sample temperature on receipt (over temperature)	Yes	No	N/A

**RECEIVED BY:**  
**DATE/TIME:**

**COMMENT/S/SPECIAL HANDLING/STORAGE OR DISPOSAL:**

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE <small>codes below</small>	TOTAL CONTAINERS	ANALYSIS REQUIRED Including SUITES (NB. Suite Codes must be listed to attract suite price) <small>Where Metals are required, specify total (unfiltered bottle required) or Dissolved (field filtered bottle required).</small>					Additional Information
						W-02 (Dissolved Metals)	EA045 (Turbidity)	TPH (TRH C6-C40)	NT-11 (Total Nitrogen, Total Phosphorus)	EA025H (Suspended Solids)	
37	SW15-3	26/02/2018	W		6						
38	SW16	26/02/2018	W		6	X	X	X	X		dispose
39	SW17	26/02/2018	W		6	X	X	X	X		
40	SW10-2										
41	SW10-3										
42	SW11-2										
43	SW11-3										
<b>URGENT</b>											
<b>TOTAL</b>					18						

**Water Container Codes:** P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/CD Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airtight Unpreserved Plastic  
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airtight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;  
Z = Zinc Asolate Preserved Bottle; E = EDTA Preserved Bottle; ASS = Plastic Bag for Acid Sulphate Solis; B = Unpreserved Bag.

## Fadi Soro

---

**From:** Julia Fracala  
**Sent:** Tuesday, 27 February 2018 10:20 AM  
**To:** Fadi Soro  
**Subject:** FW: COC - ALS ref ES1805055, GHD ref 2316261 - Water samples collected 26022018  
**Attachments:** 2316261-01 - ALS COC - Surface Water Monitoring GHD - Event 2 26022018.xls

Hi Fadi,

Please see the COC for samples arriving from GHD either this afternoon/evening or tomorrow morning. There are 4 eskies arriving for this batch.

Kind Regards,

**Julia Fracala**

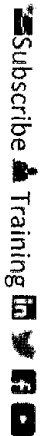
Client Services Officer, Environmental  
Sydney



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**F** +61 2 8784 8500

[julia.fracala@alsglobal.com](mailto:julia.fracala@alsglobal.com)

277-289 Woodpark Road  
Smithfield, NSW, 2164



**[New ALS office at Crows Nest is now open to receive samples!](#)**

**[We are keen for your feedback! Please click here for your 1 question survey](#)**

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[EnviroMail™ 114 - Asbestos Fibre Identification by SEM/EDS](#)

[EnviroMail™ 113 - Amoeba Confirmation PCR](#)

[EnviroMail™ 112 - Algal Capabilities](#)

[EnviroMail™ 111 - Analysis of VOCs by Thermal Desorption Analysis](#)

[EnviroMail™ 110 - Identifying Hidden PFAS Chemicals in Environmental Samples and Firefighting Foams](#)

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[www.alsglobal.com](http://www.alsglobal.com)

**From:** Jane Curran [mailto:Jane.Curran@ghd.com]  
**Sent:** Tuesday, 27 February 2018 10:06 AM  
**To:** Julia Fracala <Julia.fracala@ALSGlobal.com>  
**Subject:** COC - ALS ref ES1805055, GHD ref 2316261 - Water samples collected 26022018

Hi Julia,

Please find attached the COC to go with the samples that are getting sent today with Toll Priority. They should hopefully be there today or tomorrow morning. It will be 4 eskies.

Due to time constraints, I've told the sampling team to send ALL the samples. Having looked through the field sheets we do not require analysis on some samples. I've filled out the COC with the samples requiring analysis and could I request ALS please dispose of the others? I have marked the ones for disposal on the COC.

Kind regards,

**Jane Curran**  
**Environmental Scientist**

**GHD**

T: 61 2 4424 4960 | V: 234960 | M 0400 450 005 | E: [jane.curran@ghd.com](mailto:jane.curran@ghd.com)  
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Please consider our environment before printing this email

**GHD acknowledges the Traditional Owners of Country throughout Australia.**

**We pay respect to their continuing culture and Elders past, present and emerging.**

**[Click here](#) to learn about our Reconciliation Action Plan.**



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## Attachment E - Calibration Certificates



AirMet Scientific P/L  
7-11 Ceylon Street  
Nunawading  
Victoria 3131, Australia

# Calibration Certificate

This document hereby certifies that this instrument detailed has been calibrated to the parameters listed below.

Certificate Print Date: 9 February, 2018  
Calibration Date: 8 February, 2018  
Next Calibration Due: 8 August, 2018

Call ID: 00214690  
Arrow Job Code: 227977

Customer:	GHD Pty Ltd	Type:	Water Meter
Model:	WATERMETER	Serial No:	13J100151
Description:	YSI Pro Plus Water Quality Meter		

Sensor	Serial No	Standard Solutions	Certified	Solution # (Bottle #)	Instrument Reading	Units
Dissolved Oxygen		0%		1612235007	0	%
EC		2.76 ms/cm		312321	2.76	ms/cm
Ph		pH 7.0		307926	7.02	pH
Ph		pH 4.0		307927	4.00	pH
Redox		231.58mV		305536/305538	231.6	mV
Temp		21.1°C		MultiTherm	21.1	°C

Completed by: Wentao Zhang	Signed: 
----------------------------	--

Australian Standard Alarm Levels



**Attachment E - YSI Calibration Record  
Surface Water Event 2**

**CALIBRATION RECORD**

Instrument YSI Pro Plus  
Serial Number 13J00151

<b>Date</b>	12/03/2018
<b>Time</b>	12:45:00 PM
<b>Staff</b>	JC, RW
<b>Conductivity (S. Conductance)</b>	
Temperature	24
Solution	2707
Pre-calibration	2773
Post-calibration	2664
<b>pH 7</b>	
Temperature	24.2
Solution	7.01
Pre-calibration	7.07
Post-calibration	7.01
<b>pH 4</b>	
Temperature	24.2
Solution	4.01
Pre-calibration	4.00
Post-calibration	3.99
<b>ORP</b>	
Temperature	24.4
Solution	231.2
Pre-calibration	232
Post-calibration	231.2
<b>DO (air)</b>	
Temperature	21.1
Solution	100%
Pre-calibration	100%
Post-calibration	9.01 mg/L
<b>Signed</b>	RW* JC*

## Attachment F - Laboratory Quality Assurance and Quality Control Results

### *Field Program surface water*

Intra-laboratory duplicate samples were collected and analysed as part of the surface water sampling program and the relative percentage differences (RPD) were calculated. Intra-laboratory measures the reproducibility of measurements under a given set of conditions. The precision of the data is assessed by calculating the Relative Percent Difference (RPD) between duplicate sample pairs.

$$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where  $C_o$  = Analyte concentration of the original sample  
 $C_d$  = Analyte concentration of the duplicate sample

GHD adopts a nominal acceptance criterion of 30% RPD for field duplicates and splits for inorganics and a nominal acceptance criterion of 50% RPD for field duplicates and splits for organics, however it is noted that this may not always be achieved, particularly at low analyte concentrations. Surface water QA/QC results are presented as Table B2, Attachment B.

NO discrepancies in GHD's adopted criterion for RPDs calculated for the intra laboratory duplicate pairs for the analytes tested were detected.

### *Laboratory Program*

The NATA certified laboratories utilised for this assessment (ALS) undertook their own quality assurance and quality control procedures for sample analysis. GHD has reviewed the internal laboratory control data provided within the laboratory reports, which are attached in the laboratory reports as Error! Reference source not found..

The laboratory provided the following summary of QA/QC Compliance Assessment:

- No method blank outliers occur
- No duplicate outliers occur
- No laboratory control outliers occur
- No matrix spike outliers exist
- For all regular sample matrices, no surrogate recovery outliers occur
- One analysis holding time outliers exists – Sample SW10\_1 was analysed for turbidity one day late.

All samples were noted to be correctly preserved.

### *Summary of Quality Assurance / Quality Control Results*

The QA/QC results show that the samples collected have met the appropriate standards and therefore, the data was considered to be valid and of sufficient quality to meet the data quality objectives for the assessment.

## Attachment G - Field sheets



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 10:15 AM  
 CLIENT: RMS SAMPLING OFFICERS: JL, RW  
 SITE: SW01  
 COORDINATES/GPS (if Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION CREEK UNDER BRIDGE.

## ENVIRONMENTAL OBSERVATIONS

WEATHER RAINING  
 VEGETATION NO CHANGE - SEE PHOTOS.  
 SLOPE " "  
 EROSION " "  
 OTHER FAST FLOWING, SLIGHT BROWN CLOUDY COLOUR, SOME DEBRIS (LEAVES, STICKS)

## FIELD MEASUREMENTS

SAMPLE	SW01-1 10:16 AM	SW01-2 10:28 AM	SW01-3 10:38 AM
TEMPERATURE (°C)	17.6	17.6	17.6
CONDUCTIVITY (uS/cm)	83.5	82.8	82.2
pH	6.62	6.54	6.53
DO (ppm)	8.54	8.50	8.38
REDOX (mV)	132.5	137.9	131.9

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) ✓  
 CROSS SECTION WIDTH (m) ✓  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW01-1	6	CHILLED, Vials	Qc1	
SW01-2	6	"		
SW01-3	6	"		
<del>SW01-4</del>	<del>6</del>	<del>"</del>		

FIELD SUPERVISOR JL.

CHECKED (SIGN & DATE) JL 26/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 2/2/18  
 PROJECT NAME: FBB PC TIME: 10:53AM  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW02

COORDINATES/GPS (If Applicable)  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION WEIR CROSSING

### ENVIRONMENTAL OBSERVATIONS

WEATHER SAME AS SW01  
 VEGETATION NO CHANGE  
 SLOPE " "  
 EROSION " "  
 OTHER FAST FLOWING - SAME AS SW01

### FIELD MEASUREMENTS

SAMPLE	SW02-1 10:53	SW02-2 11:03	SW02-3 11:03
TEMPERATURE (°C)	17.7	17.7	17.7
CONDUCTIVITY (uS/cm)	88.2	87.8	87.8
pH	6.60	6.60	6.60
DO (ppm)	8.37	8.33	8.40
REDOX (mV)	153.7	146.2	141.4

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW02-1	6	"	NO.	
SW02-2	6	"		
SW02-3	6	"		

FIELD SUPERVISOR IL

CHECKED (SIGN & DATE)



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 11:19 AM  
 CLIENT: RMS SAMPLING OFFICERS: JL, RW  
 SITE: SW03  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION PRIVATE ~~MINNER~~ CREEK

### ENVIRONMENTAL OBSERVATIONS

WEATHER RAIN  
 VEGETATION NO CHANGE - SEE PHOTOS.  
 SLOPE "  
 EROSION "  
 OTHER CLEAR WATER FAST FLOWING, HIGHER WATER

### FIELD MEASUREMENTS

SAMPLE	SW03-1 11:19	SW03-2 11:25	SW03-3 11:34
TEMPERATURE (°C)	17.9	17.9	17.9
CONDUCTIVITY (uS/cm)	94.7	94.4	94.1
pH	6.69	6.67	6.67
DO (ppm)	8.12	8.0	8.10
REDOX (mV)	175.4	144.7	137.0

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW03-1	6	" "	NO.	-
SW03-2	6			
SW03-3	6			

FIELD SUPERVISOR JL CHECKED (SIGN & DATE) JL, RW



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 12:59  
 CLIENT: RMS SAMPLING OFFICERS: IL RW  
 SITE: SW04  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION BED + BREAKFAST CREEK

## ENVIRONMENTAL OBSERVATIONS

WEATHER RAIN  
 VEGETATION NO CHANGE - SEE PHOTOS  
 SLOPE " "  
 EROSION " "  
 OTHER MED FLOW, DEEP, HIGH LEVEL (NO TELESCOPIC) CLEAR WATER, S...

## FIELD MEASUREMENTS

SAMPLE	SW04-1, 12:59	SW04-2, 13:10	SW04-3, 13:20
TEMPERATURE (°C)	17.4	17.7	17.7 17.4
CONDUCTIVITY (uS/cm)	79.4	80.3	79.1
pH	6.68	6.64	6.69
DO (ppm)	8.17	7.89	8.12
REDOX (mV)	33.7	32.8	27.6

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available)  
 CROSS SECTION WIDTH (m)  
 DEPTH (m)  
 OTHER

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
✓ SW04-1	6			
✓ SW04-2	6			
✓ SW04-3	6			

FIELD SUPERVISOR [Signature] CHECKED (SIGN & DATE) RW 12/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 11:54 AM  
 CLIENT: RMS SAMPLING OFFICERS: J.L., R.W.  
 SITE: SW05

COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION TANNERY RD UNDER BRIDGE., TELESCOPIC.

## ENVIRONMENTAL OBSERVATIONS

WEATHER RAIN  
 VEGETATION NO CHANGE - SEE PHOTO.  
 SLOPE " "  
 EROSION " "  
 OTHER SLIGHT BROWN COLOUR, MED. FAST FLOW, PEEP, DEBRIS, SUMP.

## FIELD MEASUREMENTS

SAMPLE	SW05 11:54 AM		
TEMPERATURE (°C)	18.3		
CONDUCTIVITY (uS/cm)	100.8		
pH	<del>6.70</del>		
DO (ppm)	7.69		
REDOX (mV)	147.8		

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
✓ SW05	6	" "	NO	-

FIELD SUPERVISOR J.L. CHECKED (SIGN & DATE) J.L. 26/8/18





# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 12:34 PM  
 CLIENT: RMS SAMPLING OFFICERS: I.L., R.W.  
 SITE: SW06.  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION FBB OFFICES - NEAR BRIDGE.

### ENVIRONMENTAL OBSERVATIONS

WEATHER RAIN  
 VEGETATION NO CHANGE - SEE PHOTOS.  
 SLOPE " "  
 EROSION " "  
 OTHER FLOWING WATER, SLIGHT BROWN COLOUR

### FIELD MEASUREMENTS

SAMPLE	SW06-1, 12:34	SW06-2, 12:35	SW06, 12:45.
TEMPERATURE (°C)	18.6	18.6	18.6
CONDUCTIVITY (uS/cm)	151.6	151.6	151.8
pH	6.56	6.55	6.55
DO (ppm)	6.65	6.74	7.10
REDOX (mV)	138.1	137.8	136.6

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
✓ SW06-1	6	" "	NO	-
✓ SW06-2	6			
✓ SW06-3	6			

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) I.L. 26/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 13:19  
 CLIENT: RMS SAMPLING OFFICERS: J.L. RW  
 SITE: SW07

COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION BOWLING CLUB CREEK

### ENVIRONMENTAL OBSERVATIONS

WEATHER RAIN  
 VEGETATION NO CHANGE SEE MANUAL NOTES  
 SLOPE "  
 EROSION "  
 OTHER CLEAR WATER, NO SEDIMENT MED. FLOW  
 HIGHER WATER LEVEL

### FIELD MEASUREMENTS

SAMPLE	SW07-1, 13:19	SW07-2, 13:29	SW07-3, 13:40
TEMPERATURE (°C)	18.2	18.2	18.2
CONDUCTIVITY (uS/cm)	99.5	98.9	100.2
pH	6.58	6.61	6.57
DO (ppm)	7.34	7.23	7.18
REDOX (mV)	131.9	128.1	122.8

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
✓ SW07-1	6	" "	NO	- NEAR STREET
✓ SW07-2	6			
✓ SW07-3	6			

FIELD SUPERVISOR J.C. CHECKED (SIGN & DATE) J.C. 26/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 13:55  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW08  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION END OF STONEY CREEK

### ENVIRONMENTAL OBSERVATIONS

WEATHER RAIN  
 VEGETATION NO CHANGE - SEE PHOTOS.  
 SLOPE " "  
 EROSION " "  
 OTHER FAST FLOWING, CLEAR, NO SEDIMENT

### FIELD MEASUREMENTS

SAMPLE	SW08, 13:55		
TEMPERATURE (°C)	18.7		
CONDUCTIVITY (uS/cm)	156.1		
pH	6.70		
DO (ppm)	7.32		
REDOX (mV)	132.6		

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) ✓  
 CROSS SECTION WIDTH (m) ✓  
 DEPTH (m) ✓  
 OTHER ✓

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
✓ JW08	6	"	NO	- 40% SW06 ✓

FIELD SUPERVISOR IL. CHECKED (SIGN & DATE) I.L. 26/2/18

4222 1322



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 12:10 PM  
 CLIENT: RMS SAMPLING OFFICERS: JL RW  
 SITE: SW09  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION UNDER BRIDGE NEAR FB OFFICES.

## ENVIRONMENTAL OBSERVATIONS

WEATHER RAIN  
 VEGETATION NO CHANGE - SEE PHOTOS.  
 SLOPE " "  
 EROSION " "  
 OTHER FAST FLOWING WATER, SAMPLE UNDER MIDDLE OF BRIDGE.

## FIELD MEASUREMENTS

SAMPLE	SW09-1	SW09-2 12:29	SW09-3, 12:30.
TEMPERATURE (°C)	18.5	18.6	18.6
CONDUCTIVITY (uS/cm)	153.6	154.0	154.0
pH	6.59	6.55	6.55
DO (ppm)	7.43	7.41	7.39
REDOX (mV)	162.8	139.2	136.1

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
✓ SW09-1	6	"NO."	QCC ✓	-
✓ SW09-2	6			
✓ SW09-3	6			

FIELD SUPERVISOR J.L. CHECKED (SIGN & DATE) JL. 26/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 14:32  
 CLIENT: RMS SAMPLING OFFICERS: J.C., RW  
 SITE: SW10  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION BETWEEN POND & FENCE, SMALL CREEK

**ENVIRONMENTAL OBSERVATIONS**  
 WEATHER CLOUDY  
 VEGETATION NO CHANGE, - SEE PHOTOS  
 SLOPE " "  
 EROSION " "  
 OTHER CLEAR WATER, FAST FLOWING, NO SEDIMENT

### FIELD MEASUREMENTS

SAMPLE	SW10-1, 14:32	SW10-2, 14:44	SW10-3, 14:54
TEMPERATURE (°C)	20.5	20.6	20.6
CONDUCTIVITY (uS/cm)	130.0	130.3	130.5
pH	6.65	6.64	6.63
DO (ppm)	6.15	6.11	6.12
REDOX (mV)	122.2	122.8	122.7

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
✓ SW10-1	6	"	NO.	-
✓ SW10-2	6	"		
✓ SW10-3	6	"		

FIELD SUPERVISOR J.C. CHECKED (SIGN & DATE) J.C. 26/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 14:51  
 CLIENT: RMS SAMPLING OFFICERS: IC, RW  
 SITE: SW11  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION JML CREEK END OF ST.

## ENVIRONMENTAL OBSERVATIONS

WEATHER CLOUDY.  
 VEGETATION REEDS, PINE NEEDLES.  
 SLOPE STONE WALL  
 EROSION NIL.  
 OTHER SMALL FLOW, SLIGHT WHITE CLOUDY, NO SEDIMENT NO ODOUR.

## FIELD MEASUREMENTS

SAMPLE	SW11-1, 14:51	SW11-2	SW11-3
TEMPERATURE (°C)	22.0	22.1	22.1
CONDUCTIVITY (uS/cm)	262.1	262.4	262.3
pH	6.59	6.58	6.54
DO (ppm)	3.28	3.25	3.11
REDOX (mV)	128.8	125.7	122.8

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
✓ SW11-1	6	"	NO	~10m distance down from car
✓ SW11-2	6	"		
✓ SW11-3	6	"		

FIELD SUPERVISOR IC. CHECKED (SIGN & DATE) IC. 26/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 14:05  
 CLIENT: RMS SAMPLING OFFICERS: LL, PL  
 SITE: SW12  
 COORDINATES/GPS (If Applicable)  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION IN FENCE, ROCKS ABOVE ROAD

ENVIRONMENTAL OBSERVATIONS  
 WEATHER RAIN  
 VEGETATION NO CHANGE SEE PHOTOS.  
 SLOPE 1:1  
 EROSION 1:1  
 OTHER SLIGHT GREY CLOUDINESS, NO SEDIMENT, NO ODOUR

FIELD MEASUREMENTS

SAMPLE	SW12-1, 14:05	SW12-2, 14:05	SW12-3, 14:25
TEMPERATURE (°C)	9.8	19.8	19.8
CONDUCTIVITY (uS/cm)	284.8	280.6	278.6 278.6
pH	6.93	6.94	6.94
DO (ppm)	5.10	5.02	4.97
REDOX (mV)	100.3	94.4	92.3

HYDROLOGICAL DATA  
 FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
✓ SW12-1	6	" "	No	SAMPLED FROM CONCRETE CIRCUL
✓ SW12-2	6			
✓ SW12-3	6			

FIELD SUPERVISOR LL CHECKED (SIGN & DATE) PL 26/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 1614  
 CLIENT: RMS SAMPLING OFFICERS: RW. IL  
 SITE: SW13  
 COORDINATES/GPS (If Applicable)  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION SW13 NEAR RETIREMENT VILLAGE.

## ENVIRONMENTAL OBSERVATIONS

WEATHER cloudy  
 VEGETATION longgrass - SEE PHOTOS...  
 SLOPE -  
 EROSION -  
 OTHER YELLOW/GREY CLOUDY WATER, FAST FLOW.

## FIELD MEASUREMENTS

SAMPLE	SW13_1 1614	SW13_2 1624	SW13_3 1634
TEMPERATURE (°C)	20.3	20.3	20.3
CONDUCTIVITY (uS/cm)	338.9	<del>667</del> 333.7	338.1
pH	7.16	7.15	7.16
DO (ppm)	6.59	6.67	6.88
REDOX (mV)	78.1	73.3	72.1

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
✓ SW13-1	6	"	NO	
✓ SW13-2	6	"		
✓ SW13-3	6	"		

FIELD SUPERVISOR J.C. CHECKED (SIGN & DATE) J.C. 26/2/18





# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 16:41  
 CLIENT: RMS SAMPLING OFFICERS: I.L., R.W.  
 SITE: SW14  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION

## ENVIRONMENTAL OBSERVATIONS

WEATHER CLOUDY  
 VEGETATION NO CHANGE - SEE PHOTOS  
 SLOPE " "  
 EROSION " "  
 OTHER ~~PALE BROWN CLOUDY, HIGH SEDIMENT~~  
 AREAS REEL (NO SHEEN)

## FIELD MEASUREMENTS

SAMPLE	SW14, 16.41		
TEMPERATURE (°C)	22.3		
CONDUCTIVITY (uS/cm)	340.7		
pH	7.07		
DO (ppm)	4.97		
REDOX (mV)	92.7		

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW14	6	" "	No.	-

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) I.L.



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 1538 1535  
 CLIENT: RMS SAMPLING OFFICERS: RW IL  
 SITE: SW15  
 COORDINATES/GPS (If Applicable) —  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION SW15

ENVIRONMENTAL OBSERVATIONS  
 WEATHER Cloudy  
 VEGETATION Grasslands, few trees & some scrubs NO CHANGE  
 SLOPE flat, steep bank  
 EROSION —  
 OTHER cloudy, white water, low flow, water filled with grasses, grey yellow

FIELD MEASUREMENTS	
SAMPLE	SW15-1 1535      SW15-2 1545      SW15-3 1555
TEMPERATURE (°C)	21.5      21.5      21.5
CONDUCTIVITY (uS/cm)	323.5      329.4      338.5
pH	7.05      7.04      6.82
DO (ppm)	5.88      5.90      5.95
REDOX (mV)	99.2      87.2      79.2

HYDROLOGICAL DATA  
 FLOW MEASUREMENT (or stream height if rating table available) —  
 CROSS SECTION WIDTH (m) —  
 DEPTH (m) —  
 OTHER —

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW15-1	6	"	ALL	—
SW15-2	6	"		
SW15-3	6	"		

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) I.L. 26/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 17:04  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW18  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION ABOVE BRIDGE

**ENVIRONMENTAL OBSERVATIONS**  
 WEATHER CLOUDY  
 VEGETATION NO CHANGE - SEE PHOTOS  
 SLOPE " "  
 EROSION " "  
 OTHER CLEAR FLOWING WATER, NO SEDIMENT OR COARSE.

**FIELD MEASUREMENTS**

SAMPLE	SW16, 17:05		
TEMPERATURE (°C)	19.2		
CONDUCTIVITY (uS/cm)	212.8		
pH	6.42		
DO (ppm)	6.68		
REDOX (mV)	117.2		

**HYDROLOGICAL DATA**  
 FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW16	6	" "	No.	-

FIELD SUPERVISOR IL CHECKED (SIGN & DATE) IL 26/2/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 26/2/18  
 PROJECT NAME: FBB PC TIME: 17:10  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW17  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION UNDER BRIDGE

## ENVIRONMENTAL OBSERVATIONS

WEATHER SAME AS SW16  
 VEGETATION " "  
 SLOPE " "  
 EROSION " "  
 OTHER " "

## FIELD MEASUREMENTS

SAMPLE	SW17, 17:10		
TEMPERATURE (°C)	19.2		
CONDUCTIVITY (uS/cm)	215.8		
pH	6.44		
DO (ppm)	6.96		
REDOX (mV)	124.4		

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) -  
 CROSS SECTION WIDTH (m) -  
 DEPTH (m) -  
 OTHER -

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW17	6	" "	NO	-

FIELD SUPERVISOR IL CHECKED (SIGN & DATE) IL 26/2/18



28 May 2018

Ryan Whiddon  
Roads and Maritime Services  
PO Box 477  
Wollongong NSW 2500

Our ref: 23/16261  
Draft A

Dear Ryan,

## **Surface Water Monitoring – Post Construction Event 3 (Minor Event 2)**

### **1 Scope and limitations**

In accordance with the Princes Highway upgrade for Foxground and Berry Bypass (FBB) - Water Monitoring Project Brief (*Contract No. 17.0000303651.0922*), GHD undertook surface water monitoring at 17 locations (SW01 to SW17) after a major rainfall event ( $\geq 50$  mm rain in a 24 hour period). During the operational phase, minor events are considered to have occurred when at least 15 mm of rainfall has fallen in the past 24 hours, and major events where at least 50 mm of rainfall in the past 24 hours has occurred.

Sampling locations have been selected based on their proximity to permanent water quality basins located along the FBB alignment and proximity to operational water control measures (such as sedimentation basins and vegetation swales). This report documents the third surface water sampling event (Event 3) undertaken since the completion of construction, which is also the second minor surface water sampling event (Minor Event 2) since operation began in October 2017. Limitations are provided in Section 5.

The objective of this monitoring event is to collect and assess upstream and downstream waterway data to contribute to their eventual certification. Certification of waterways as remediated has not occurred; therefore, all 17 locations were monitored during this event.

### **2 Field Program**

Surface water sampling was undertaken at all surface water sampling locations on the 22<sup>nd</sup> March 2018; refer to Figure 1, Attachment A for sampling locations. This monthly surface water sampling event was conducted in accordance with the sampling program and protocols provided in:

- GHD 2014, Foxground to Berry Bypass Water Quality Management - Surface Water and Groundwater Sampling Protocol, prepared for Roads and Maritime Services.
- GHD 2016, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services
- GHD 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring Report, prepared for Roads and Maritime Services

Field parameters were measured during the monitoring event including temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), and reduction-oxidation potential (redox), and are provided in Table B1, Attachment B. Field sheets are provided in Attachment G.

Where 10% difference in field parameters is observed at a location, another two samples are collected at the location and its associated upstream or downstream location. During this event an additional two samples were collected from SW04, SW07, SW10 and SW11.

Water samples were submitted to a NATA certified testing laboratory (ALS) to be analysed for the schedule of minor suite analysis of:

- Turbidity
- Total suspended solids (TSS)
- Total recoverable hydrocarbons (TRH)
- Total Phosphorus and Total Nitrogen
- Heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn)

All locations had stream flow and were therefore able to be sampled.

### 3 Results and Discussion

This section presents control charts and discusses results in respect to exceedances of criteria or inconsistencies in the surface water results for Event 3 (Minor Event 2) in accordance with:

- The limitations provided in Section 6.
- GHD 2016, Foxground to Berry Bypass Water Quality Management - Surface Water Quality Management Plan, prepared for Roads and Maritime Services.
- GHD 2014, Princes Highway Upgrade – Foxground to Berry Bypass Project, Final Interpretive Water Monitoring Report, prepared for Roads and Maritime Services.

#### 3.1 Control charts

The surface water locations have been grouped into separate control charts by the specific surface water bodies they are located within and whether they are up and down gradient of the FBB alignment. The upstream locations represent the ‘reference’ (un-impacted) sites while the down-stream locations represent the ‘test’ sites (impacted by operation). By comparing upstream water quality with down-stream water quality using the control chart methods it is expected that impacts will be able to be adequately characterised during operation. The groupings used for the control charts are summarised in **Table 1**.

**Table 1 Surface water locations within specific surface water bodies**

Surface water location	Upstream of Alignment	Downstream of Alignment
Broughton Creek	SW01	SW02, SW03, SW05
Connelly’s Creek and Broughton Mill Creek and Bundewallah Creek	SW04, SW06	SW07, SW09
Bundewallah Creek and Connelly’s Creek	SW08	SW06
Town Creek (realigned)	SW10	SW11

Hitchcocks Lane Creek Tributary	SW12	SW13
Hitchcocks Lane Creek	SW14	SW15
Unnamed Tributary	SW16	SW17

The primary control chart indicators for assessing potential impacts associated with the FBB upgrade works during operation for Event 3 include pH, turbidity, TSS and heavy metals. The control charts for are presented in Attachment C.

Operational data has been compared against baseline data in the control charts to understand what changes may be occurring following the construction of the FBB. Final 80<sup>th</sup> percentile data and median data from baseline monitoring has been used for pH, turbidity and TSS and maximum baseline values have been used for heavy metal results as an upper threshold. Control charts for metals are unable to include 80<sup>th</sup> percentile or median data as concentrations are usually zero or very low. 80<sup>th</sup> Percentile and median data will become more accurate with more sampling events.

A review of Event 3 control charts is provided in Section 4.

### 3.2 Recorded rainfall event

The rainfall within Broughton Creek catchment and the surface water flows within Broughton Creek are presented in Figure 2, Attachment A. This information was obtained from the NSW Office of Water (NOW) website (<http://realtimedata.water.nsw.gov.au/water.stm>). The location of this gauge is on Broughton Mill Creek approximately 2 km upstream of SW04.

The data in Figure 2 illustrates a high correlation between rainfall and river flow, with a spike in rainfall coinciding with a spike in river flow. The surface water sampling events are also marked on Figure 2, Attachment A.

### 3.3 Surface water monitoring QA/QC

Surface water analytical results for the suite listed in Section 0, are tabulated against selected criteria (in accordance with the protocol documents detailed in Section 0) in Table B1 and B2 of Attachment B. Laboratory certificates are provided in **Error! Reference source not found.**

Sampling was completed as per the method outlined within the project WQMP. The water quality meter used during water quality monitoring is certified every six months and between certification, calibrated before each event. Evidence of calibration is provided in Attachment E.

A field quality control and laboratory control assessment of the results from this monthly monitoring round (Event 3 – Minor Event 2) is provided in Attachment F.

Matrix spike recovery for Naphthalene indicate matrix spike interference could be occurring and impacting results. All samples were just outside holding time for turbidity due to courier delay therefore turbidity results should be interpreted with this potential for error in results. Sample SW07\_3 was overdue for nutrient analysis, therefore nutrient results for this sample should be interpreted with this disclaimer. One RPD exceedance with a value of 59% occurred for duplicate sample QC1 within Total (oxidised) Nitrogen as N. The exceedance is considered low and would not significantly affect Total Nitrogen results reported.

## 4 Discussion of Results

The field and laboratory analytical results are summarised in Attachment B. The adopted assessment criteria are also included in these tables. Laboratory reports are included in Attachment D. Exceedances of assessment criteria in samples analysed are highlighted in these tables and exceedances reported for Event 3 are discussed in the following sections.

### 4.1.1 pH (field)

Exceedances of assessment criteria in samples analysed in the field included:

Upstream locations:

- The operational 80<sup>th</sup> percentile for SW06 exceeded the baseline 80<sup>th</sup> percentile
- The operational 80<sup>th</sup> percentile for SW10 and SW14 was above the baseline 80<sup>th</sup> percentile although they are reducing to the baseline percentile gradually.
- The median value for SW15 is still above the baseline median value calculated.

Downstream locations:

- Downstream location SW13 exceeded 80<sup>th</sup> percentile SW12 slightly. Both values for this event are currently the same as the values calculated during baseline monitoring.
- The median value for SW06 was only slightly above the baseline median value although the median for SW06 has not exceeded the 80<sup>th</sup> percentile

No results were outside the selected ANZECC 2000 – Lowland Rivers (NSW Rivers) guidelines or Aesthetic guidelines.

pH results have been graphed in control charts available in Attachment C.

### 4.1.2 Turbidity and Total Suspended Solids (TSS)

Exceedances in samples analysed for Turbidity and TSS include the following:

Downstream:

- Turbidity exceeded ANZECC criteria at location SW13 with a value of 51.5 mg/L. SW13 is downstream of SW12, which only exceeded the aesthetic guidelines. The control charts for this waterway indicate the median value is below the 80<sup>th</sup> percentile therefore exceedances may be part of background variation at this site.
- TSS exceedances against the ANZECC criteria occurred at location SW11 although the median value did not exceed the 80<sup>th</sup> percentile and therefore may suggest background variation is present.
- TSS for SW03 was above the 80<sup>th</sup> percentile for its reference site SW01.
- TSS for SW10 80<sup>th</sup> percentile and SW11 median are still above values calculated during baseline monitoring.
- Similar to the last event, TSS for SW13 was above the 80<sup>th</sup> percentile for its reference site SW12. TSS for SW15 was again slightly above the 80<sup>th</sup> percentile for its reference site SW14.

A number of aesthetic exceedances occurred up and downstream of the alignment.

Results have been graphed in control charts against baseline 80<sup>th</sup> percentile and median values. These charts can be found in Attachment C.



#### **4.1.3 Electrical Conductivity (field)**

The following exceedances were identified for Electrical Conductivity:

Upstream:

- Electrical Conductivity (EC) ANZECC 2000 criteria exceedances occurred SW12 and SW14.

Downstream:

- EC ANZECC criteria was exceeded at locations SW11, SW13 and SW15. Both SW13 and SW15 associated upstream locations also have EC exceedances indicating background variation is present. SW11 reference site SW10 had high EC values although they were within the ANZECC criteria.

#### **4.1.4 Nitrogen and Phosphorus**

Exceedances in samples analysed for Nitrogen and Phosphorus include the following:

Upstream:

- Upstream location SW01 in Broughton Creek did not have any Total Nitrogen exceedances. The remainder of upstream locations all exceeded criteria.
- All upstream locations had Phosphorus exceedances against the ANZECC guidelines other than SW01, SW04 and SW14.
- Due to upstream locations having both nitrogen and phosphorus exceedances, suggests background variation is occurring.

Downstream:

- Downstream Broughton creek sites SW02, SW03 and SW05 were the only downstream locations that did not have exceedances. The remainder of downstream sites exceeded the criteria.
- All downstream locations had Phosphorus exceedances against the ANZECC guidelines other than SW02, SW05 and SW07. Downstream and upstream exceedances are occurring within waterways suggesting background variation is present.

#### **4.1.5 TRH**

No TRH's were detected above Limit of Reporting (LOR) during this event. No oily sheen was observed within creeks sampled during sampling Event 3 which is consistent with laboratory results. .

#### **4.1.6 Heavy Metals**

The concentrations for dissolved heavy metals (with detectable concentrations) were plotted in time series to assess the changes before and after construction and identify any emergence of trends. Control charts have not been included as the metals data generally have a high percentage of values below detection limits. This resulted in identified exceedances in the control charts that were associated with statistical issues rather than trends in the data. Time series graphs of the results were created for the following metals:

- Copper
- Zinc.

The results graphs for Event 3 are presented in Attachment F and are summarised below.

## **Copper**

The following exceedances against the ANZECC (2000) 95% Freshwater guidelines occurred:

Upstream:

- Locations SW10, SW12 and SW14 had copper exceedances.

Downstream:

- Locations SW02, SW03, SW11, SW13 and SW15 had copper exceedances. All locations have also detected exceedances in the upstream location therefore, exceedances are attributed to background variation. Location SW02 and SW03 do not have an exceedance in the upstream location (SW01) although are positioned within the same waterway with SW02 upstream of SW03. Results may suggest potential copper impacts are occurring from operation.
- Copper concentrations in SW11 and SW13 are above the baseline maximum values and have been increasing since the first operational monitoring event at the locations. Further sampling should clarify if this is an emerging trend.

## **Zinc**

The following exceedances against criteria and baseline maximum values were detected:

Upstream:

- All upstream locations were below criteria other than locations SW08, SW10 and SW12.

Downstream:

- Locations SW05, SW07, SW09, SW11, SW13 and SW15 were above criteria. Associated upstream locations for SW11 and SW13 also had zinc exceedances suggesting background variation is occurring. SW09 could be considered an upstream location of SW07 and may suggest background variation may be occurring at these locations. Results at SW05 have increased gradually since the beginning of operational monitoring and may suggest operation impacts are occurring.

## **5 Conclusion**

Upstream exceedances in EC, TSS, Nitrogen, Phosphorus and metals at locations suggest background variation may be occurring within a number of catchments along the FBB alignment which is consistent with baseline monitoring.

Locations SW11 and SW13 had downstream exceedances within zinc and may suggest operational impacts. Copper concentrations in both of these locations has been increasing since the start of operational monitoring and could be an indication of an emerging trend. Further sampling would confirm this. Locations with zinc exceedances that can't be attributed to background variations include SW05 which has steadily increased during operational monitoring. Further sampling should confirm if this is an emerging trend.

A number of total suspended solids (TSS) exceedances have occurred. TSS for SW03, SW11, SW13 and SW15 were all above the upstream 80<sup>th</sup> percentile suggesting the results are not background variations but may be an emerging trend.

Turbidity in SW13 exceeded ANZECC 2000 guidelines. Control charts for this waterway indicate the median value is below the 80<sup>th</sup> percentile therefore exceedances can be attributed to background

variation. Similarly, TSS exceedances against the ANZECC criteria occurred at location SW11 although the median value did not exceed the 80<sup>th</sup> percentile and therefore may suggest background variations. Further sampling should clarify if exceedances are suggesting residual impact remains.

## **6 Limitations**

This report has been prepared by GHD Pty Ltd (GHD) for Roads and Maritime Services (RMS) and may only be used and relied on by RMS for the purpose agreed between GHD and RMS as set out in Section 1 of this report.

GHD otherwise disclaims responsibility to any person other than RMS arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Roads and Maritime Services and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

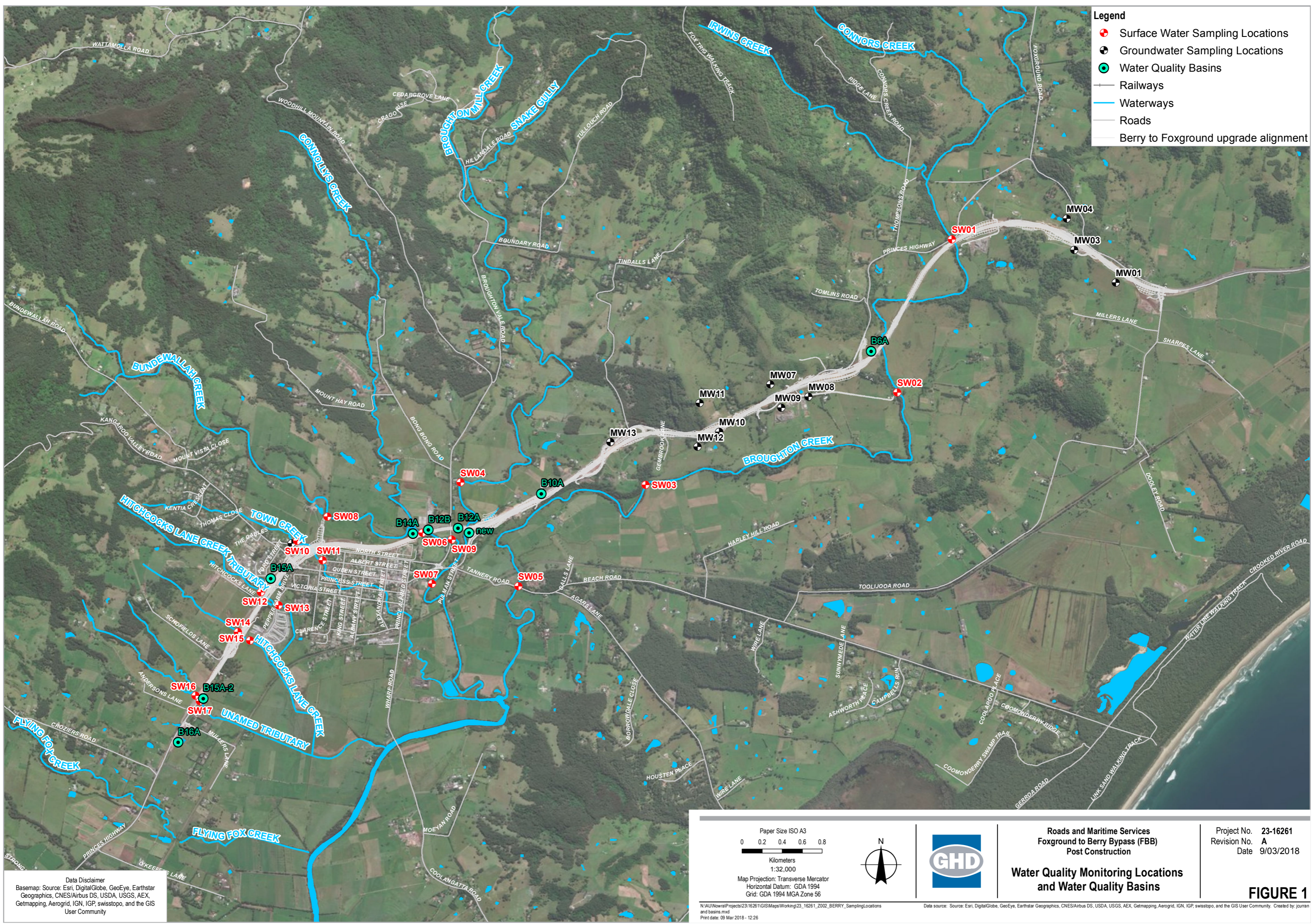
Please contact the undersigned if you have any questions or require further information.

Kind Regards,

A handwritten signature in cursive script, appearing to read 'Jane Curran'.

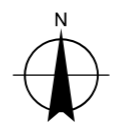
**Jane Curran**  
Environmental Scientist  
02 4424 4960

## Attachment A - Figures



- Legend**
- Surface Water Sampling Locations
  - ⊕ Groundwater Sampling Locations
  - Water Quality Basins
  - Railways
  - Waterways
  - Roads
  - Berry to Foxground upgrade alignment

Paper Size ISO A3  
 0 0.2 0.4 0.6 0.8  
 Kilometers  
 1:32,000  
 Map Projection: Transverse Mercator  
 Horizontal Datum: GDA 1994  
 Grid: GDA 1994 MGA Zone 56



Roads and Maritime Services  
 Foxground to Berry Bypass (FBB)  
 Post Construction

**Water Quality Monitoring Locations  
 and Water Quality Basins**

Project No. 23-16261  
 Revision No. A  
 Date 9/03/2018

**FIGURE 1**

**Data Disclaimer**  
 Basemap: Source: Esri, DigitalGlobe, GeoEye, Earthstar  
 Geographics, CNES/Airbus DS, USDA, USGS, AEX,  
 Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS  
 User Community

N:\AU\Nowra\Projects\23-16261\GIS\Maps\Working\23\_16261\_2002\_BERRY\_SamplingLocations  
 and basins.mxd  
 Print date: 09 Mar 2018 - 12:26

Data source: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community. Created by: jcurran

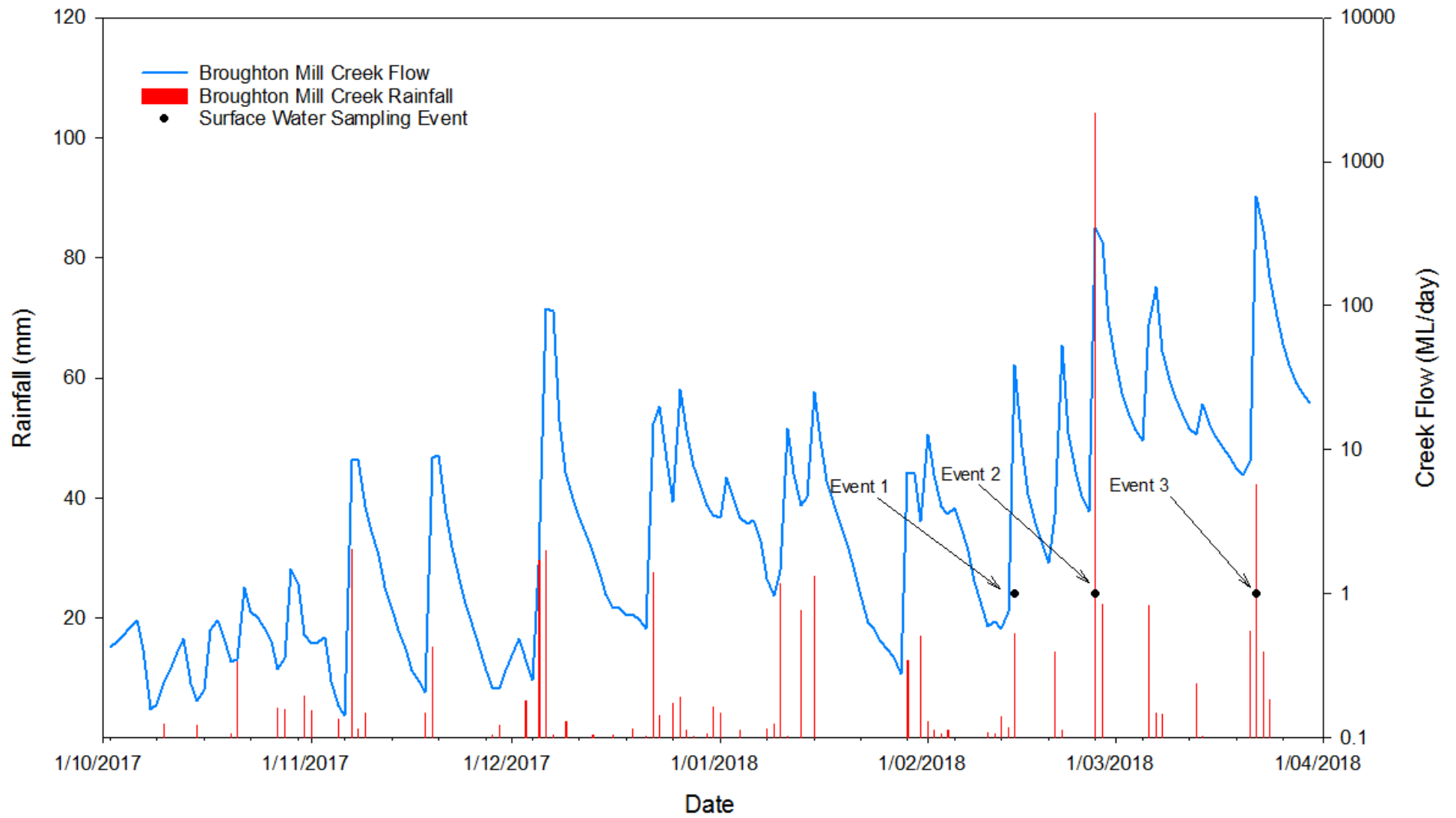


Figure 2 Rainfall vs Flow within Broughton Mill Creek



## Attachment B - Tabulated Results





**Attachment B  
Table B1  
Surface Water Sampling Results - Event 3**

RMS  
Foxground to Berry Bypass (FBB)  
Post construction Monitoring

	Field Parameters				
	pH (Field)	Electrical conductivity (field)	Dissolved Oxygen (Field)	Redox (Field)	Temperature (Field)
	pH Units	µS/cm	mg/L	mV	°C
ADWG 2011 Aesthetic	6.5-8.5				
ANZECC 2000 - Lowland Rivers (NSW rivers)	6.5-9	300			

Sampled Date	Field ID					
22/03/2018	SW01_1	6.78	103.1	9.12	119.2	16.9
22/03/2018	SW02_1	6.67	106.1	8.87	139.2	16.9
22/03/2018	SW03_1	6.63	112.1	8.75	140.8	17
22/03/2018	SW04_1	6.7	103.3	7.64	122.4	17.4
22/03/2018	SW04_2	6.64	103.4	7.75	121.5	17.4
22/03/2018	SW04_3	6.62	103.8	7.76	122	17.4
22/03/2018	SW05	6.66	112.2	7.9	138.9	17
22/03/2018	SW06_1	6.67	158.7	7.1	128.4	18.1
22/03/2018	SW07_1	6.58	128	8.03	129.3	17.7
22/03/2018	SW07_2	6.55	127.4	7.95	125.8	17.7
22/03/2018	SW07_3	6.54	128.9	7.9	123.5	17.7
22/03/2018	SW08	6.8	150.6	8.47	96.8	18.1
22/03/2018	SW09_1	6.56	158.1	8.21	128.8	18
22/03/2018	SW10_1	6.68	214.1	6.87	118.4	20.7
22/03/2018	SW10_2	6.66	214.2	6.87	118.5	20.7
22/03/2018	SW10_3	6.66	214	6.89	118.6	20.7
22/03/2018	SW11_1	6.56	389.9	3.15	120	21.4
22/03/2018	SW11_2	6.57	395.1	3.82	113.3	21.3
22/03/2018	SW11_3	6.53	396.1	3.65	100.7	21.4
22/03/2018	SW12_1	7	415.8	5.32	106.7	19.2
22/03/2018	SW13_1	7.11	463.7	7.26	78.5	19.4
22/03/2018	SW14	6.84	349.7	5.48	84.3	22
22/03/2018	SW15_1	6.97	382.7	6.01	73	21.2
22/03/2018	SW16	6.61	236.1	7.52	113	18.9
22/03/2018	SW17	6.72	237	7.46	105.3	18.9

Statistical Summary						
Number of Results	25	25	25	25	25	25
Number of Detects	25	25	25	25	25	25
Minimum Concentration	6.53	103.1	3.15	73	16.9	
Minimum Detect	6.53	103.1	3.15	73	16.9	
Maximum Concentration	7.11	463.7	9.12	140.8	22	
Maximum Detect	7.11	463.7	9.12	140.8	22	
Average Concentration	6.7	220	7	115	19	
Median Concentration	6.66	158.7	7.52	119.2	18.1	
Standard Deviation	0.15	123	1.6	18	1.7	
Number of Guideline Exceedances	0	7	0	0	0	0
Number of Guideline Exceedances(Detects Onl	0	7	0	0	0	0

EQ/Standard	BTEX						Inorganics		Nutrients				Metals						TRH - NEPM 2013						TRH - NEPM 1999				PAHs							
	Benzene	Toluene	Ethylbenzene	Xylenes (o)	Xylenes (m & p)	Xylenes Total	BTEX (Sum of Total) - Lab Calc	Total Suspended Solids	Turbidity	Nitrogen (Total Oxidised) (as N)	Nitrogen (Total)	Phosphorus (Total)	Kjeldahl Nitrogen Total	Arsenic (Filtered)	Cadmium (Filtered)	Chromium (III+VI) (Filtered)	Copper (Filtered)	Lead (Filtered)	Mercury (Filtered)	Nickel (Filtered)	Zinc (Filtered)	C6-C10 minus BTEX (F1)	C6-C10 Fraction	>C10-C16 minus Naphthalene (F2)	>C10-C16 Fraction	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C10-C40 (Sum of Total)	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 (Sum of Total)	Naphthalene		
EQ	1	2	2	2	2	2	1	5	0.1	0.01	0.1	0.01	0.1	0.001	0.0001	0.001	0.001	0.001	0.001	0.005	20	20	100	100	100	100	100	20	50	100	50	50	50	5		
ADWG 2011 Aesthetic (v3.4 updated 2017)		25	3				20	5								1				3																
ANZECC 2000 - Lowland Rivers (NSW rivers)								50			0.6	0.05																								
ANZECC 2000 FW 95%	950			350										0.013	0.0002	0.001	0.0014	0.0034	0.0006	0.011	0.008														16	

Reference Site	Sampled Date	Field ID	Benzene	Toluene	Ethylbenzene	Xylenes (o)	Xylenes (m & p)	Xylenes Total	BTEX (Sum of Total) - Lab Calc	Total Suspended Solids	Turbidity	Nitrogen (Total Oxidised) (as N)	Nitrogen (Total)	Phosphorus (Total)	Kjeldahl Nitrogen Total	Arsenic (Filtered)	Cadmium (Filtered)	Chromium (III+VI) (Filtered)	Copper (Filtered)	Lead (Filtered)	Mercury (Filtered)	Nickel (Filtered)	Zinc (Filtered)	C6-C10 minus BTEX (F1)	C6-C10 Fraction	>C10-C16 minus Naphthalene (F2)	>C10-C16 Fraction	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C10-C40 (Sum of Total)	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 (Sum of Total)	Naphthalene
	22/03/2018	QC1	<1	<2	<2	<2	<2	<2	<1	<5	5.5	0.11	0.5	0.05	0.4	<0.001	<0.0001	<0.001	0.002	<0.001	<0.0001	<0.001	0.006	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
	22/03/2018	QC2	<1	<2	<2	<2	<2	<2	<1	<5	5.7	0.53	1	0.07	0.5	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.005	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW01	22/03/2018	SW01_1	<1	<2	<2	<2	<2	<2	<1	<5	4.9	0.13	0.4	0.03	0.3	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.006	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW02	22/03/2018	SW02_1	<1	<2	<2	<2	<2	<2	<1	<5	5.8	0.13	0.4	0.03	0.3	<0.001	<0.0001	<0.001	0.002	<0.001	<0.0001	<0.001	<0.005	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW03	22/03/2018	SW03_1	<1	<2	<2	<2	<2	<2	<1	<5	6.2	0.06	0.5	0.06	0.4	<0.001	<0.0001	<0.001	0.002	<0.001	<0.0001	<0.001	0.005	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW04	22/03/2018	SW04_1	-	-	-	-	-	-	-	11	3.6	0.35	0.6	0.02	0.2	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.005	-	-	-	<100	<100	<100	<100	-	<50	<100	<50	<50	-
SW04	22/03/2018	SW04_2	<1	<2	<2	<2	<2	<2	<1	<5	3.6	-	-	-	-	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.006	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW04	22/03/2018	SW04_3	<1	<2	<2	<2	<2	<2	<1	<5	3.8	0.37	1.4	0.02	1	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.005	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW05	22/03/2018	SW05	<1	<2	<2	<2	<2	<2	<1	<5	5.5	0.14	0.5	0.04	0.4	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.011	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW06	22/03/2018	SW06_1	<1	<2	<2	<2	<2	<2	<1	<5	6.2	0.52	0.9	0.05	0.4	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.007	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW07	22/03/2018	SW07_1	<1	<2	<2	<2	<2	<2	<1	-	-	0.26	0.7	0.06	0.4	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.009	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW07	22/03/2018	SW07_2	<1	<2	<2	<2	<2	<2	<1	<5	4.9	0.41	0.8	0.05	0.4	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.012	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW07	22/03/2018	SW07_3	<1	<2	<2	<2	<2	<2	<1	<5	4.4	0.46	0.8	0.04	0.3	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.008	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW08	22/03/2018	SW08	<1	<2	<2	<2	<2	<2	<1	<5	4.5	0.35	0.8	0.06	0.4	<0.001	<0.0001	<0.001	0.001	<0.001	<0.0001	<0.001	0.011	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW09	22/03/2018	SW09_1	<1	<2	<2	<2	<2	<2	<1	<5	5.8	0.53	1	0.06	0.5	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.006	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW10	22/03/2018	SW10_1	<1	<2	<2	<2	<2	<2	<1	8	6.9	0.22	1.7	0.21	1.5	<0.001	<0.0001	<0.001	0.002	<0.001	<0.0001	<0.001	0.01	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW10	22/03/2018	SW10_2	<1	<2	<2	<2	<2	<2	<1	<5	6.6	0.24	1.6	0.21	1.4	<0.001	<0.0001	<0.001	0.003	<0.001	<0.0001	<0.001	0.01	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW10	22/03/2018	SW10_3	<1	<2	<2	<2	<2	<2	<1	<5	6.8	0.22	1.7	0.24	1.5	<0.001	<0.0001	<0.001	0.002	<0.001	<0.0001	<0.001	0.017	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW11	22/03/2018	SW11_1	<1	<2	<2	<2	<2	<2	<1	128	38.9	2.06	4.7	0.1	2.6	<0.001	<0.0001	<0.001	0.006	<0.001	<0.0001	<0.001	0.015	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW11	22/03/2018	SW11_2	<1	<2	<2	<2	<2	<2	<1	50	38.4	2.16	4.2	0.11	2	<0.001	<0.0001	<0.001	0.006	<0.001	<0.0001	<0.001	0.013	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW11	22/03/2018	SW11_3	<1	<2	<2	<2	<2	<2	<1	40	37.1	2.18	3.4	0.09	1.2	<0.001	<0.0001	<0.001	0.007	<0.001	<0.0001	<0.001	0.018	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW12	22/03/2018	SW12_1	<1	<2	<2	<2	<2	<2	<1	<5	11.2	0.67	1.3	0.06	0.6	<0.001	<0.0001	<0.001	0.002	<0.001	<0.0001	<0.001	0.006	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW13	22/03/2018	SW13_1	<1	<2	<2	<2	<2	<2	<1	26	51.5	0.08	1.2	0.1	1.1	<0.001	<0.0001	<0.001	0.007	<0.001	<0.0001	<0.001	0.018	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW14	22/03/2018	SW14	<1	<2	<2	<2	<2	<2	<1	<5	9.9	0.71	1.3	0.04	0.6	0.001	<0.0001	<0.001	0.003	<0.001	<0.0001	<0.001	0.006	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW15	22/03/2018	SW15_1	<1	<2	<2	<2	<2	<2	<1	33	44.3	0.12	1.9	0.19	1.8	<0.001	<0.0001	<0.001	0.006	<0.001	<0.0001	<0.001	0.009	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW16	22/03/2018	SW16	<1	<2	<2	<2	<2	<2	<1	<5	6.5	0.27	0.8	0.06	0.5	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.006	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5
SW17	22/03/2018	SW17	<1	<2	<2	<2	<2	<2	<1	<5	5.9	0.27	0.9	0.06	0.6	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.0001	<0.001	0.006	<20	<20	<100	<100	<100	<100	<100	<20	<50	<100	<50	<50	<5

Statistical Summary																																					
Number of Results	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	27	27	27	27	27	27	27	27	26	26	26	27	27	27	27	26	27	27	27	27	26	
Number of Detects	0	0	0	0	0	0	0	0	7	26	26	26	26	26	26	1	0	0	14	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Concentration	<1	<2	<2	<2	<2	<2	<1	<5	3.6	0.06	0.4	0.02	0.2	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0															



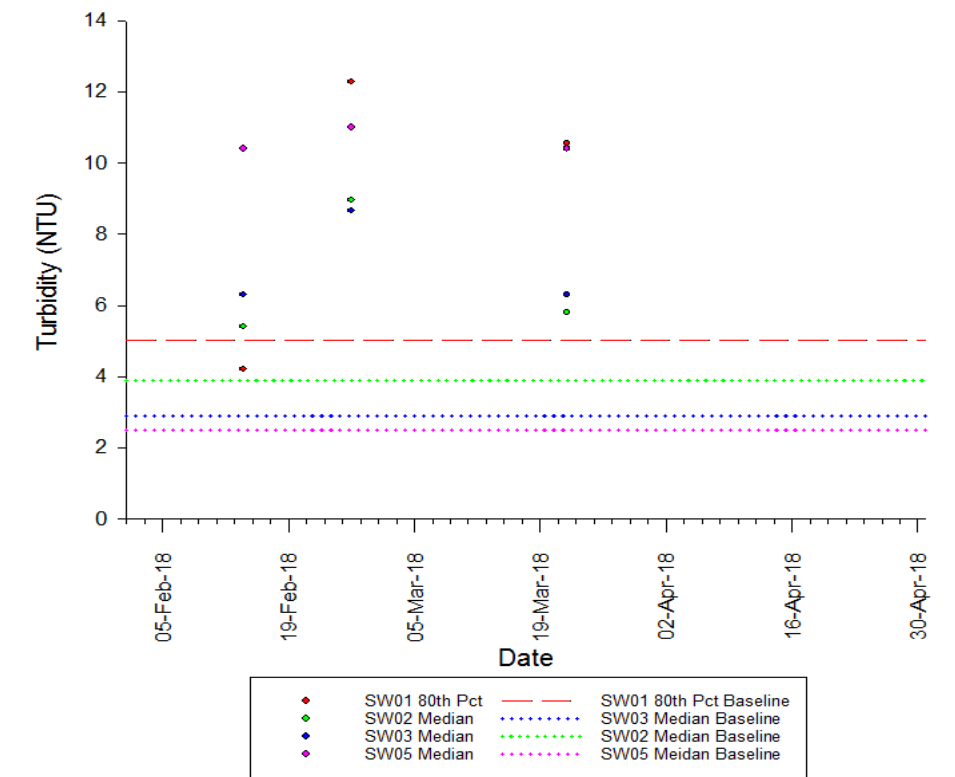
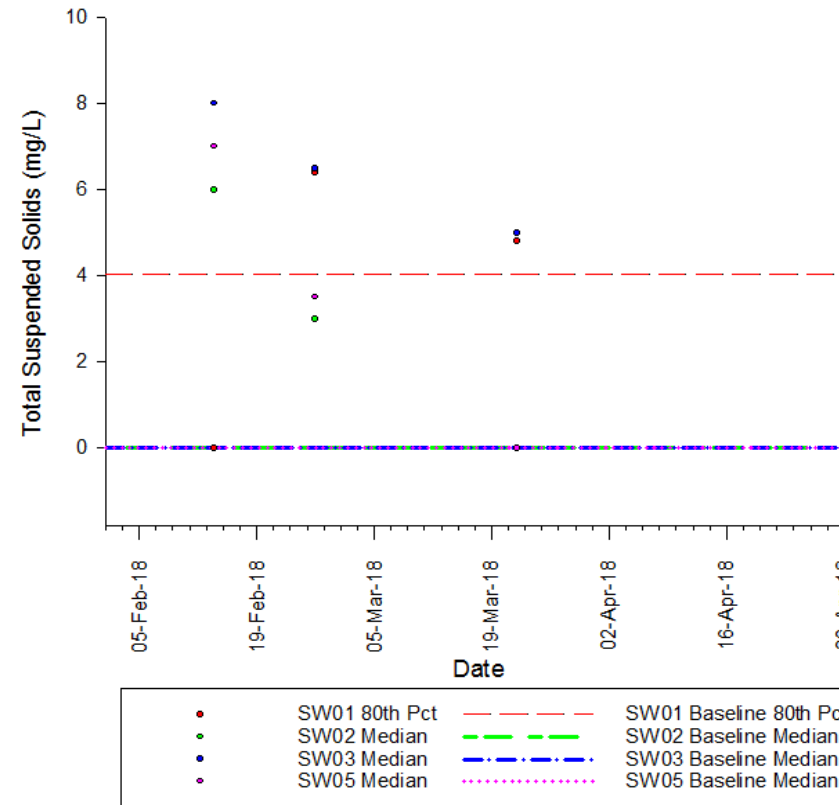
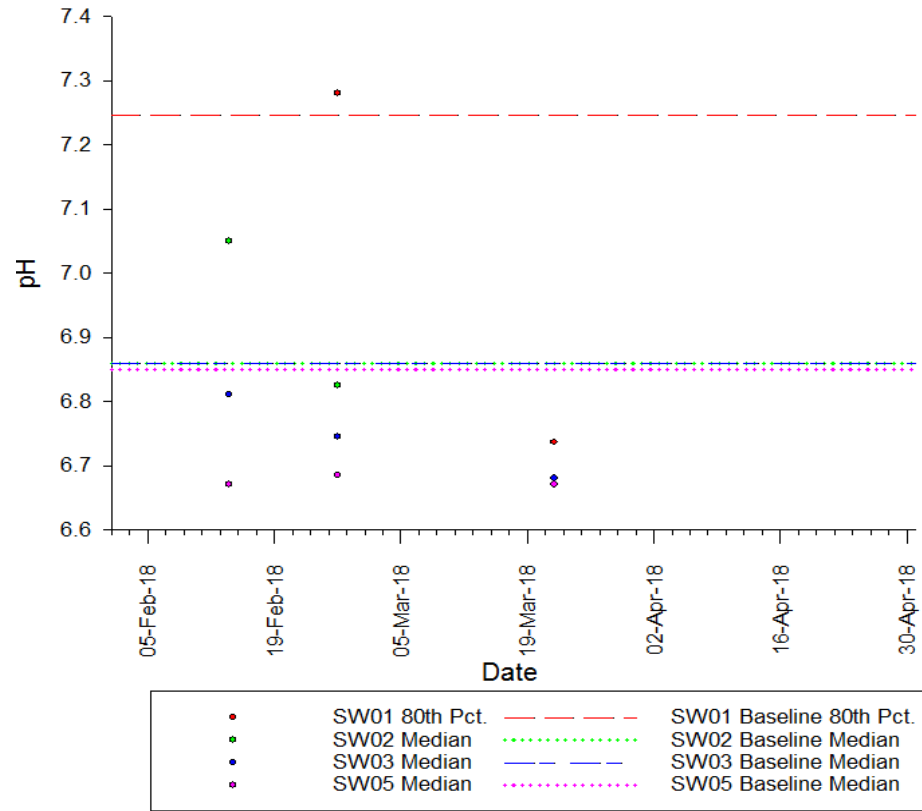
		Location Code	SW03			SW09		
		Date	22/03/2018	22/03/2018		22/03/2018	22/03/2018	
		Field ID	SW03_1	QC1		SW09_1	QC2	
		Sample Type	Normal	Field_D		Normal	Field_D	
		Matrix Type	water	water	RPD	water	water	RPD
	Unit	EQL						
<b>Inorganics</b>								
Turbidity	NTU	0.1	6.2	5.5	12	5.8	5.7	2
Total Suspended Solids	mg/L	5	<5	<5	0	<5	<5	0
<b>Nutrients</b>								
Nitrogen (Total Oxidised) (as N)	mg/L	0.01	0.06	0.11	59	0.53	0.53	0
Nitrogen (Total)	mg/L	0.1	0.5	0.5	0	1	1	0
Phosphorus (Total)	mg/L	0.01	0.06	0.05	18	0.06	0.07	15
Kjeldahl Nitrogen Total	mg/L	0.1	0.4	0.4	0	0.5	0.5	0
<b>Metals</b>								
Arsenic (filtered)	mg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
Cadmium (filtered)	mg/L	0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	0
Chromium (III+VI) (filtered)	mg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
Copper (filtered)	mg/L	0.001	0.002	0.002	0	<0.001	<0.001	0
Lead (filtered)	mg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
Mercury (filtered)	mg/L	0.0001	<0.0001	<0.0001	0	<0.0001	<0.0001	0
Nickel (filtered)	mg/L	0.001	<0.001	<0.001	0	<0.001	<0.001	0
Zinc (filtered)	mg/L	0.005	0.005	0.006	18	0.006	0.005	18
<b>BTEXN</b>								
Benzene	µg/L	1	<1	<1	0	<1	<1	0
Toluene	µg/L	2	<2	<2	0	<2	<2	0
Ethylbenzene	µg/L	2	<2	<2	0	<2	<2	0
Xylene (o)	µg/L	2	<2	<2	0	<2	<2	0
Xylene (m & p)	µg/L	2	<2	<2	0	<2	<2	0
Xylene Total	µg/L	2	<2	<2	0	<2	<2	0
BTEX (Sum of Total) - Lab Calc	µg/L	1	<1	<1	0	<1	<1	0
<b>TRH - NEPM 2013</b>								
C6-C10 minus BTEX (F1)	µg/L	20	<20	<20	0	<20	<20	0
C6-C10 Fraction	µg/L	20	<20	<20	0	<20	<20	0
>C10-C16 minus Naphthalene (F2)	µg/L	100	<100	<100	0	<100	<100	0
>C10-C16 Fraction	µg/L	100	<100	<100	0	<100	<100	0
>C16-C34 Fraction (F3)	µg/L	100	<100	<100	0	<100	<100	0
>C34-C40 Fraction (F4)	µg/L	100	<100	<100	0	<100	<100	0
>C10-C40 (Sum of Total)	µg/L	100	<100	<100	0	<100	<100	0
<b>TRH - NEPM 1999</b>								
C6-C9 Fraction	µg/L	20	<20	<20	0	<20	<20	0
C10-C14 Fraction	µg/L	50	<50	<50	0	<50	<50	0
C15-C28 Fraction	µg/L	100	<100	<100	0	<100	<100	0
C29-C36 Fraction	µg/L	50	<50	<50	0	<50	<50	0
C10-C36 (Sum of Total)	µg/L	50	<50	<50	0	<50	<50	0
<b>PAHs</b>								
Naphthalene	µg/L	5	<5	<5	0	<5	<5	0

## Attachment C - Control Charts

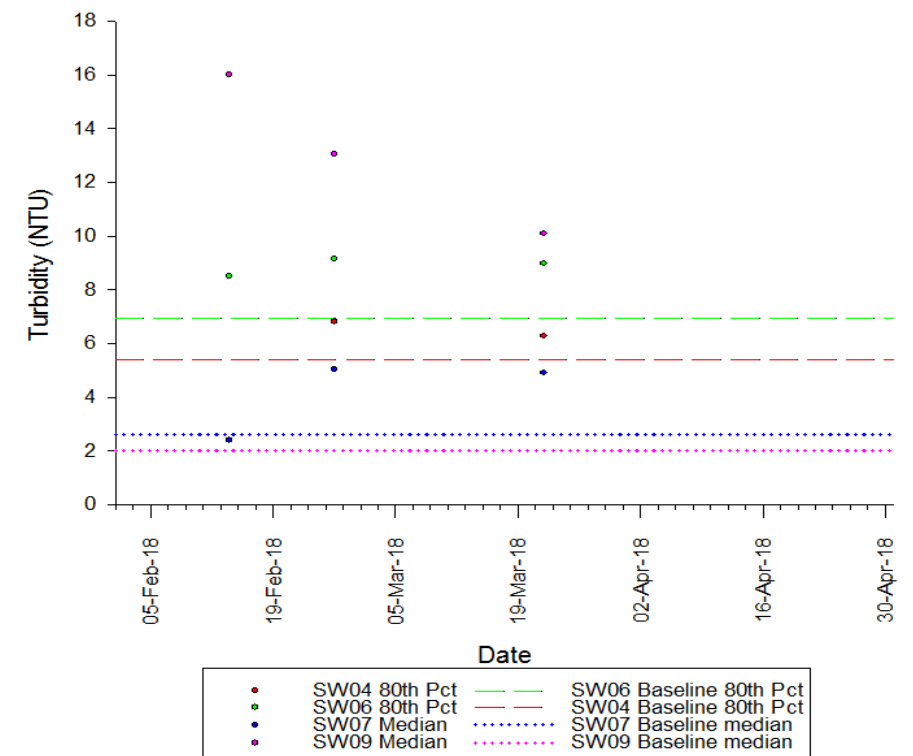
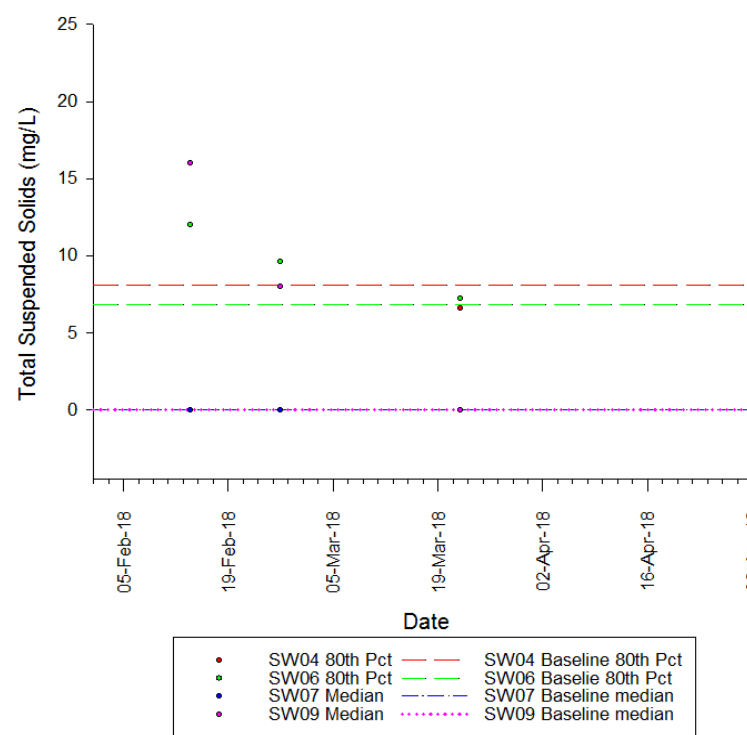
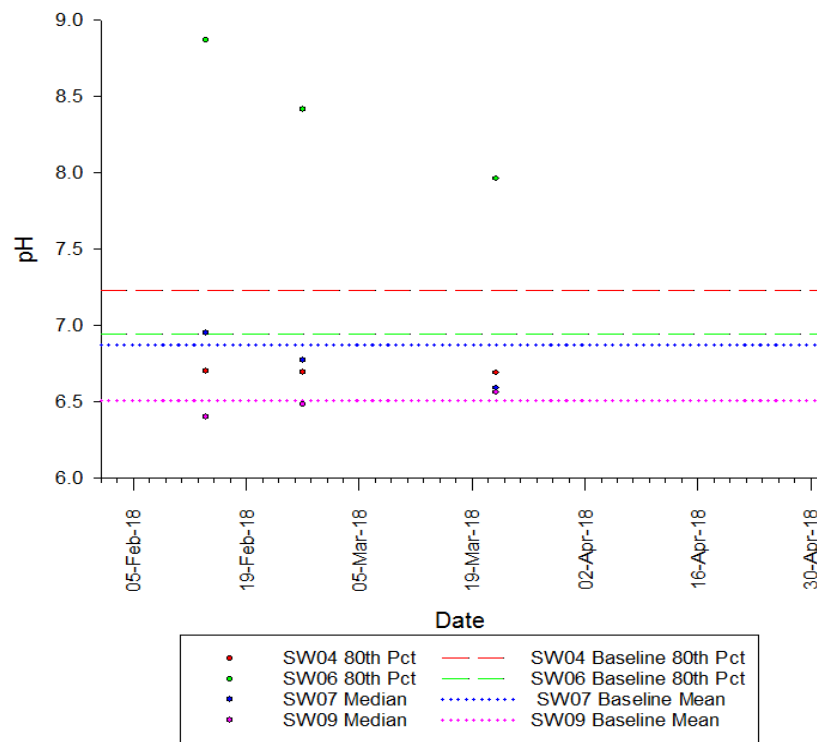


# Event 3 - Attachment E Control Charts -pH, TSS, Turbidity

## 1. Broughton Creek



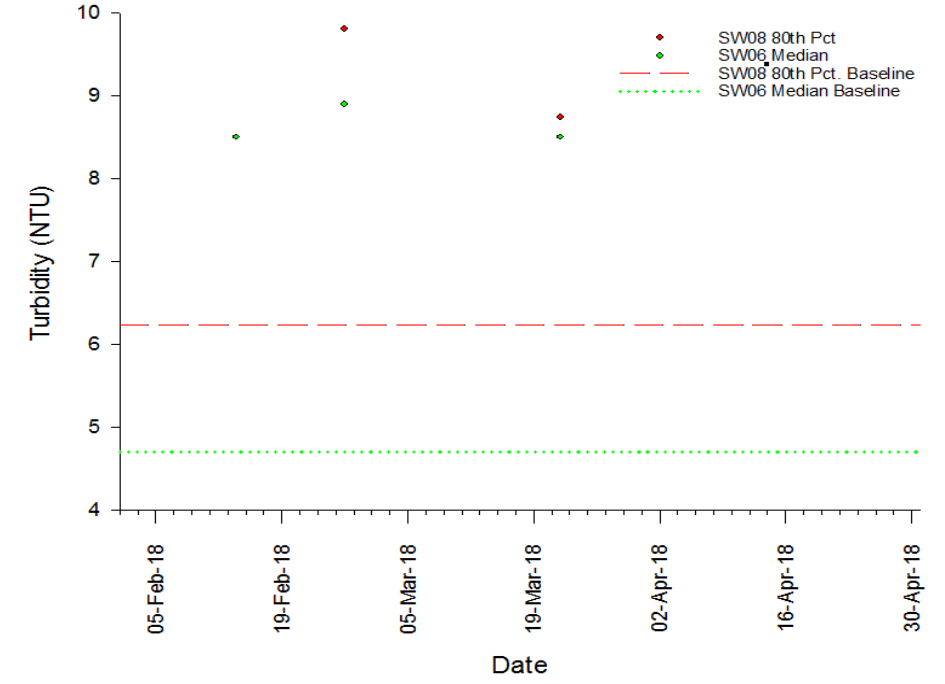
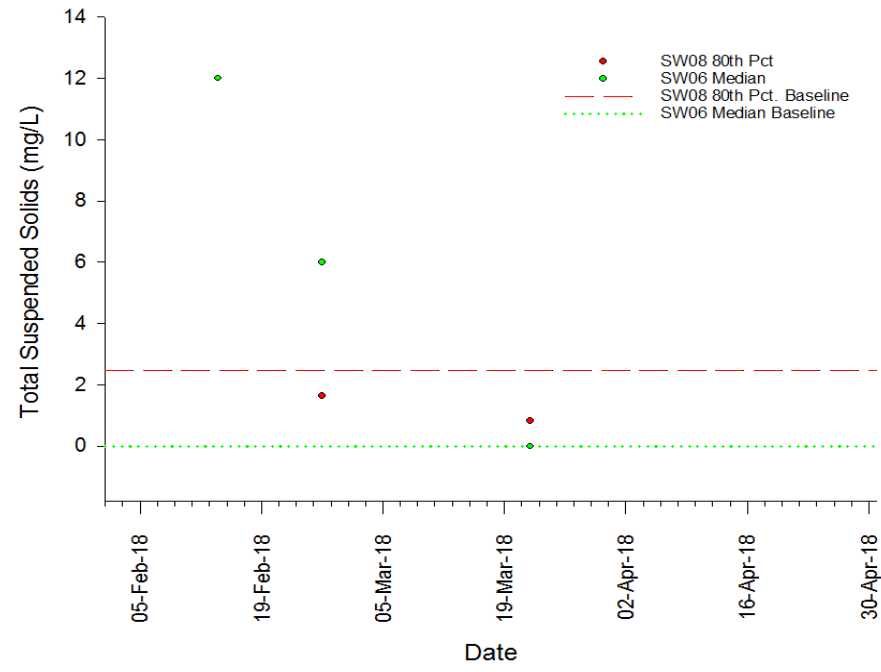
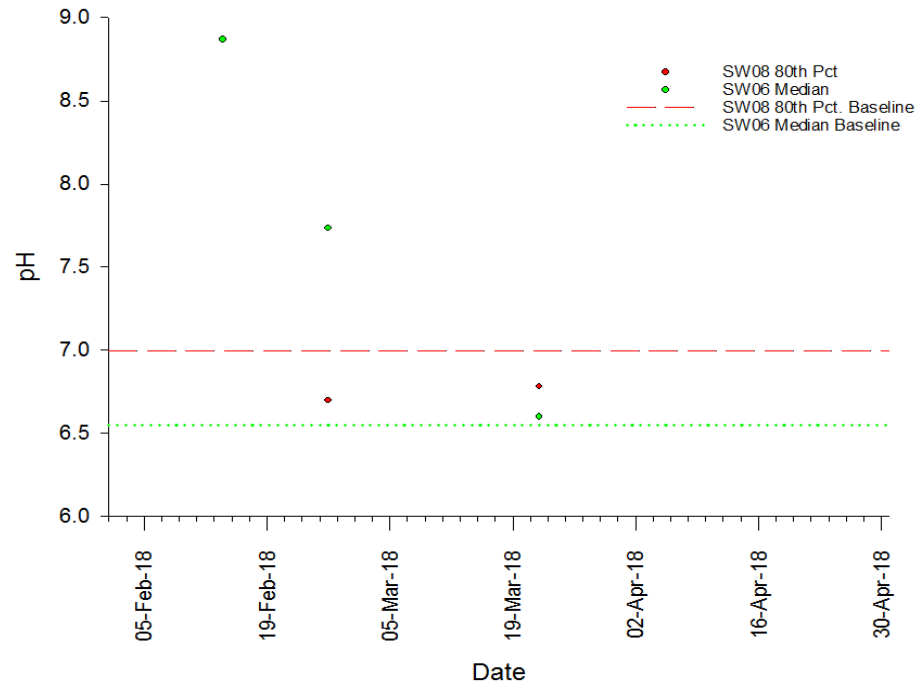
## 2. Connelly's Creek and Broughton Mill Creek and Bundewallah Creek



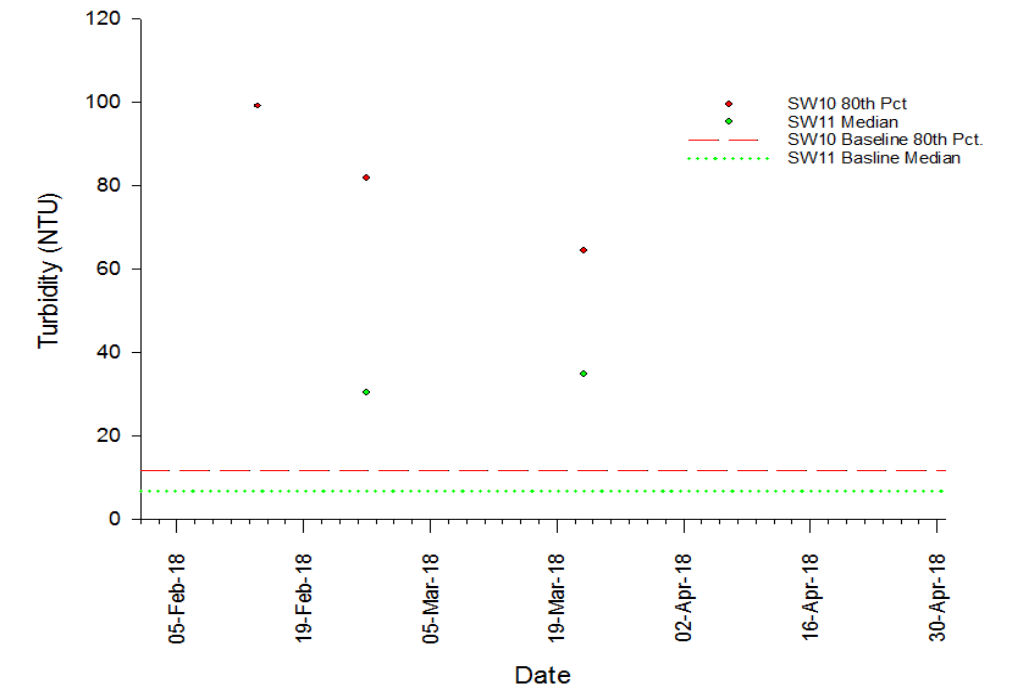
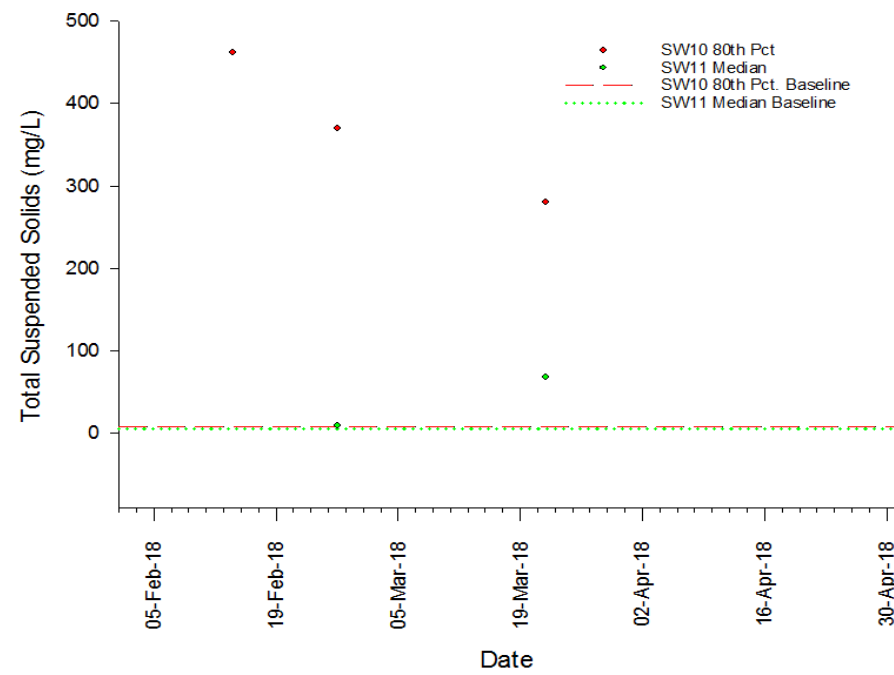
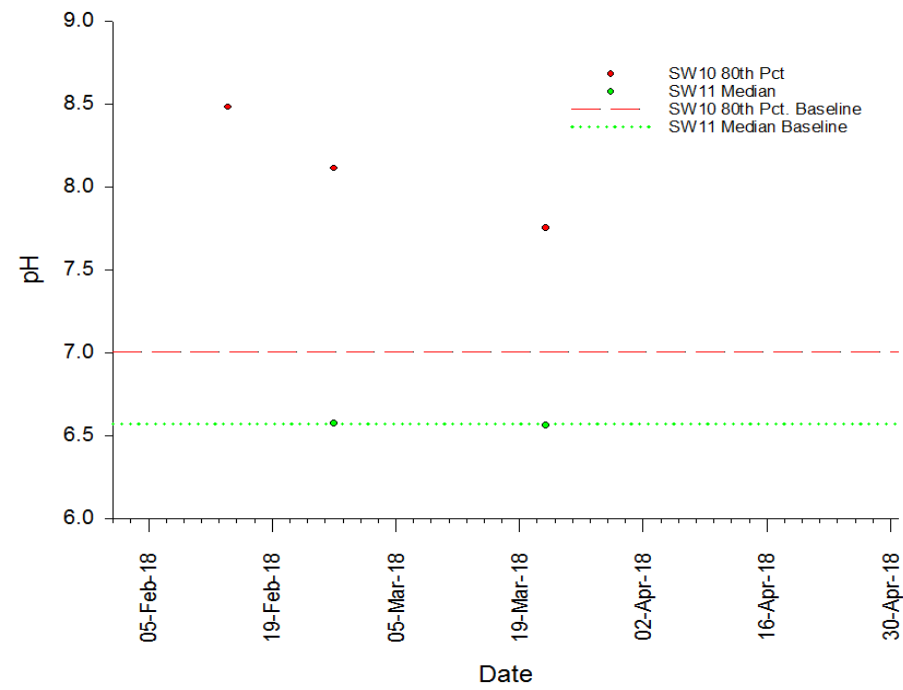


### Event 3 - Attachment E Control Charts -pH, TSS, Turbidity

#### 3. Bundewallah Creek and Connelly's Creek



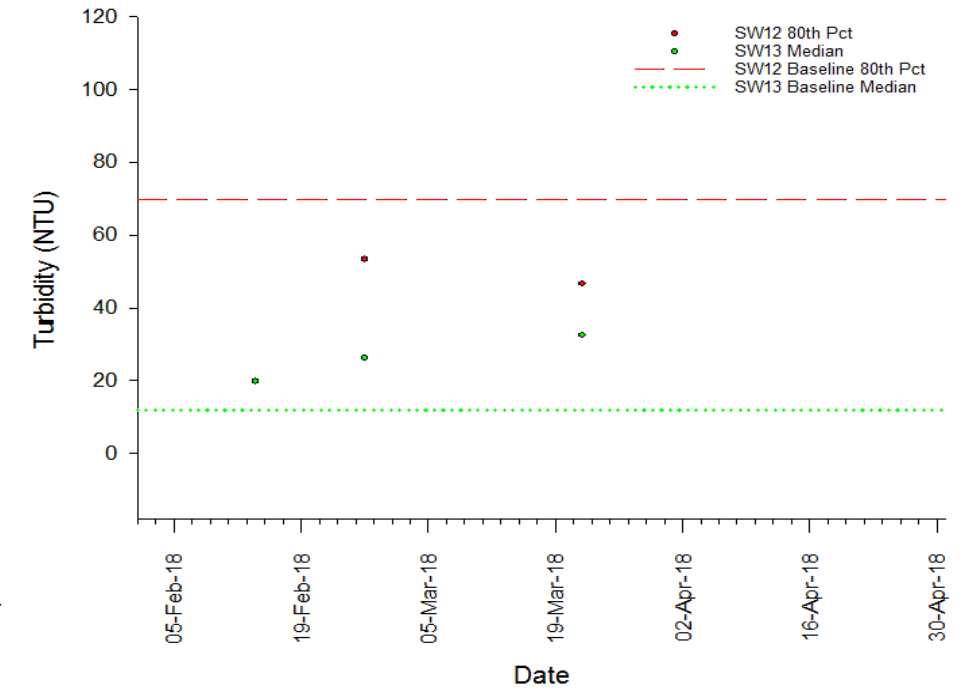
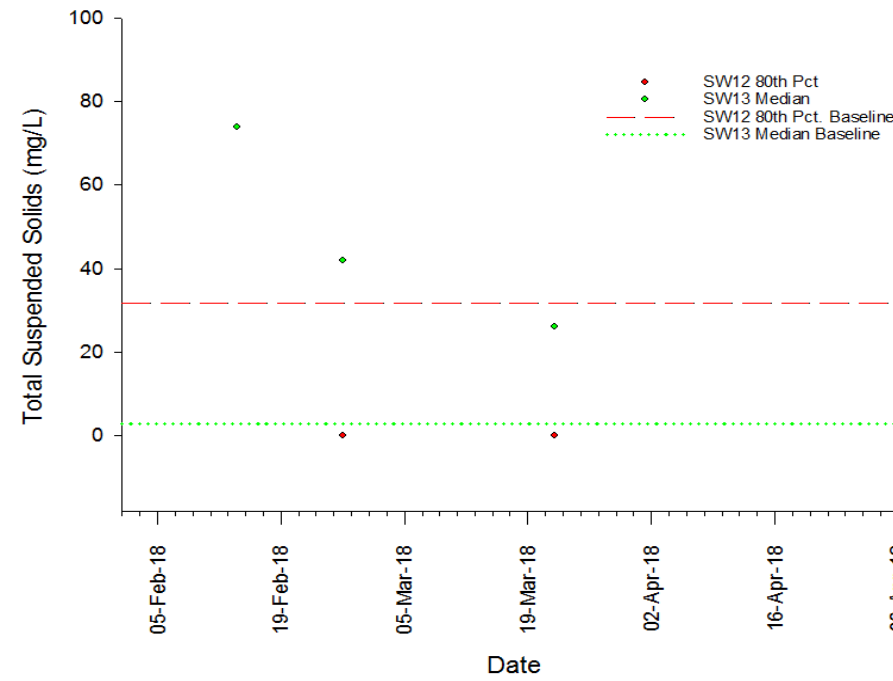
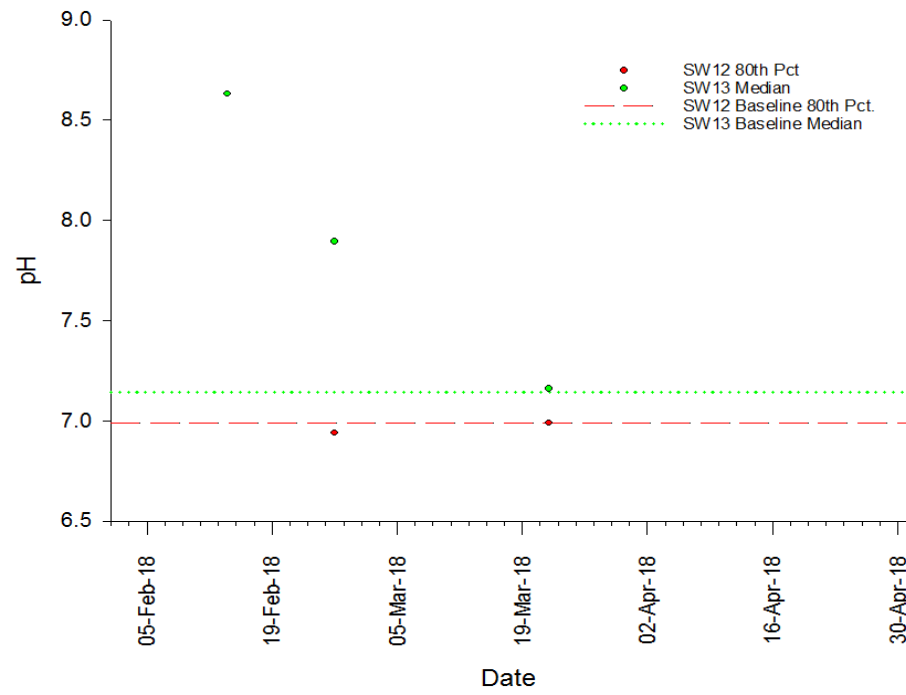
#### 4. Town Creek



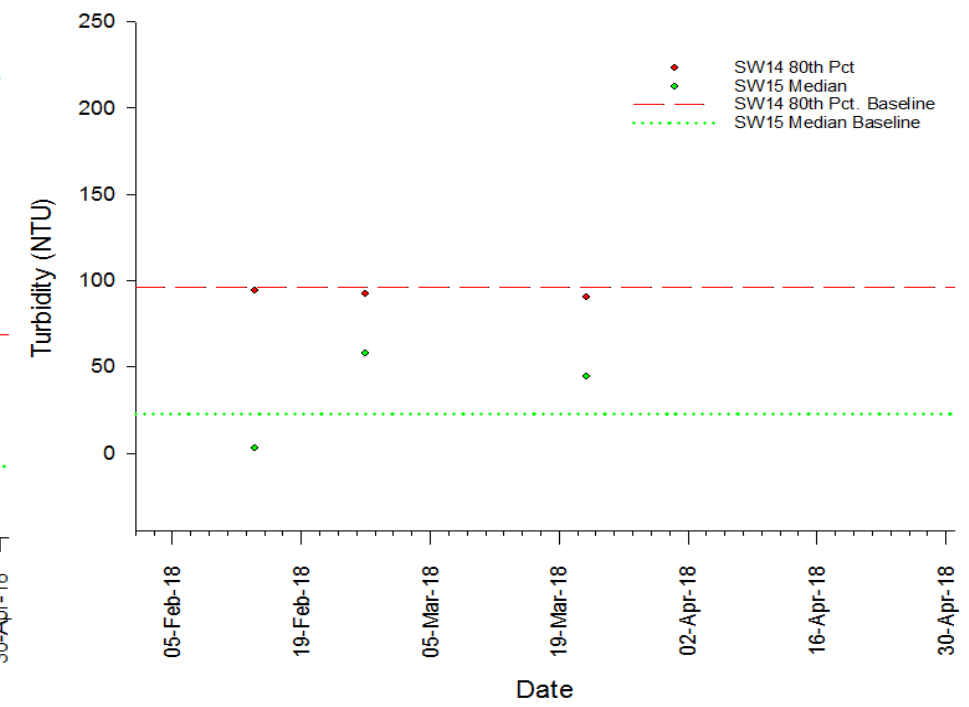
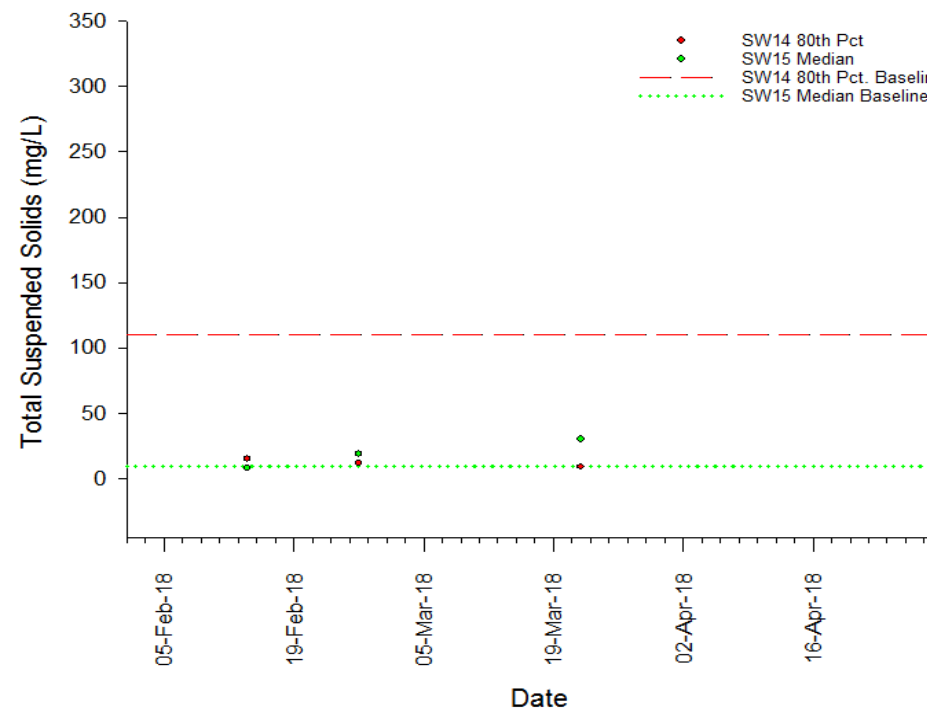
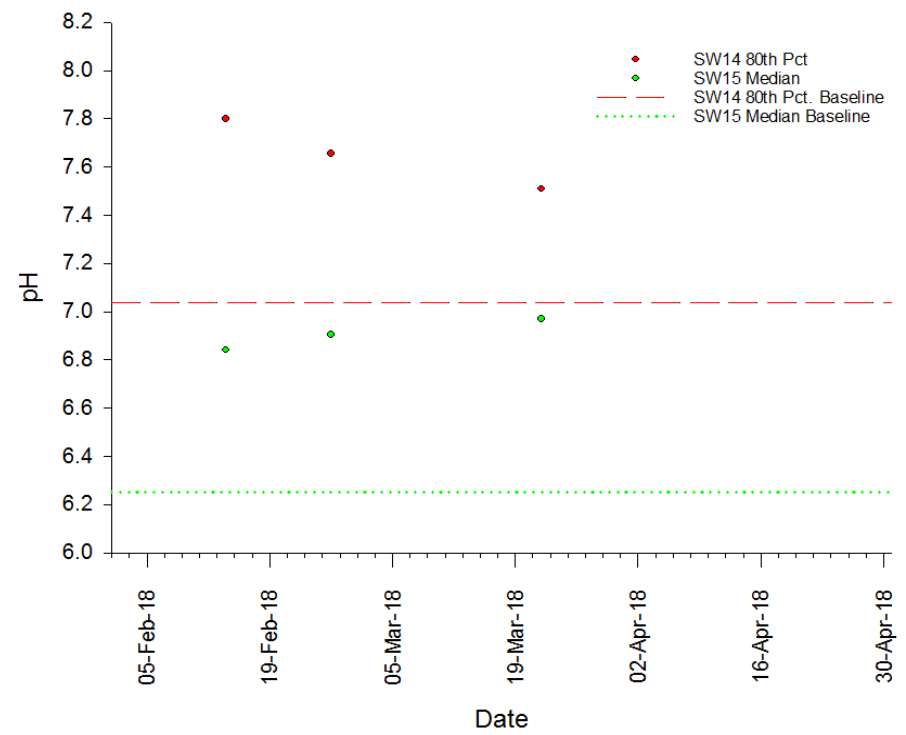


# Event 3 - Attachment E Control Charts -pH, TSS, Turbidity

## 5. Hitchcocks Lane Creek Tributary



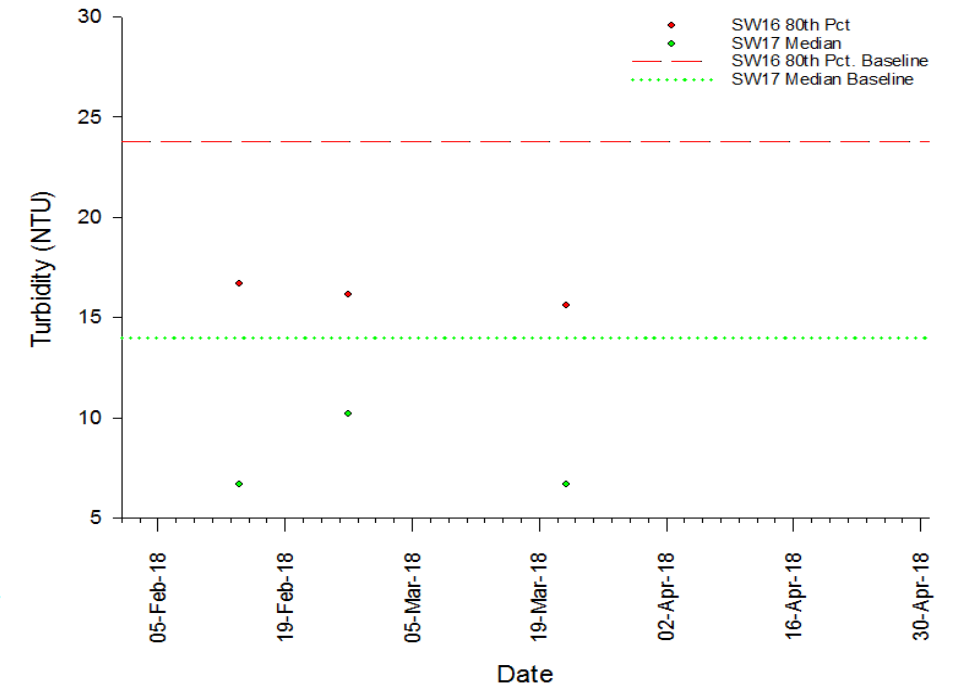
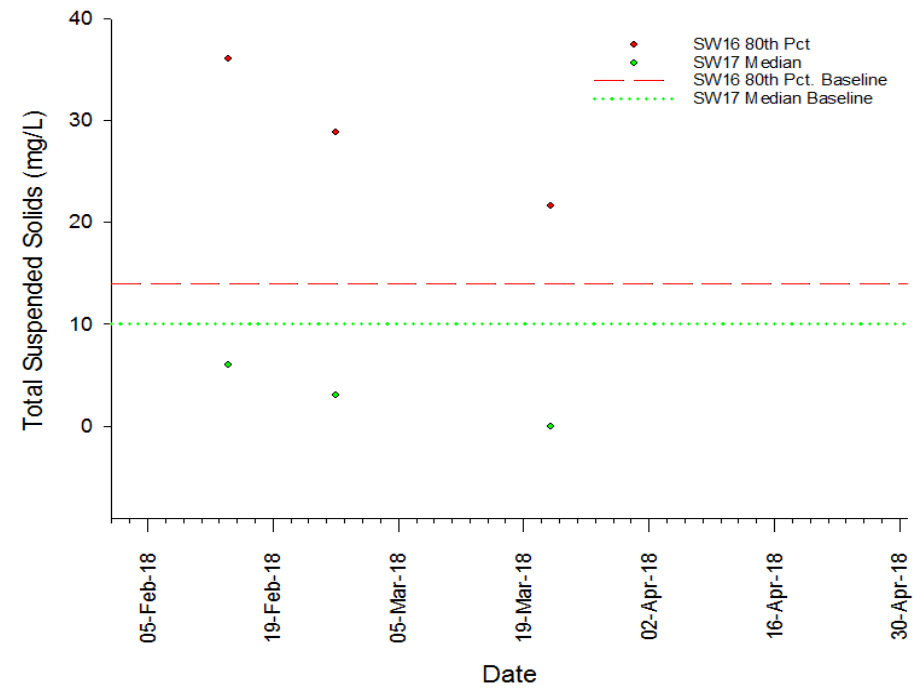
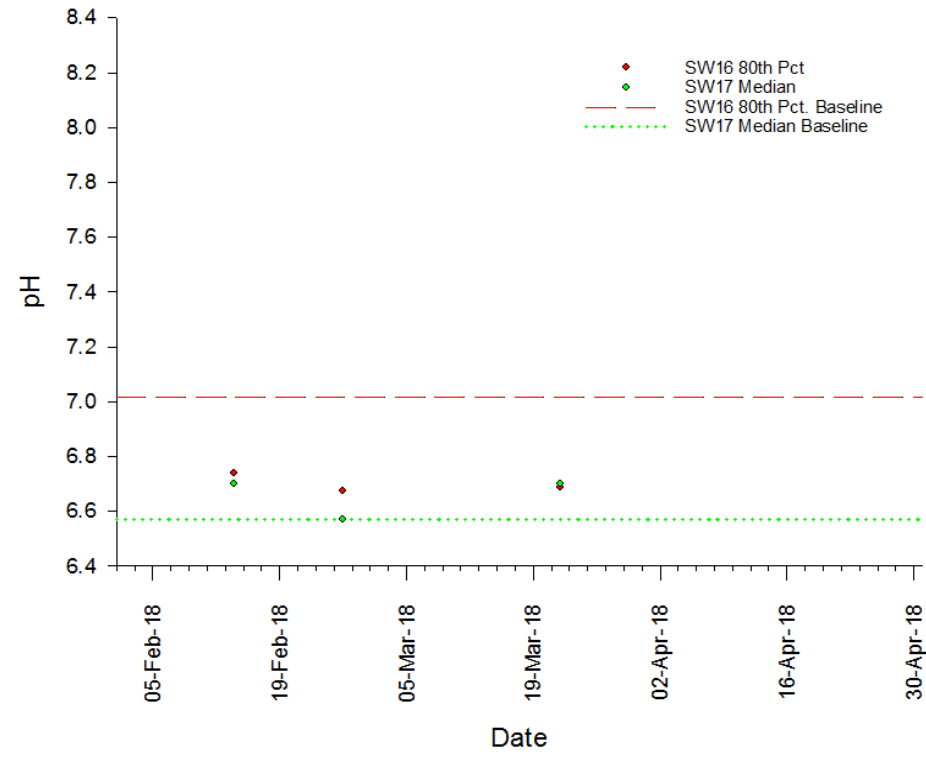
## 6. Hitchcocks Lane Creek





# Event 3 - Attachment E Control Charts -pH, TSS, Turbidity

## 7. Unnamed Tributary



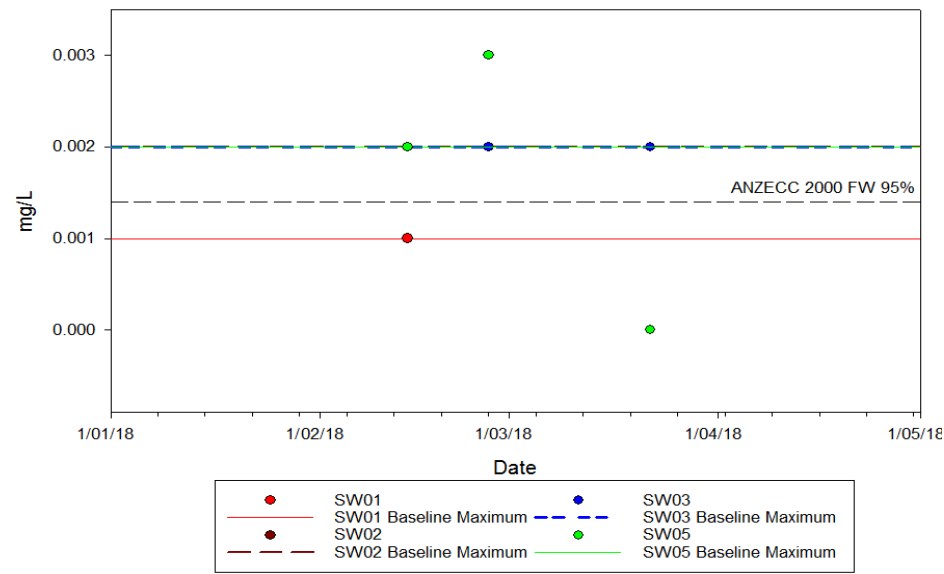




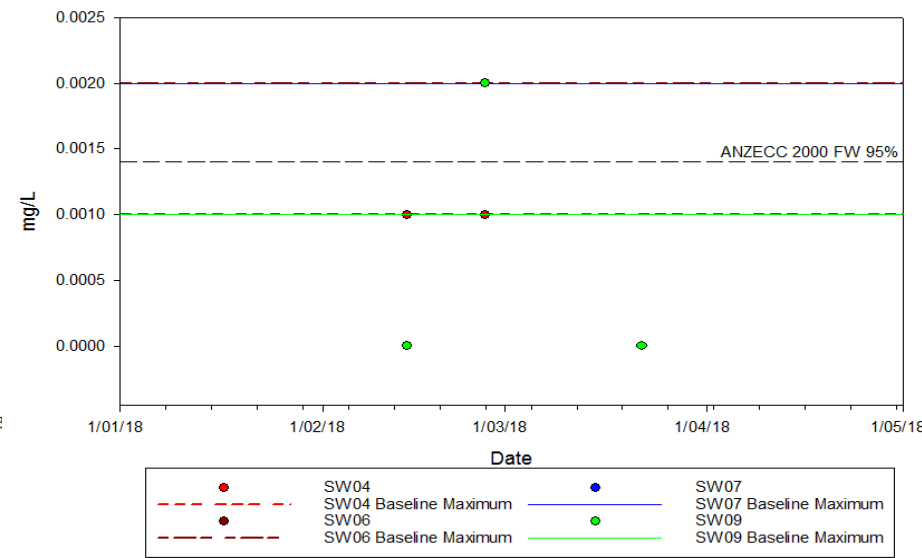
# Event 3 - Attachment E Control Charts - Heavy Metals

## Copper

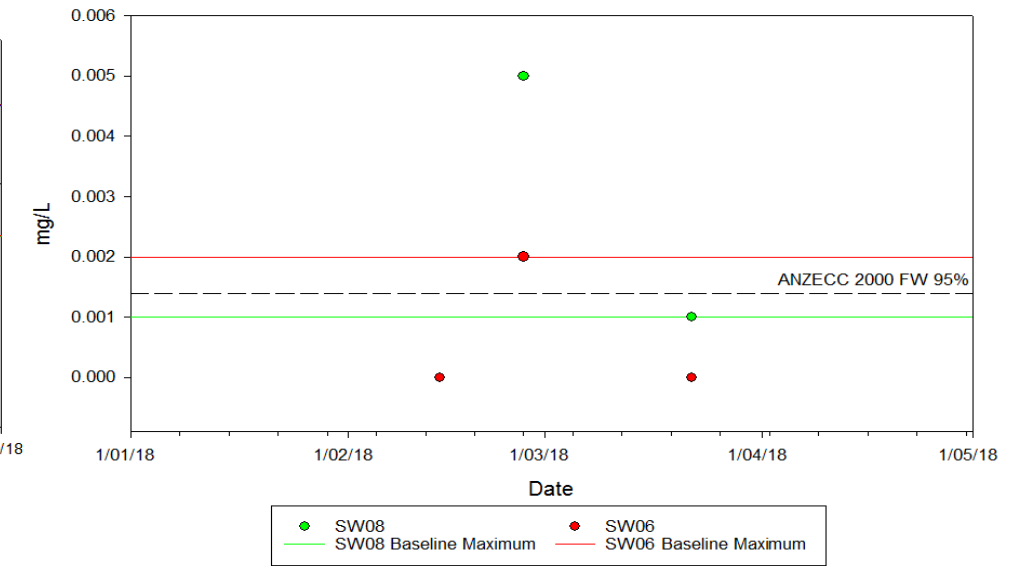
Copper Concentration Broughton Creek



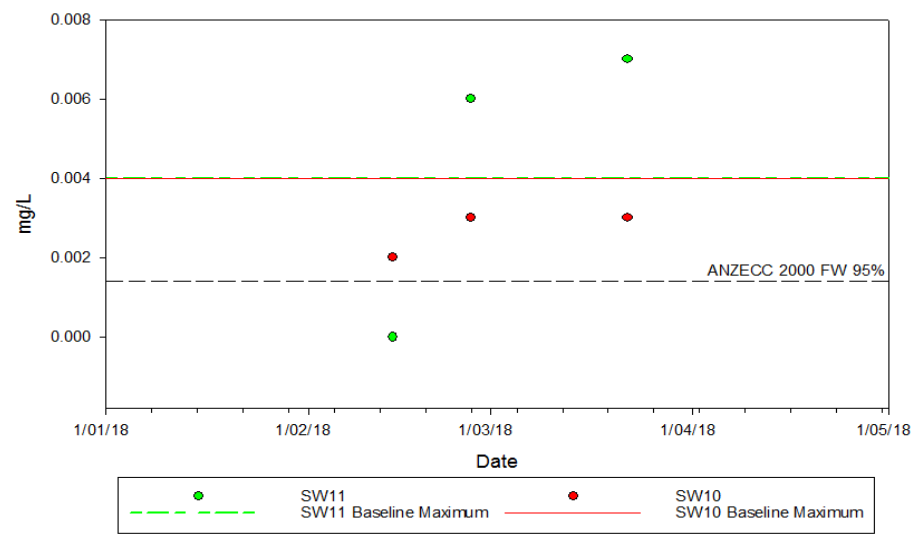
Copper Concentration Connelly's Creek, Broughton Mill Creek and Bundewallah Creek



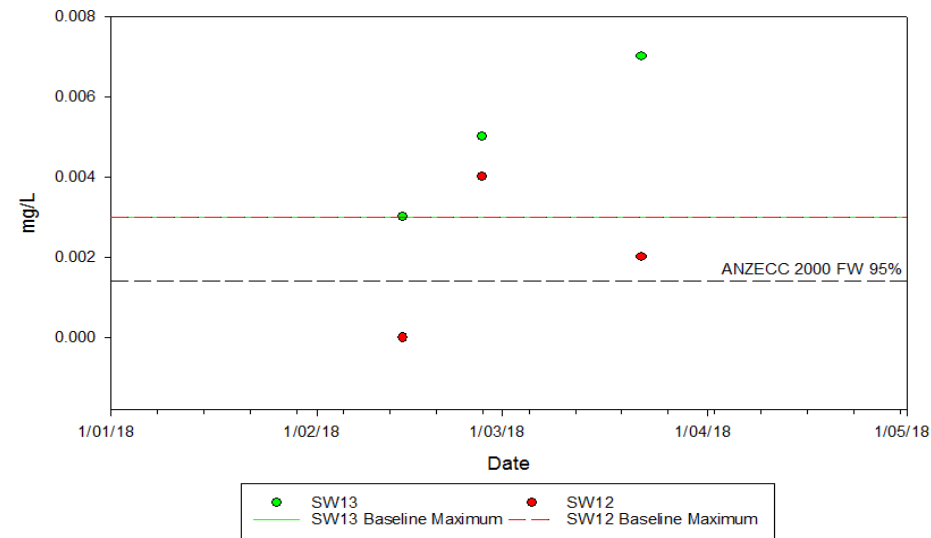
Copper Concentration Bundewallah Creek and Connelly's Creek



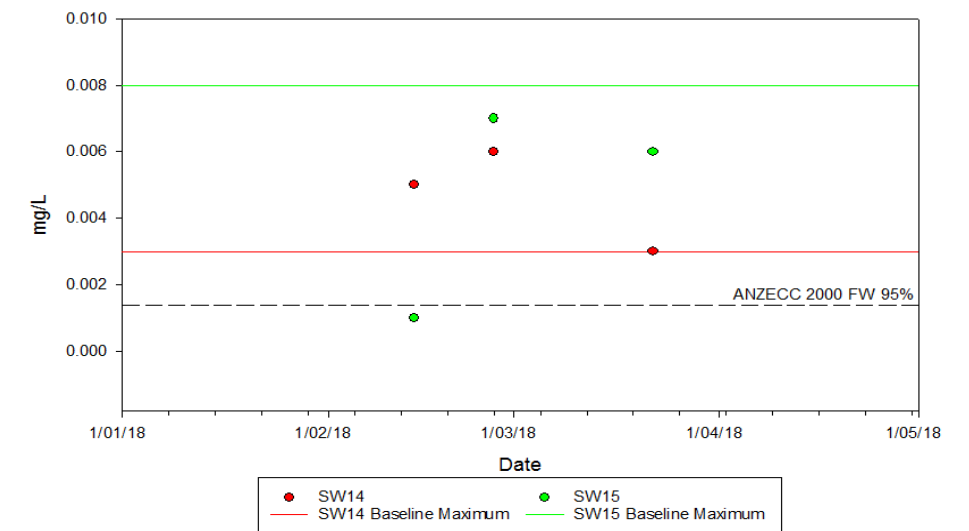
Copper Concentration Town Creek



Copper Concentration Hitchcocks Lane Creek Tributary



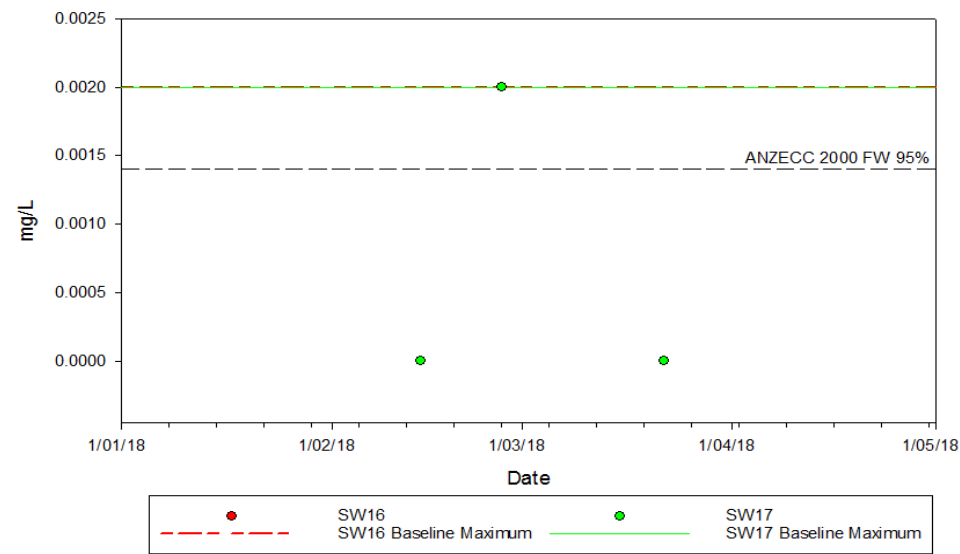
Copper Concentration Hitchcocks Lane Creek Tributary





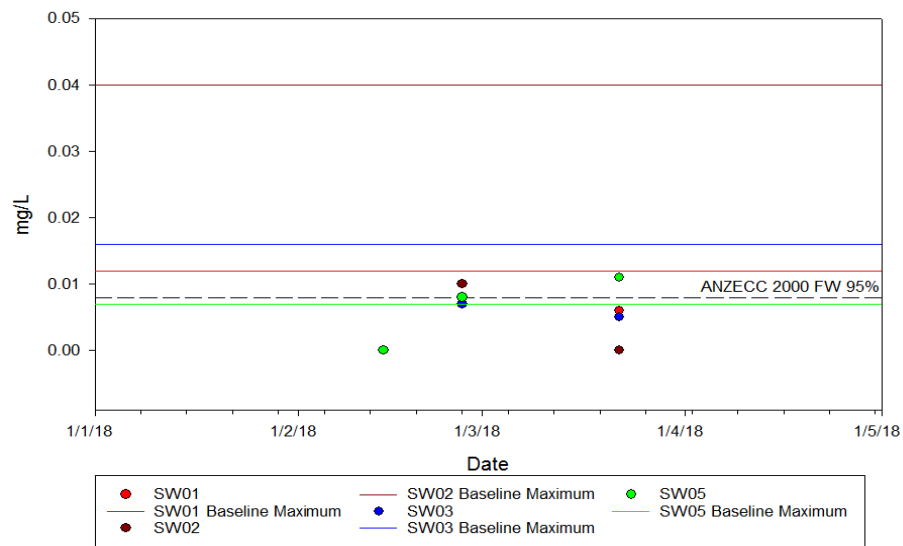
# Event 3 - Attachment E Control Charts - Heavy Metals

### Copper Concentration Unnamed Tributary

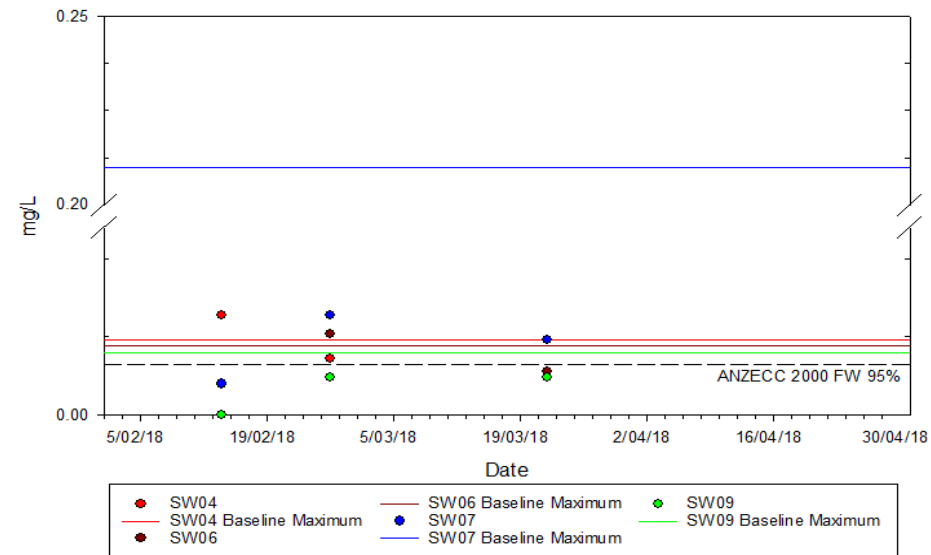


## Zinc

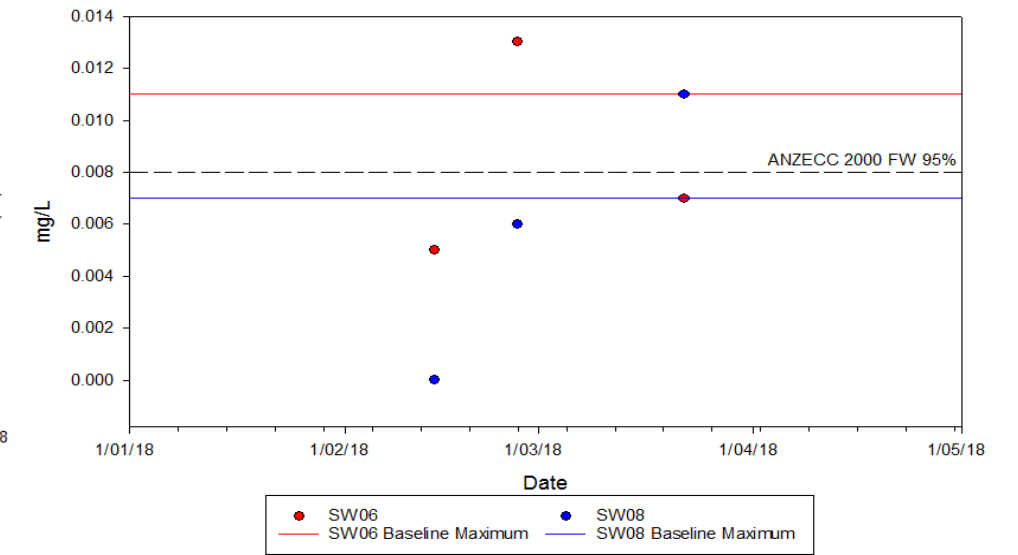
### Zinc Concentration Broughton Creek



### Zinc Concentration Connelly's Creek, Broughton Mill Creek and Bundewallah Creek



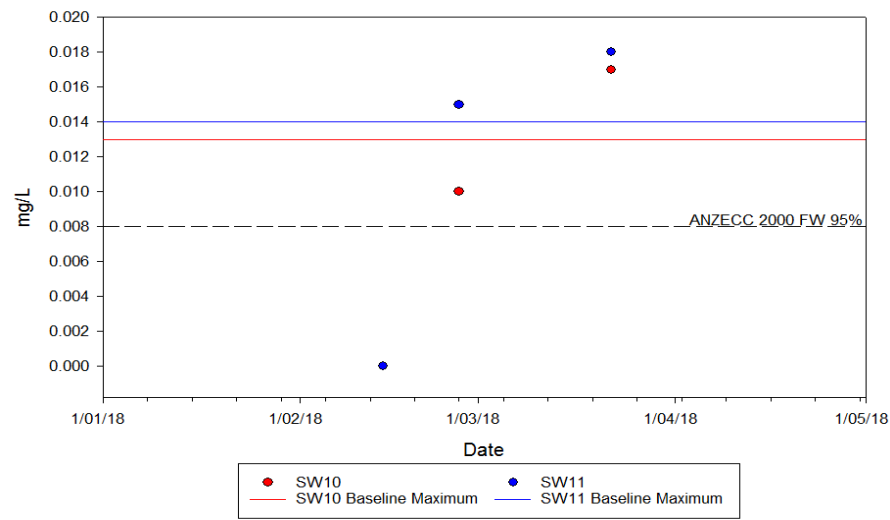
### Zinc Concentration Bundewallah Creek and Connelly's Creek



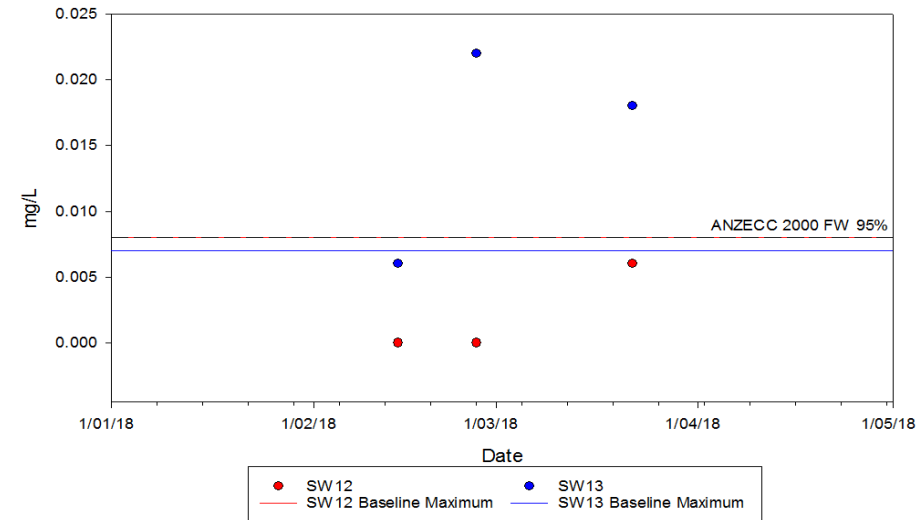


# Event 3 - Attachment E Control Charts - Heavy Metals

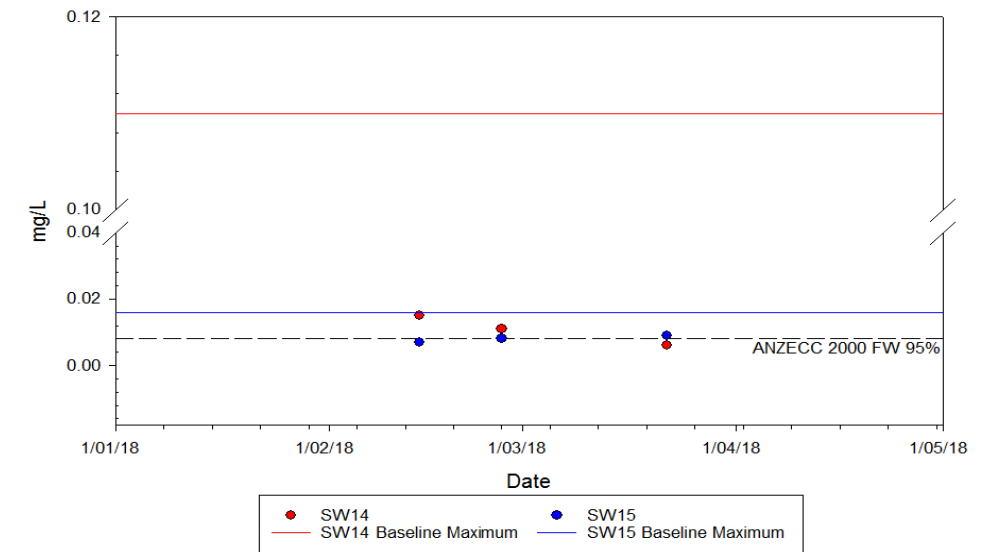
### Zinc Concentration Town Creek



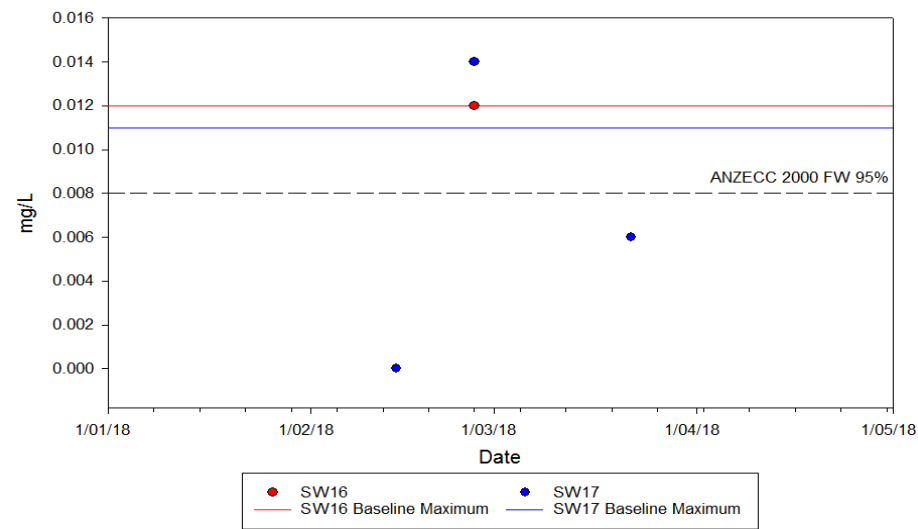
### Zinc Concentration Hitchcock Lane Creek Tributary



### Zinc Concentration Hitchcocks Lane Creek



### Zinc Concentration Unamed Tributary



## Attachment D - Laboratory Certificates

## CERTIFICATE OF ANALYSIS

**Work Order** : **ES1808893**  
**Client** : **GHD PTY LTD**  
**Contact** : **MS JANE CURRAN**  
**Address** : **1/51 GRAHAM STREET**  
**NOWRA NSW, AUSTRALIA 2541**  
**Telephone** : **+61 02 9239 7100**  
**Project** : **2316261**  
**Order number** : **2316261**  
**C-O-C number** : **----**  
**Sampler** : **Iain Lindley, Rob Webb**  
**Site** : **----**  
**Quote number** : **SY/603/17 A**  
**No. of samples received** : **43**  
**No. of samples analysed** : **27**

**Page** : 1 of 15  
**Laboratory** : Environmental Division Sydney  
**Contact** : Customer Services ES  
**Address** : 277-289 Woodpark Road Smithfield NSW Australia 2164  
**Telephone** : +61-2-8784 8555  
**Date Samples Received** : 26-Mar-2018 08:00  
**Date Analysis Commenced** : 27-Mar-2018  
**Issue Date** : 04-Apr-2018 17:18



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dian Dao		Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW



## General Comments

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

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
LOR = Limit of reporting  
^ = This result is computed from individual analyte detections at or above the level of reporting  
ø = ALS is not NATA accredited for these tests.  
~ = Indicates an estimated value.



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW01_1	SW02_1	SW03_1	QC1	SW04_1
Client sampling date / time				22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1808893-001	ES1808893-004	ES1808893-007	ES1808893-008	ES1808893-011	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	11	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	4.9	5.8	6.2	5.5	3.6	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	0.002	0.002	0.002	<0.001	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	0.006	<0.005	0.005	0.006	<0.005	
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	0.13	0.13	0.06	0.11	0.35	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	0.3	0.4	0.4	0.2	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L	0.4	0.4	0.5	0.5	0.6	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L	0.03	0.03	0.06	0.05	0.02	
<b>EP080/071: Total Petroleum Hydrocarbons</b>									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	----	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	----	
C10 - C14 Fraction	----	50	µg/L	----	----	----	----	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	----	
C15 - C28 Fraction	----	100	µg/L	----	----	----	----	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	----	
C29 - C36 Fraction	----	50	µg/L	----	----	----	----	<50	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	----	
^ C10 - C36 Fraction (sum)	----	50	µg/L	----	----	----	----	<50	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	----	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW01_1	SW02_1	SW03_1	QC1	SW04_1
Client sampling date / time				22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1808893-001	ES1808893-004	ES1808893-007	ES1808893-008	ES1808893-011	
				Result	Result	Result	Result	Result	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>									
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	----	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	----	
>C10 - C16 Fraction	----	100	µg/L	----	----	----	----	<100	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	----	
>C16 - C34 Fraction	----	100	µg/L	----	----	----	----	<100	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	----	
>C34 - C40 Fraction	----	100	µg/L	----	----	----	----	<100	
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	<100	<100	----	
^ >C10 - C40 Fraction (sum)	----	100	µg/L	----	----	----	----	<100	
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	<100	<100	----	
<b>EP080: BTEXN</b>									
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	----	
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2	----	
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	----	
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	----	
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	----	
^ Total Xylenes	----	2	µg/L	<2	<2	<2	<2	----	
^ Sum of BTEX	----	1	µg/L	<1	<1	<1	<1	----	
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	----	
<b>EP080S: TPH(V)/BTEX Surrogates</b>									
1,2-Dichloroethane-D4	17060-07-0	2	%	96.1	97.6	94.8	96.0	----	
Toluene-D8	2037-26-5	2	%	96.9	98.1	97.2	96.1	----	
4-Bromofluorobenzene	460-00-4	2	%	97.7	99.0	95.4	95.8	----	





## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW04_2	SW04_3	SW05	SW06_1	SW08
Client sampling date / time				22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1808893-012	ES1808893-013	ES1808893-014	ES1808893-015	ES1808893-018	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	3.6	3.8	5.5	6.2	4.5	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	0.001	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	0.006	<0.005	0.011	0.007	0.011	
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	----	0.37	0.14	0.52	0.35	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	----	1.0	0.4	0.4	0.4	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L	----	1.4	0.5	0.9	0.8	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L	----	0.02	0.04	0.05	0.06	
<b>EP080/071: Total Petroleum Hydrocarbons</b>									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	<50	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW04_2	SW04_3	SW05	SW06_1	SW08	
Client sampling date / time				22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00		
Compound	CAS Number	LOR	Unit	ES1808893-012	ES1808893-013	ES1808893-014	ES1808893-015	ES1808893-018		
				Result	Result	Result	Result	Result		
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>										
^ >C10 - C40 Fraction (sum)				----	100	µg/L	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)				----	100	µg/L	<100	<100	<100	<100
<b>EP080: BTEXN</b>										
Benzene				71-43-2	1	µg/L	<1	<1	<1	<1
Toluene				108-88-3	2	µg/L	<2	<2	<2	<2
Ethylbenzene				100-41-4	2	µg/L	<2	<2	<2	<2
meta- & para-Xylene				108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2
ortho-Xylene				95-47-6	2	µg/L	<2	<2	<2	<2
^ Total Xylenes				----	2	µg/L	<2	<2	<2	<2
^ Sum of BTEX				----	1	µg/L	<1	<1	<1	<1
Naphthalene				91-20-3	5	µg/L	<5	<5	<5	<5
<b>EP080S: TPH(V)/BTEX Surrogates</b>										
1,2-Dichloroethane-D4				17060-07-0	2	%	101	95.6	102	98.2
Toluene-D8				2037-26-5	2	%	97.9	96.0	97.1	97.9
4-Bromofluorobenzene				460-00-4	2	%	94.6	93.7	93.7	97.7



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW09_1	QC2	SW07_1	SW07_2	SW07_3
Client sampling date / time				22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1808893-019	ES1808893-020	ES1808893-023	ES1808893-024	ES1808893-025	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	<5	----	<5	<5	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	5.8	5.7	----	4.9	4.4	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	0.006	0.005	0.009	0.012	0.008	
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	0.53	0.53	0.26	0.41	0.46	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	0.5	0.4	0.4	0.3	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L	1.0	1.0	0.7	0.8	0.8	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L	0.06	0.07	0.06	0.05	0.04	
<b>EP080/071: Total Petroleum Hydrocarbons</b>									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	<50	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW09_1	QC2	SW07_1	SW07_2	SW07_3		
Client sampling date / time				22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00			
Compound	CAS Number	LOR	Unit	ES1808893-019	ES1808893-020	ES1808893-023	ES1808893-024	ES1808893-025			
				Result	Result	Result	Result	Result			
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>											
^ >C10 - C40 Fraction (sum)				----	100	µg/L	<100	<100	<100	<100	
^ >C10 - C16 Fraction minus Naphthalene (F2)				----	100	µg/L	<100	<100	<100	<100	
<b>EP080: BTEXN</b>											
Benzene				71-43-2	1	µg/L	<1	<1	<1	<1	
Toluene				108-88-3	2	µg/L	<2	<2	<2	<2	
Ethylbenzene				100-41-4	2	µg/L	<2	<2	<2	<2	
meta- & para-Xylene				108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	
ortho-Xylene				95-47-6	2	µg/L	<2	<2	<2	<2	
^ Total Xylenes				----	2	µg/L	<2	<2	<2	<2	
^ Sum of BTEX				----	1	µg/L	<1	<1	<1	<1	
Naphthalene				91-20-3	5	µg/L	<5	<5	<5	<5	
<b>EP080S: TPH(V)/BTEX Surrogates</b>											
1,2-Dichloroethane-D4				17060-07-0	2	%	96.1	92.5	95.1	97.7	105
Toluene-D8				2037-26-5	2	%	95.2	92.1	95.9	96.9	111
4-Bromofluorobenzene				460-00-4	2	%	90.0	90.3	93.4	94.0	102



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW12_1	SW13_1	SW14	SW15_1	SW16
Client sampling date / time				22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1808893-026	ES1808893-029	ES1808893-032	ES1808893-033	ES1808893-036	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	26	<5	33	<5	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	11.2	51.5	9.9	44.3	6.5	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	0.002	0.007	0.003	0.006	<0.001	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	0.006	0.018	0.006	0.009	0.006	
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	0.67	0.08	0.71	0.12	0.27	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.6	1.1	0.6	1.8	0.5	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L	1.3	1.2	1.3	1.9	0.8	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L	0.06	0.10	0.04	0.19	0.06	
<b>EP080/071: Total Petroleum Hydrocarbons</b>									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	<50	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW12_1	SW13_1	SW14	SW15_1	SW16		
Client sampling date / time				22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00			
Compound	CAS Number	LOR	Unit	ES1808893-026	ES1808893-029	ES1808893-032	ES1808893-033	ES1808893-036			
				Result	Result	Result	Result	Result			
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>											
^ >C10 - C40 Fraction (sum)				----	100	µg/L	<100	<100	<100	<100	
^ >C10 - C16 Fraction minus Naphthalene (F2)				----	100	µg/L	<100	<100	<100	<100	
<b>EP080: BTEXN</b>											
Benzene				71-43-2	1	µg/L	<1	<1	<1	<1	
Toluene				108-88-3	2	µg/L	<2	<2	<2	<2	
Ethylbenzene				100-41-4	2	µg/L	<2	<2	<2	<2	
meta- & para-Xylene				108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	
ortho-Xylene				95-47-6	2	µg/L	<2	<2	<2	<2	
^ Total Xylenes				----	2	µg/L	<2	<2	<2	<2	
^ Sum of BTEX				----	1	µg/L	<1	<1	<1	<1	
Naphthalene				91-20-3	5	µg/L	<5	<5	<5	<5	
<b>EP080S: TPH(V)/BTEX Surrogates</b>											
1,2-Dichloroethane-D4				17060-07-0	2	%	96.7	108	103	105	106
Toluene-D8				2037-26-5	2	%	96.5	109	102	104	106
4-Bromofluorobenzene				460-00-4	2	%	93.2	102	97.8	100	99.9



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW17	SW10_1	SW10_2	SW10_3	SW11_1
Client sampling date / time				22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	
Compound	CAS Number	LOR	Unit	ES1808893-037	ES1808893-038	ES1808893-039	ES1808893-040	ES1808893-041	
				Result	Result	Result	Result	Result	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>									
Suspended Solids (SS)	----	5	mg/L	<5	8	<5	<5	128	
<b>EA045: Turbidity</b>									
Turbidity	----	0.1	NTU	5.9	6.9	6.6	6.8	38.9	
<b>EG020F: Dissolved Metals by ICP-MS</b>									
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Copper	7440-50-8	0.001	mg/L	<0.001	0.002	0.003	0.002	0.006	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Zinc	7440-66-6	0.005	mg/L	0.006	0.010	0.010	0.017	0.015	
<b>EG035F: Dissolved Mercury by FIMS</b>									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>									
Nitrite + Nitrate as N	----	0.01	mg/L	0.27	0.22	0.24	0.22	2.06	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.6	1.5	1.4	1.5	2.6	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>									
^ Total Nitrogen as N	----	0.1	mg/L	0.9	1.7	1.6	1.7	4.7	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>									
Total Phosphorus as P	----	0.01	mg/L	0.06	0.21	0.21	0.24	0.10	
<b>EP080/071: Total Petroleum Hydrocarbons</b>									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20	
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	<50	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW17	SW10_1	SW10_2	SW10_3	SW11_1	
Client sampling date / time				22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00	22-Mar-2018 00:00		
Compound	CAS Number	LOR	Unit	ES1808893-037	ES1808893-038	ES1808893-039	ES1808893-040	ES1808893-041		
				Result	Result	Result	Result	Result		
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>										
^ >C10 - C40 Fraction (sum)				----	100	µg/L	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)				----	100	µg/L	<100	<100	<100	<100
<b>EP080: BTEXN</b>										
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1	<1	
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2	<2	<2	
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2	<2	
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2	<2	
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2	<2	
^ Total Xylenes				----	2	µg/L	<2	<2	<2	<2
^ Sum of BTEX				----	1	µg/L	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5	<5	
<b>EP080S: TPH(V)/BTEX Surrogates</b>										
1,2-Dichloroethane-D4	17060-07-0	2	%	96.8	98.6	96.4	95.1	96.9		
Toluene-D8	2037-26-5	2	%	96.7	105	99.1	101	101		
4-Bromofluorobenzene	460-00-4	2	%	94.2	105	102	99.9	102		





## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID			SW11_2	SW11_3	----	----	----
Client sampling date / time				22-Mar-2018 00:00	22-Mar-2018 00:00	----	----	----	----	----	
Compound	CAS Number	LOR	Unit	ES1808893-042	ES1808893-043	-----	-----	-----	-----	-----	
				Result	Result	----	----	----	----	----	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>											
Suspended Solids (SS)	----	5	mg/L	50	40	----	----	----	----	----	
<b>EA045: Turbidity</b>											
Turbidity	----	0.1	NTU	38.4	37.1	----	----	----	----	----	
<b>EG020F: Dissolved Metals by ICP-MS</b>											
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	----	----	----	----	----	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----	----	----	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----	----	----	
Copper	7440-50-8	0.001	mg/L	0.006	0.007	----	----	----	----	----	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	----	----	----	----	----	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----	----	----	
Zinc	7440-66-6	0.005	mg/L	0.013	0.018	----	----	----	----	----	
<b>EG035F: Dissolved Mercury by FIMS</b>											
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----	----	----	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>											
Nitrite + Nitrate as N	----	0.01	mg/L	2.16	2.18	----	----	----	----	----	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>											
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.0	1.2	----	----	----	----	----	
<b>EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser</b>											
^ Total Nitrogen as N	----	0.1	mg/L	4.2	3.4	----	----	----	----	----	
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>											
Total Phosphorus as P	----	0.01	mg/L	0.11	0.09	----	----	----	----	----	
<b>EP080/071: Total Petroleum Hydrocarbons</b>											
C6 - C9 Fraction	----	20	µg/L	<20	<20	----	----	----	----	----	
C10 - C14 Fraction	----	50	µg/L	<50	<50	----	----	----	----	----	
C15 - C28 Fraction	----	100	µg/L	<100	<100	----	----	----	----	----	
C29 - C36 Fraction	----	50	µg/L	<50	<50	----	----	----	----	----	
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	----	----	----	----	----	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>											
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	----	----	----	----	----	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	----	----	----	----	----	
>C10 - C16 Fraction	----	100	µg/L	<100	<100	----	----	----	----	----	
>C16 - C34 Fraction	----	100	µg/L	<100	<100	----	----	----	----	----	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	----	----	----	----	----	



## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW11_2	SW11_3	----	----	----
Client sampling date / time				22-Mar-2018 00:00	22-Mar-2018 00:00	----	----	----	
Compound	CAS Number	LOR	Unit	ES1808893-042	ES1808893-043	-----	-----	-----	
				Result	Result	----	----	----	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued</b>									
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	----	----	----	
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	----	----	----	
<b>EP080: BTEXN</b>									
Benzene	71-43-2	1	µg/L	<1	<1	----	----	----	
Toluene	108-88-3	2	µg/L	<2	<2	----	----	----	
Ethylbenzene	100-41-4	2	µg/L	<2	<2	----	----	----	
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	----	----	----	
ortho-Xylene	95-47-6	2	µg/L	<2	<2	----	----	----	
^ Total Xylenes	----	2	µg/L	<2	<2	----	----	----	
^ Sum of BTEX	----	1	µg/L	<1	<1	----	----	----	
Naphthalene	91-20-3	5	µg/L	<5	<5	----	----	----	
<b>EP080S: TPH(V)/BTEX Surrogates</b>									
1,2-Dichloroethane-D4	17060-07-0	2	%	99.1	96.7	----	----	----	
Toluene-D8	2037-26-5	2	%	103	104	----	----	----	
4-Bromofluorobenzene	460-00-4	2	%	103	100	----	----	----	



## Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
<b>EP080S: TPH(V)/BTEX Surrogates</b>			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

## QUALITY CONTROL REPORT

<b>Work Order</b>	<b>: ES1808893</b>	<b>Page</b>	<b>: 1 of 10</b>
<b>Client</b>	<b>: GHD PTY LTD</b>	<b>Laboratory</b>	<b>: Environmental Division Sydney</b>
<b>Contact</b>	<b>: MS JANE CURRAN</b>	<b>Contact</b>	<b>: Customer Services ES</b>
<b>Address</b>	<b>: 1/51 GRAHAM STREET NOWRA NSW, AUSTRALIA 2541</b>	<b>Address</b>	<b>: 277-289 Woodpark Road Smithfield NSW Australia 2164</b>
<b>Telephone</b>	<b>: +61 02 9239 7100</b>	<b>Telephone</b>	<b>: +61-2-8784 8555</b>
<b>Project</b>	<b>: 2316261</b>	<b>Date Samples Received</b>	<b>: 26-Mar-2018</b>
<b>Order number</b>	<b>: 2316261</b>	<b>Date Analysis Commenced</b>	<b>: 27-Mar-2018</b>
<b>C-O-C number</b>	<b>: ----</b>	<b>Issue Date</b>	<b>: 04-Apr-2018</b>
<b>Sampler</b>	<b>: Iain Lindley, Rob Webb</b>		
<b>Site</b>	<b>: ----</b>		
<b>Quote number</b>	<b>: SY/603/17 A</b>		
<b>No. of samples received</b>	<b>: 43</b>		
<b>No. of samples analysed</b>	<b>: 27</b>		



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

This Quality Control Report contains the following information:

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dian Dao		Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW



## General Comments

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

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

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

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

## Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 1532270)</b>									
ES1808670-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	10500	8780	17.9	0% - 20%
ES1808893-014	SW05	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.00	No Limit
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 1532271)</b>									
ES1808893-033	SW15_1	EA025H: Suspended Solids (SS)	----	5	mg/L	33	36	7.30	No Limit
ES1808894-006	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	96	102	5.31	0% - 20%
<b>EA045: Turbidity (QC Lot: 1525574)</b>									
ES1808804-001	Anonymous	EA045: Turbidity	----	0.1	NTU	0.9	0.9	0.00	No Limit
ES1808893-012	SW04_2	EA045: Turbidity	----	0.1	NTU	3.6	3.7	0.00	0% - 20%
<b>EA045: Turbidity (QC Lot: 1525575)</b>									
ES1808893-032	SW14	EA045: Turbidity	----	0.1	NTU	9.9	9.9	0.00	0% - 20%
ES1808893-043	SW11_3	EA045: Turbidity	----	0.1	NTU	37.1	37.3	0.538	0% - 20%
<b>EG020F: Dissolved Metals by ICP-MS (QC Lot: 1525807)</b>									
ES1808620-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.070	0.067	5.13	0% - 50%
ES1808893-012	SW04_2	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit



Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
<b>EG020F: Dissolved Metals by ICP-MS (QC Lot: 1525807) - continued</b>									
ES1808893-012	SW04_2	EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.006	0.007	0.00	No Limit
<b>EG020F: Dissolved Metals by ICP-MS (QC Lot: 1525809)</b>									
ES1808893-026	SW12_1	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.006	0.006	0.00	No Limit
ES1808893-042	SW11_2	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.006	0.006	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.013	0.016	22.4	No Limit
<b>EG035F: Dissolved Mercury by FIMS (QC Lot: 1525808)</b>									
ES1808620-002	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
ES1808893-014	SW05	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
<b>EG035F: Dissolved Mercury by FIMS (QC Lot: 1525810)</b>									
ES1808893-036	SW16	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 1531087)</b>									
ES1808893-001	SW01_1	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.13	0.14	0.00	0% - 50%
ES1808893-019	SW09_1	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.53	0.53	0.00	0% - 20%
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 1531088)</b>									
ES1808990-005	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	7.76	7.72	0.502	0% - 20%
ES1808990-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.02	0.02	0.00	No Limit
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 1531083)</b>									
ES1808893-001	SW01_1	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	0.3	0.00	No Limit
ES1808893-020	QC2	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.5	0.4	0.00	No Limit
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 1531085)</b>									
ES1808990-012	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	0.2	0.00	No Limit
ES1808893-038	SW10_1	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.5	1.3	13.2	0% - 50%
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 1531084)</b>									
ES1808893-001	SW01_1	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.03	0.03	0.00	No Limit
ES1808893-020	QC2	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.07	0.07	0.00	No Limit
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 1531086)</b>									



Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)	
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 1531086) - continued</b>										
ES1808990-011	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit	
ES1808893-038	SW10_1	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.21	0.20	7.95	0% - 20%	
<b>EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1531068)</b>										
ES1808893-001	SW01_1	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.00	No Limit	
ES1808893-020	QC2	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.00	No Limit	
<b>EP080/071: Total Petroleum Hydrocarbons (QC Lot: 1531070)</b>										
ES1808884-004	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	70	70	0.00	No Limit	
ES1808884-005	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	90	90	0.00	No Limit	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 1531068)</b>										
ES1808893-001	SW01_1	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.00	No Limit	
ES1808893-020	QC2	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.00	No Limit	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 1531070)</b>										
ES1808884-004	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	200	200	0.00	0% - 50%	
ES1808884-005	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	280	280	0.00	0% - 50%	
<b>EP080: BTEXN (QC Lot: 1531068)</b>										
ES1808893-001	SW01_1	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit	
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit	
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit	
		EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	0.00	No Limit	
			106-42-3							
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit	
ES1808893-020	QC2	EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.00	No Limit	
		EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit	
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit	
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit	
		EP080: meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	0.00	No Limit	
			106-42-3							
ES1808893-020	QC2	EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit	
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.00	No Limit	
<b>EP080: BTEXN (QC Lot: 1531070)</b>										
ES1808884-004	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit	
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit	
		EP080: Ethylbenzene	100-41-4	2	µg/L	6	6	0.00	No Limit	
		EP080: meta- & para-Xylene	108-38-3	2	µg/L	23	22	0.00	0% - 50%	
			106-42-3							
		EP080: ortho-Xylene	95-47-6	2	µg/L	3	3	0.00	No Limit	
ES1808884-005	Anonymous	EP080: Naphthalene	91-20-3	5	µg/L	161	155	3.73	0% - 20%	
		EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit	
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit	

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 Project : 2316261



Sub-Matrix: **WATER**

				<i>Laboratory Duplicate (DUP) Report</i>					
<i>Laboratory sample ID</i>	<i>Client sample ID</i>	<i>Method: Compound</i>	<i>CAS Number</i>	<i>LOR</i>	<i>Unit</i>	<i>Original Result</i>	<i>Duplicate Result</i>	<i>RPD (%)</i>	<i>Recovery Limits (%)</i>
<b>EP080: BTEXN (QC Lot: 1531070) - continued</b>									
ES1808884-005	Anonymous	EP080: Ethylbenzene	100-41-4	2	µg/L	8	8	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	29	29	0.00	0% - 50%
		EP080: ortho-Xylene	95-47-6	2	µg/L	4	4	0.00	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	188	190	0.998	0% - 20%





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

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

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 1532270)</b>									
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	99.3	83	129	
				<5	1000 mg/L	90.6	82	110	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 1532271)</b>									
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	91.0	83	129	
				<5	1000 mg/L	86.6	82	110	
<b>EA045: Turbidity (QCLot: 1525574)</b>									
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	100	91	105	
<b>EA045: Turbidity (QCLot: 1525575)</b>									
EA045: Turbidity	----	0.1	NTU	<0.1	40 NTU	100	91	105	
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 1525807)</b>									
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	101	85	114	
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	99.1	84	110	
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	97.6	85	111	
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	97.1	81	111	
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.6	83	111	
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	95.9	82	112	
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	96.4	81	117	
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 1525809)</b>									
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	99.9	85	114	
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	100	84	110	
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	95.4	85	111	
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	98.4	81	111	
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	97.0	83	111	
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	97.7	82	112	
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	101	81	117	
<b>EG035F: Dissolved Mercury by FIMS (QCLot: 1525808)</b>									
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	101	83	105	
<b>EG035F: Dissolved Mercury by FIMS (QCLot: 1525810)</b>									
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	99.3	83	105	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1531087)</b>									
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	98.0	91	113	
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1531088)</b>									
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	98.7	91	113	



Sub-Matrix: WATER

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report				
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	High
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1531083)</b>									
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	88.9	69	101	
				<0.1	1 mg/L	88.9	70	118	
				<0.1	5 mg/L	94.0	74	118	
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1531085)</b>									
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	92.5	69	101	
				<0.1	1 mg/L	94.5	70	118	
				<0.1	5 mg/L	94.3	74	118	
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1531084)</b>									
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	92.2	71	101	
				<0.01	0.442 mg/L	91.5	72	108	
				<0.01	1 mg/L	98.2	78	118	
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1531086)</b>									
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	91.8	71	101	
				<0.01	0.442 mg/L	88.4	72	108	
				<0.01	1 mg/L	98.2	78	118	
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1523530)</b>									
EP071: C10 - C14 Fraction	----	50	µg/L	<50	2000 µg/L	82.0	76	116	
EP071: C15 - C28 Fraction	----	100	µg/L	<100	3000 µg/L	106	83	109	
EP071: C29 - C36 Fraction	----	50	µg/L	<50	2000 µg/L	82.3	75	113	
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1523531)</b>									
EP071-SV: C10 - C14 Fraction	----	50	µg/L	<50	2000 µg/L	92.7	71	119	
EP071-SV: C15 - C28 Fraction	----	100	µg/L	<100	3000 µg/L	86.3	81	111	
EP071-SV: C29 - C36 Fraction	----	50	µg/L	<50	2000 µg/L	85.9	70	116	
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1523552)</b>									
EP071: C10 - C14 Fraction	----	50	µg/L	<50	2000 µg/L	80.6	76	116	
EP071: C15 - C28 Fraction	----	100	µg/L	<100	3000 µg/L	98.5	83	109	
EP071: C29 - C36 Fraction	----	50	µg/L	<50	2000 µg/L	88.1	75	113	
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1531068)</b>									
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	77.9	75	127	
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1531070)</b>									
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	91.8	75	127	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1523530)</b>									
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	2500 µg/L	82.4	76	114	
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	3500 µg/L	94.7	81	111	
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	1500 µg/L	93.6	77	119	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1523531)</b>									
EP071-SV: >C10 - C16 Fraction	----	100	µg/L	<100	2500 µg/L	88.0	75	113	
EP071-SV: >C16 - C34 Fraction	----	100	µg/L	<100	3500 µg/L	98.4	81	113	



Sub-Matrix: WATER

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
						LCS	Low	High
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1523531) - continued</b>								
EP071-SV: >C34 - C40 Fraction	----	100	µg/L	<100	1500 µg/L	95.7	65	123
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1523552)</b>								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	2500 µg/L	104	76	114
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	3500 µg/L	89.5	81	111
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	1500 µg/L	87.6	77	119
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1531068)</b>								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	78.0	75	127
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1531070)</b>								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	92.3	75	127
<b>EP080: BTEXN (QCLot: 1531068)</b>								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	90.4	70	122
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	87.8	69	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	86.7	70	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	84.1	69	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	85.7	72	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	88.3	70	120
<b>EP080: BTEXN (QCLot: 1531070)</b>								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	97.0	70	122
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	95.2	69	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	94.0	70	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	90.5	69	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	90.7	72	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	96.7	70	120

### Matrix Spike (MS) Report

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

Sub-Matrix: WATER

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery(%)	Recovery Limits (%)	
					MS	Low	High
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 1525807)</b>							
ES1808620-002	Anonymous	EG020A-F: Arsenic	7440-38-2	1 mg/L	92.6	70	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	96.3	70	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	98.0	70	130
		EG020A-F: Copper	7440-50-8	1 mg/L	95.4	70	130



Sub-Matrix: WATER

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 1525807) - continued</b>							
ES1808620-002	Anonymous	EG020A-F: Lead	7439-92-1	1 mg/L	95.8	70	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	95.5	70	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	95.2	70	130
<b>EG020F: Dissolved Metals by ICP-MS (QCLot: 1525809)</b>							
ES1808893-029	SW13_1	EG020A-F: Arsenic	7440-38-2	1 mg/L	100	70	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	103	70	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	101	70	130
		EG020A-F: Copper	7440-50-8	1 mg/L	103	70	130
		EG020A-F: Lead	7439-92-1	1 mg/L	98.8	70	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	104	70	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	103	70	130
<b>EG035F: Dissolved Mercury by FIMS (QCLot: 1525808)</b>							
ES1808620-001	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	83.4	70	130
<b>EG035F: Dissolved Mercury by FIMS (QCLot: 1525810)</b>							
ES1808893-033	SW15_1	EG035F: Mercury	7439-97-6	0.01 mg/L	84.0	70	130
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1531087)</b>							
ES1808893-001	SW01_1	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	98.4	70	130
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 1531088)</b>							
ES1808990-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	98.6	70	130
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1531083)</b>							
ES1808893-004	SW02_1	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	91.1	70	130
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 1531085)</b>							
ES1808893-039	SW10_2	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	87.2	70	130
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1531084)</b>							
ES1808893-004	SW02_1	EK067G: Total Phosphorus as P	----	1 mg/L	96.3	70	130
<b>EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 1531086)</b>							
ES1808893-039	SW10_2	EK067G: Total Phosphorus as P	----	1 mg/L	96.9	70	130
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1531068)</b>							
ES1808893-001	SW01_1	EP080: C6 - C9 Fraction	----	325 µg/L	88.0	70	130
<b>EP080/071: Total Petroleum Hydrocarbons (QCLot: 1531070)</b>							
ES1808884-004	Anonymous	EP080: C6 - C9 Fraction	----	325 µg/L	82.1	70	130
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1531068)</b>							
ES1808893-001	SW01_1	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	88.3	70	130
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1531070)</b>							

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 Work Order : ES1808893  
 Client : GHD PTY LTD  
 Project : 2316261



Sub-Matrix: WATER

				Matrix Spike (MS) Report				
				Spike	Spike Recovery(%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 1531070) - continued</b>								
ES1808884-004	Anonymous	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	80.2	70	130	
<b>EP080: BTEXN (QCLot: 1531068)</b>								
ES1808893-001	SW01_1	EP080: Benzene	71-43-2	25 µg/L	93.7	70	130	
		EP080: Toluene	108-88-3	25 µg/L	92.3	70	130	
		EP080: Ethylbenzene	100-41-4	25 µg/L	94.6	70	130	
		EP080: meta- & para-Xylene	108-38-3	25 µg/L	95.6	70	130	
			106-42-3					
		EP080: ortho-Xylene	95-47-6	25 µg/L	92.0	70	130	
	EP080: Naphthalene	91-20-3	25 µg/L	89.1	70	130		
<b>EP080: BTEXN (QCLot: 1531070)</b>								
ES1808884-004	Anonymous	EP080: Benzene	71-43-2	25 µg/L	92.4	70	130	
		EP080: Toluene	108-88-3	25 µg/L	87.0	70	130	
		EP080: Ethylbenzene	100-41-4	25 µg/L	86.8	70	130	
		EP080: meta- & para-Xylene	108-38-3	25 µg/L	80.0	70	130	
			106-42-3					
		EP080: ortho-Xylene	95-47-6	25 µg/L	85.8	70	130	
	EP080: Naphthalene	91-20-3	25 µg/L	# Not Determined	70	130		

## QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES1808893	Page	: 1 of 13
Client	: GHD PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: MS JANE CURRAN	Telephone	: +61-2-8784 8555
Project	: 2316261	Date Samples Received	: 26-Mar-2018
Site	: ----	Issue Date	: 04-Apr-2018
Sampler	: Iain Lindley, Rob Webb	No. of samples received	: 43
Order number	: 2316261	No. of samples analysed	: 27

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

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

### Summary of Outliers

#### Outliers : Quality Control Samples

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

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- Matrix Spike outliers exist - please see following pages for full details.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

#### Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

#### Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers exist - please see following pages for full details.



**Outliers : Quality Control Samples**

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
<b>Matrix Spike (MS) Recoveries</b>							
EP080: BTEXN	ES1808884--004	Anonymous	Naphthalene	91-20-3	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

**Outliers : Analysis Holding Time Compliance**

Matrix: **WATER**

Method	Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
<b>EA045: Turbidity</b>							
<b>Clear Plastic Bottle - Natural</b>							
SW01_1, SW03_1, SW04_1, SW04_3, SW06_1, SW09_1, SW07_2, SW12_1, SW14, SW16, SW10_1, SW10_3, SW11_2,	SW02_1, QC1, SW04_2, SW05, SW08, QC2, SW07_3, SW13_1, SW15_1, SW17, SW10_2, SW11_1, SW11_3	----	----	----	27-Mar-2018	24-Mar-2018	3
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>							
<b>Clear Plastic Bottle - Natural</b>							
SW07_3		----	----	----	28-Mar-2018	24-Mar-2018	4
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>							
<b>Clear Plastic Bottle - Natural</b>							
SW07_3		28-Mar-2018	23-Mar-2018	5	----	----	----
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>							
<b>Clear Plastic Bottle - Natural</b>							
SW07_3		28-Mar-2018	24-Mar-2018	4	----	----	----

**Outliers : Frequency of Quality Control Samples**

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
<b>Laboratory Duplicates (DUP)</b>					
TRH - Semivolatle Fraction	0	26	0.00	10.00	NEPM 2013 B3 & ALS QC Standard



Matrix: **WATER**

Quality Control Sample Type Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
<b>Laboratory Duplicates (DUP) - Continued</b>					
TRH - Semivolatile Fractions Only	0	1	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
<b>Matrix Spikes (MS)</b>					
TRH - Semivolatile Fraction	0	26	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fractions Only	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

### Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EA025: Total Suspended Solids dried at 104 ± 2°C</b>								
<b>Clear Plastic Bottle - Natural (EA025H)</b>								
SW01_1, SW03_1, SW04_1, SW04_3, SW06_1, SW09_1, SW07_2, SW12_1, SW14, SW16, SW10_1, SW10_3, SW11_2	SW02_1, QC1, SW04_2, SW05, SW08, QC2, SW07_3, SW13_1, SW15_1, SW17, SW10_2, SW11_1, SW11_3	22-Mar-2018	----	----	----	29-Mar-2018	29-Mar-2018	✓





Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
<b>EA045: Turbidity</b>							
<b>Clear Plastic Bottle - Natural (EA045)</b>							
SW01_1, SW03_1, SW04_1, SW04_3, SW06_1, SW09_1, SW07_2, SW12_1, SW14, SW16, SW10_1, SW10_3, SW11_2, SW02_1, QC1, SW04_2, SW05, SW08, QC2, SW07_3, SW13_1, SW15_1, SW17, SW10_2, SW11_1, SW11_3	22-Mar-2018	----	----	----	27-Mar-2018	24-Mar-2018	*
<b>EG020F: Dissolved Metals by ICP-MS</b>							
<b>Clear Plastic Bottle - Nitric Acid; Filtered (EG020A-F)</b>							
SW01_1, SW03_1, SW04_1, SW04_3, SW06_1, SW09_1, SW07_1, SW07_3, SW13_1, SW15_1, SW17, SW10_2, SW11_1, SW11_3, SW02_1, QC1, SW04_2, SW05, SW08, QC2, SW07_2, SW12_1, SW14, SW16, SW10_1, SW10_3, SW11_2	22-Mar-2018	----	----	----	27-Mar-2018	18-Sep-2018	✓



Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EG035F: Dissolved Mercury by FIMS</b>								
<b>Clear Plastic Bottle - Nitric Acid; Filtered (EG035F)</b>								
SW01_1, SW03_1, SW04_1, SW04_3, SW06_1, SW09_1, SW07_1, SW07_3, SW13_1, SW15_1, SW17, SW10_2, SW11_1, SW11_3	SW02_1, QC1, SW04_2, SW05, SW08, QC2, SW07_2, SW12_1, SW14, SW16, SW10_1, SW10_3, SW11_2	22-Mar-2018	----	----	----	28-Mar-2018	19-Apr-2018	✓
<b>EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser</b>								
<b>Clear Plastic Bottle - Natural (EK059G)</b>								
SW07_3		22-Mar-2018	----	----	----	28-Mar-2018	24-Mar-2018	*
<b>Clear Plastic Bottle - Sulfuric Acid (EK059G)</b>								
SW01_1, SW03_1, SW04_1, SW05, SW08, QC2, SW07_2, SW13_1, SW15_1, SW17, SW10_2, SW11_1, SW11_3	SW02_1, QC1, SW04_3, SW06_1, SW09_1, SW07_1, SW12_1, SW14, SW16, SW10_1, SW10_3, SW11_2	22-Mar-2018	----	----	----	28-Mar-2018	19-Apr-2018	✓



Matrix: **WATER** Evaluation: ✘ = Holding time breach ; ✔ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
<b>EK061G: Total Kjeldahl Nitrogen By Discrete Analyser</b>							
<b>Clear Plastic Bottle - Natural (EK061G)</b> SW07_3	22-Mar-2018	28-Mar-2018	23-Mar-2018	✘	28-Mar-2018	25-Apr-2018	✔
<b>Clear Plastic Bottle - Sulfuric Acid (EK061G)</b> SW01_1, SW03_1, SW04_1, SW05, SW08, QC2, SW07_2, SW13_1, SW15_1, SW17, SW10_2, SW11_1, SW11_3 SW02_1, QC1, SW04_3, SW06_1, SW09_1, SW07_1, SW12_1, SW14, SW16, SW10_1, SW10_3, SW11_2	22-Mar-2018	28-Mar-2018	19-Apr-2018	✔	28-Mar-2018	19-Apr-2018	✔
<b>EK067G: Total Phosphorus as P by Discrete Analyser</b>							
<b>Clear Plastic Bottle - Natural (EK067G)</b> SW07_3	22-Mar-2018	28-Mar-2018	24-Mar-2018	✘	28-Mar-2018	25-Apr-2018	✔
<b>Clear Plastic Bottle - Sulfuric Acid (EK067G)</b> SW01_1, SW03_1, SW04_1, SW05, SW08, QC2, SW07_2, SW13_1, SW15_1, SW17, SW10_2, SW11_1, SW11_3 SW02_1, QC1, SW04_3, SW06_1, SW09_1, SW07_1, SW12_1, SW14, SW16, SW10_1, SW10_3, SW11_2	22-Mar-2018	28-Mar-2018	19-Apr-2018	✔	28-Mar-2018	19-Apr-2018	✔



Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EP080/071: Total Petroleum Hydrocarbons</b>								
<b>Amber Glass Bottle - Unpreserved (EP071)</b>								
SW01_1, SW03_1, SW04_1, SW04_3, SW06_1, SW09_1, SW07_1, SW07_3, SW13_1, SW15_1, SW17, SW10_2, SW11_1, SW11_3	SW02_1, QC1, SW04_2, SW05, SW08, QC2, SW07_2, SW12_1, SW14, SW16, SW10_1, SW10_3, SW11_2,	22-Mar-2018	28-Mar-2018	29-Mar-2018	✓	30-Mar-2018	07-May-2018	✓
<b>Amber VOC Vial - Sulfuric Acid (EP080)</b>								
SW01_1, SW03_1, SW04_2, SW05, SW08, QC2, SW07_2, SW12_1, SW14, SW16, SW10_1, SW10_3, SW11_2,	SW02_1, QC1, SW04_3, SW06_1, SW09_1, SW07_1, SW07_3, SW13_1, SW15_1, SW17, SW10_2, SW11_1, SW11_3	22-Mar-2018	29-Mar-2018	05-Apr-2018	✓	29-Mar-2018	05-Apr-2018	✓



Matrix: **WATER** Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions</b>								
<b>Amber Glass Bottle - Unpreserved (EP071)</b>								
SW01_1, SW03_1, SW04_1, SW04_3, SW06_1, SW09_1, SW07_1, SW07_3, SW13_1, SW15_1, SW17, SW10_2, SW11_1, SW11_3	SW02_1, QC1, SW04_2, SW05, SW08, QC2, SW07_2, SW12_1, SW14, SW16, SW10_1, SW10_3, SW11_2,	22-Mar-2018	28-Mar-2018	29-Mar-2018	✓	30-Mar-2018	07-May-2018	✓
<b>Amber VOC Vial - Sulfuric Acid (EP080)</b>								
SW01_1, SW03_1, SW04_2, SW05, SW08, QC2, SW07_2, SW12_1, SW14, SW16, SW10_1, SW10_3, SW11_2,	SW02_1, QC1, SW04_3, SW06_1, SW09_1, SW07_1, SW07_3, SW13_1, SW15_1, SW17, SW10_2, SW11_1, SW11_3	22-Mar-2018	29-Mar-2018	05-Apr-2018	✓	29-Mar-2018	05-Apr-2018	✓



Matrix: **WATER**

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
<b>EP080: BTEXN</b>								
<b>Amber VOC Vial - Sulfuric Acid (EP080)</b>								
SW01_1, SW03_1, SW04_2, SW05, SW08, QC2, SW07_2, SW12_1, SW14, SW16, SW10_1, SW10_3, SW11_2,	SW02_1, QC1, SW04_3, SW06_1, SW09_1, SW07_1, SW07_3, SW13_1, SW15_1, SW17, SW10_2, SW11_1, SW11_3	22-Mar-2018	29-Mar-2018	05-Apr-2018	✓	29-Mar-2018	05-Apr-2018	✓



## Quality Control Parameter Frequency Compliance

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

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

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaural	Actual	Expected	Evaluation	
<b>Analytical Methods</b>							
<b>Laboratory Duplicates (DUP)</b>							
Dissolved Mercury by FIMS	EG035F	3	29	10.34	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	4	32	12.50	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	4	30	13.33	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	4	40	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	4	31	12.90	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	4	32	12.50	10.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	26	0.00	10.00	✖	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fractions Only	EP071-SV	0	1	0.00	10.00	✖	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	4	40	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	4	39	10.26	10.00	✔	NEPM 2013 B3 & ALS QC Standard
<b>Laboratory Control Samples (LCS)</b>							
Dissolved Mercury by FIMS	EG035F	2	29	6.90	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	32	6.25	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	30	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	4	40	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	6	31	19.35	15.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	6	32	18.75	15.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	26	7.69	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fractions Only	EP071-SV	1	1	100.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	40	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	39	5.13	5.00	✔	NEPM 2013 B3 & ALS QC Standard
<b>Method Blanks (MB)</b>							
Dissolved Mercury by FIMS	EG035F	2	29	6.90	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	32	6.25	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	30	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	40	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	31	6.45	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	32	6.25	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	26	7.69	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fractions Only	EP071-SV	1	1	100.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	40	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Turbidity	EA045	2	39	5.13	5.00	✔	NEPM 2013 B3 & ALS QC Standard
<b>Matrix Spikes (MS)</b>							
Dissolved Mercury by FIMS	EG035F	2	29	6.90	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	32	6.25	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	30	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Matrix: **WATER**

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

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Regular	Actual	Expected	Evaluation	
<b>Matrix Spikes (MS) - Continued</b>							
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	31	6.45	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	32	6.25	5.00	✔	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	26	0.00	5.00	✖	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fractions Only	EP071-SV	0	1	0.00	5.00	✖	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	40	5.00	5.00	✔	NEPM 2013 B3 & ALS QC Standard





## Brief Method Summaries


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

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of 'non-filterable' residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (2013) Schedule B(3)
Turbidity	EA045	WATER	In house: Referenced to APHA 2130 B. This method is compliant with NEPM (2013) Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl <sub>2</sub> )(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl <sub>2</sub> which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Nitrite and Nitrate as N (NO <sub>x</sub> ) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO <sub>3</sub> - F. Combined oxidised Nitrogen (NO <sub>2</sub> +NO <sub>3</sub> ) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
Total Nitrogen as N (TKN + No <sub>x</sub> ) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO <sub>3</sub> -. This method is compliant with NEPM (2013) Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al (1976), Zhang et al (2006). This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM (2013) Schedule B(3)
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015A The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)
TRH - Semivolatile Fractions Only	EP071-SV	WATER	In house: Referenced to USEPA SW 846 - 8015A The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with NEPM (2013) Schedule B(3)



<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260B Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)
<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM (2013) Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510B 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (2013) Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for sparging.

4.418



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CLIENT: GHD	<b>TURNAROUND REQUIREMENTS :</b> <input type="checkbox"/> Standard TAT (List due date): (Standard TAT may be longer for some tests e.g. Ultra Trace Organics) <input type="checkbox"/> Non Standard or urgent TAT (List due date):	<b>FOR LABORATORY USE ONLY (Circle)</b> Grandly Seal/Label? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Specific Storage Conditions? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Refrigerate upon Temperature of Receipt? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Other Comments:
OFFICE: Nowra/Wollongong	<b>ALQS QUOTE NO.:</b> SY/603/17A <b>COC SEQUENCE NUMBER (Circle)</b> coc: <span style="border: 1px solid black; padding: 2px;">1</span> 2 3 4 5 6 7 OF: 1 2 3 <span style="border: 1px solid black; padding: 2px;">4</span> 5 6 7	
PROJECT: FBB PC		
ORDER NUMBER: 2316261		
PROJECT MANAGER: Jane Curran	CONTACT PH: 0400450005 or 0244244960	
SAMPLER: Iain Lindley, Rob Webb	SAMPLER MOBILE:	RELINQUISHED BY:
COC emailed to ALS? ( YES / NO)	EDD FORMAT (or default):	RECEIVED BY:
Email Reports to jane.curran@ghd.com, stefan.charteris@ghd.com, ghdlabreports@ghd.com	DATE/TIME:	DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed): jane.curran@ghd.com	23/03/2018 12pm	26/3/18 08:00

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

LAB ID		SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE <i>codes below</i>	(refer to)	TOTAL CONTAINERS	W-02 (Dissolved Metals)	EA045 (Turbidity)	TPH (TRH C6-C40)	NT-11 (Total Nitrogen, Total Phosphorus)	EA025H (Suspended Solids)	Additional Information	
1	SW01_1		22/03/2018	w	P, N, AG, V, H		6	X	X	X	X	X	Metals are field filtered for all metal samples	
2	SW01_2		22/03/2018	w			6						dispose	
3	SW01_3		22/03/2018	w			6						dispose	
4	SW02_1		22/03/2018	w			6	x	x	x	x	x		
5	SW02_2		22/03/2018	w			6						dispose	
6	SW02_3		22/03/2018	w			6						dispose	
7	SW03_1		22/03/2018	w			6	x	x	x	x	x		
8	QC1		22/03/2018	w			6	x	x	x	x	x		
9	SW03_2		22/03/2018	w			6						dispose	
10	SW03_3		22/03/2018	w			6						dispose	
11	SW04_1	1	22/03/2018	w			6	x	x	x	x	x	66-9 - not required on SW04-1 as	
12	SW04_2	3	22/03/2018	w			6	x	x	x	x	x	per Jane, 26-3-18	
<b>TOTAL</b>							72	no NT-11 for SW04_2 as no purple bottles as per Jane						

**Water Container Codes:** P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic  
 V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;  
 Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

26-3-18 *AK*

ES1808893



# CHAIN OF CUSTODY

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CLIENT: GHD	TURNAROUND REQUIREMENTS : <input type="checkbox"/> Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)	
OFFICE: New South Wales	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) <input type="checkbox"/> Non Standard or urgent TAT (List due date):		Custody Seal intact? Yes No	
PROJECT: FBB PC	ALS QUOTE NO.: SY/603/17A	COC SEQUENCE NUMBER (Circle)		Freeze / freeze packs present upon receipt? Yes No
ORDER NUMBER: 2316261		COC: 1 2 3 4 5 6 7		Random sample lab used on Receipt? Yes No
PROJECT MANAGER: Jane Curran	CONTACT PH: 0400450005	OF: 1 2 3 4 5 6 7		Others comment:
SAMPLER: Iain Lindley, Rob Webb	SAMPLER MOBILE:	RELINQUISHED BY:	RECEIVED BY: J. Curran	RELINQUISHED BY:
COC emailed to ALS? ( YES / NO)	EDD FORMAT (or default):	DATE/TIME:	DATE/TIME: 26/3/18 08:00	RECEIVED BY:
Email Reports to (will default to PM if no other addresses are listed): jane.curran@ghd.com, stefan.charteris@ghd.com				DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed): jane.curran@ghd.com				

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

LAB ID	SAMPLE DETAILS		MATRIX	CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).					Additional Information
	SAMPLE ID	DATE / TIME		TYPE & PRESERVATIVE codes below	(refer to)	TOTAL CONTAINERS	W-02 (Dissolved Metals)	EA045 (Turbidity)	TPH (TRH C6-C40)	NT-11 (Total Nitrogen, Total Phosphorus)	
13	SW04_3	22/03/2018	w		6	x	x	x	x	x	
14	SW05	22/03/2018	w		6	x	x	x	x	x	
15	SW06_1	22/03/2018	w		6	x	x	x	x	x	
16	SW06_2	22/03/2018	w		6						dispose
17	SW06_3	22/03/2018	w		6						dispose
18	SW08	22/03/2018	w		6	x	x	x	x	x	
19	SW09_1	22/03/2018	w		6	x	x	x	x	x	
20	QC2	22/03/2018	w		6	x	x	x	x	x	
21	SW09_2	22/03/2018	w		6						dispose
22	SW09_3	22/03/2018	w		6						dispose
23	SW07_1	22/03/2018	w		6	x	x	x	x	x	-no analysis from green as bottle not received, as per
TOTAL					66						

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic  
 V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;  
 Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.  
 Jane, 26.3.18



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CLIENT: GHD		TURNAROUND REQUIREMENTS : <input type="checkbox"/> Standard TAT (List due date):				FOR LABORATORY USE ONLY (Circle) Custody sealed? Yes No N/A Freezer / frozen / broken / present / upon receipt? Yes No N/A Refrigeration temperature on Receipt: C Other comment:			
OFFICE: <i>Warralunga</i>		(Standard TAT may be longer for some tests e.g., Ultra Trace Organics) <input type="checkbox"/> Non Standard or urgent TAT (List due date):							
PROJECT: FBB PC		ALS QUOTE NO.: SY/60317A		COC SEQUENCE NUMBER (Circle)					
ORDER NUMBER: 2316261				COC: 1 2 3 4 5 6 7					
PROJECT MANAGER: Jane Curran		CONTACT PH: 0400450005		OF: 1 2 3 4 5 6 7					
SAMPLER: Iain Lindley, Rob Webb		SAMPLER MOBILE:		RELINQUISHED BY:		RECEIVED BY: <i>J Curraly</i>		RELINQUISHED BY:	
COC emailed to ALS? ( YES / NO)		EDD FORMAT (or default):		DATE/TIME:		DATE/TIME: <i>26/3/18 08:00</i>		RECEIVED BY:	
Email Reports to (will default to PM if no other addresses are listed): jane.curran@ghd.com, stefan.charteris@ghd.com								DATE/TIME:	
Email Invoice to (will default to PM if no other addresses are listed): jane.curran@ghd.com									

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS			CONTAINER INFORMATION			ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).					Additional Information
	MATRIX	DATE / TIME	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	W-02 (Dissolved Metals)	EA045 (Turbidity)	TPH (TRH C6-C40)	NT-11 (Total Nitrogen, Total Phosphorus)	EA025H (Suspended Solids)			
24	SW07_2	22/03/2018	w	6	X	X	X	X	X			
25	SW07_3	22/03/2018	w	6	X	X	X	X	X			
26	SW12_1	22/03/2018	w	6	X	X	X	X	X			
27	SW12_2	22/03/2018	w	6								dispose
28	SW12_3	22/03/2018	w	6								dispose
29	SW13_1	22/03/2018	w	6	X	X	X	X	X			
30	SW13_2	22/03/2018	w	6								dispose
31	SW13_3	22/03/2018	w	6								dispose
32	SW14	22/03/2018	w	6	X	X	X	X	X			
33	SW15_1	22/03/2018	w	6	X	X	X	X	X			
34	SW15_2	22/03/2018	w	6								dispose
<b>TOTAL</b>				66								

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic  
 V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;  
 Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.



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CLIENT: GHD		TURNAROUND REQUIREMENTS: <input type="checkbox"/> Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle): Custody seal intact? Yes No N/A Freeze / freeze pack preserved? Yes No N/A Example? Yes No N/A Refrigerate sample / Temperature protected? Yes No N/A Other comment:	
OFFICE: <i>Wollongong</i>		(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) <input type="checkbox"/> Non Standard or urgent TAT (List due date):			
PROJECT: FBB PC		ALS QUOTE NO.: SY/603/17A		COC SEQUENCE NUMBER (Circle)	
ORDER NUMBER: 2316261				COC: 1 2 3 4 5 6 7	
PROJECT MANAGER: Jane Curran		CONTACT PH: 0400450005		OF: 1 2 3 4 5 6 7	
SAMPLER: Iain Lindley, Rob Webb		SAMPLER MOBILE:		RECEIVED BY: <i>J. Acrely</i>	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):		RECEIVED BY:	
Email Reports to (will default to PM if no other addresses are listed): jane.curran@ghd.com, stefan.charteris@ghd.com		DATE/TIME:		DATE/TIME: <i>26/3/18 08:00</i>	
Email Invoice to (will default to PM if no other addresses are listed): jane.curran@ghd.com				RECEIVED BY:	

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS (MATRIX: SOLIDS/WATER/AW)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).					Additional Information	
	LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE codes below (refer to)	TOTAL CONTAINERS	W-02 (Dissolved Metals)	EA045 (Turbidity)	TPH (TRH C6-C40)	NT-11 (Total Nitrogen, Total Phosphorus)		EA025H (Suspended Solids)
	<i>35</i>	SW15_3	22/03/2018	w		6						dispose
	<i>36</i>	SW16	22/03/2018	w		6	X	X	X	X	X	
	<i>37</i>	SW17	22/03/2018	w		6	X	X	X	X	X	
	<i>38</i>	SW10_1	22/03/2018	w		6	X	X	X	X	X	
	<i>39</i>	SW10_2	22/03/2018	w		6	X	X	X	X	X	
	<i>40</i>	SW10_3	22/03/2018	w		6	X	X	X	X	X	
	<i>41</i>	SW11_1	22/03/2018	w		6	X	X	X	X	X	
	<i>42</i>	SW11_2	22/03/2018	w		6	X	X	X	X	X	
	<i>43</i>	SW11_3	22/03/2018	w		6	X	X	X	X	X	
<b>TOTAL</b>						54						dispose

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic  
 V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;  
 Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

## Attachment E– Calibration Certificates



AirMet Scientific P/L  
7-11 Ceylon Street  
Nunawading  
Victoria 3131, Australia

# Calibration Certificate

This document hereby certifies that this instrument detailed has been calibrated to the parameters listed below.

Certificate Print Date: 9 February, 2018  
Calibration Date: 8 February, 2018  
Next Calibration Due: 8 August, 2018

Call ID: 00214690  
Arrow Job Code: 227977

Customer:	GHD Pty Ltd	Type:	Water Meter
Model:	WATERMETER	Serial No:	13J100151
Description:	YSI Pro Plus Water Quality Meter		

Sensor	Serial No	Standard Solutions	Certified	Solution # (Bottle #)	Instrument Reading	Units
Dissolved Oxygen		0%		1612235007	0	%
EC		2.76 ms/cm		312321	2.76	ms/cm
Ph		pH 7.0		307926	7.02	pH
Ph		pH 4.0		307927	4.00	pH
Redox		231.58mV		305536/305538	231.6	mV
Temp		21.1°C		MultiTherm	21.1	°C

Completed by: Wentao Zhang	Signed: 
----------------------------	--

Australian Standard Alarm Levels



**Attachment E - YSI Calibration Record  
Surface Water Event 3**

**CALIBRATION RECORD**

Instrument YSI Pro Plus  
Serial Number 13J00151

<b>Date</b>	12/03/2018	22/03/2018
<b>Time</b>	12:45:00 PM	8:00:00 AM
<b>Staff</b>	JC, RW	RW, IL
<b>Conductivity (S. Conductance)</b>		
Temperature	24	23.1
Solution	2707	2655
Pre-calibration	2773	2517
Post-calibration	2664	2655
<b>pH 7</b>		
Temperature	24.2	23.2
Solution	7.01	7.01
Pre-calibration	7.07	7
Post-calibration	7.01	7
<b>pH 4</b>		
Temperature	24.2	23.2
Solution	4.01	4.01
Pre-calibration	4.00	4.00
Post-calibration	3.99	4.00
<b>ORP</b>		
Temperature	24.4	23.1
Solution	231.2	232.1
Pre-calibration	232	230.4
Post-calibration	231.2	234.6
<b>DO (air)</b>		
Temperature	21.1	18.7
Solution	100%	100%
Pre-calibration	100%	97.90%
Post-calibration	9.01 mg/L	9.37 mg/L
<b>Signed</b>	RW* JC*	RW* IL*

## Attachment F - Laboratory Quality Assurance and Quality Control Results

### Field Program surface water

Intra-laboratory duplicate samples were collected and analysed as part of the surface water sampling program and the relative percentage differences (RPD) were calculated. Intra-laboratory measures the reproducibility of measurements under a given set of conditions. The precision of the data is assessed by calculating the Relative Percent Difference (RPD) between duplicate sample pairs.

$$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where  $C_o$  = Analyte concentration of the original sample  
 $C_d$  = Analyte concentration of the duplicate sample

GHD adopts a nominal acceptance criterion of 30% RPD for field duplicates and splits for inorganics and a nominal acceptance criterion of 50% RPD for field duplicates and splits for organics, however it is noted that this may not always be achieved, particularly at low analyte concentrations. Surface water QA/QC results are presented as Table B2, Attachment B.

One discrepancy in GHD's adopted criterion for RPDs calculated for the intra laboratory duplicate pairs for the analytes tested were detected. Sample QC1 had a RPD of 59% for Total (Oxidised) Nitrogen as N, which is just over the recommended maximum of 50%. The other Nitrogen RPD results were within the recommended RPD. The exceedance would likely have minimal impact on the reporting of results.

### Laboratory Program

The NATA accredited laboratories utilised for this assessment (ALS) undertook their own quality assurance and quality control procedures for sample analysis. GHD has reviewed the internal laboratory control data provided within the laboratory reports, which are attached in the laboratory reports as Attachment E.

The laboratory provided the following summary of QA/QC Compliance Assessment:

- No method blank outliers occur
- No duplicate outliers occur
- No laboratory control outliers occur
- Matrix spike outliers exist: Matrix spike recovery could not be determined in a Naphthalene sample due to a background level greater than or equal to four times spike level.
- For all regular sample matrices, no surrogate recovery outliers occur
- Analysis holding time outliers exist for turbidity samples due to courier not delivering to ALS on time. SW07\_3 is outside holding time for Total Nitrogen and Total Phosphorus.

All samples were noted to be correctly preserved.

### Summary of Quality Assurance / Quality Control Results

Matrix Spike (MS) was not determined in Naphthalene because background levels were greater than or equal to four times the spike level. This QA/QC results indicates sample matrix interference may be occurring for turbidity and would therefore impact on reported results. Sample SW07\_3 was also outside holding time for nutrient analysis. One RPD exceedance was detected although is not expected to greatly affect reporting of Total Nitrogen.

Remaining QA/QC results show that the samples collected have met the appropriate standards and therefore, the data was considered to be valid and of sufficient quality to meet the data quality objectives for the assessment.

Attachment G - Field sheets



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18  
 PROJECT NAME: FBB PC TIME: 10:30 am  
 CLIENT: RMS SAMPLING OFFICERS: R.W I.L  
 SITE: SW01

COORDINATES/GPS (If Applicable)  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION under bridge, in fast flowing area

ENVIRONMENTAL OBSERVATIONS  
 WEATHER cloudy, break in rain  
 VEGETATION no change / see photo  
 SLOPE "  
 EROSION "  
 OTHER recently stopped raining / clear, fast flowing, no sediment

### FIELD MEASUREMENTS

SAMPLE	SW01-1 10:35	SW01-2 10:45	SW01-3 10:55
TEMPERATURE (°C)	16.4	16.4	16.4
CONDUCTIVITY (uS/cm)	<del>1031</del> 1031	1032	1033
pH	6.78	6.56	6.55
DO (ppm)	9.12	9.07	9.08
REDOX (mV)	119.2	115.8	115.1

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available)  
 CROSS SECTION WIDTH (m)  
 DEPTH (m)  
 OTHER

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW01-1	18 6	varied	no	
SW01-2	6	" "	—	
SW01-3	6	" "		

FIELD SUPERVISOR J.L. CHECKED (SIGN & DATE) I.L. 22/3/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18  
 PROJECT NAME: FBB PC TIME: 11:00am  
 CLIENT: RMS SAMPLING OFFICERS: I.L. R.W.  
 SITE: SW02  
 COORDINATES/GPS (If Applicable) \_\_\_\_\_  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION Next to weir

## ENVIRONMENTAL OBSERVATIONS

WEATHER cloudy  
 VEGETATION no change - see photo  
 SLOPE " "  
 EROSION " "  
 OTHER slight brown, no sediment, fast flowing

## FIELD MEASUREMENTS

SAMPLE	SW02-1 11:05	SW02-2 11:15	SW02-3 11:28
TEMPERATURE (°C)	16.9	16.9	17.0
CONDUCTIVITY (uS/cm)	106.1	106.3	106.4
pH	6.67	6.62	6.62
DO (ppm)	8.87	8.85	8.93
REDOX (mV)	134.2	125.8	120.8

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) \_\_\_\_\_  
 CROSS SECTION WIDTH (m) \_\_\_\_\_  
 DEPTH (m) \_\_\_\_\_  
 OTHER \_\_\_\_\_

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW02-1	6	various	No	-
SW02-2	6			
SW02-3	6			

FIELD SUPERVISOR IL CHECKED (SIGN & DATE) IL 22/3/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18  
 PROJECT NAME: FBB PC TIME: 11:30  
 CLIENT: RMS SAMPLING OFFICERS: L.L. R.W.  
 SITE: SW03

COORDINATES/GPS (If Applicable) -

SAMPLING METHOD (ie grab, bucket) Grab

DETAILED SAMPLE LOCATION DESCRIPTION private property, back creek  
 next to track & tall long grass, on creek

### ENVIRONMENTAL OBSERVATIONS

WEATHER partly cloudy  
 VEGETATION no change / see photo  
 SLOPE "  
 EROSION "  
 OTHER med-high level, not bank full, fast flowing, slight brown

### FIELD MEASUREMENTS

SAMPLE	SW03-1 11:30	SW03-2 11:40	SW03-3 11:50	QCI
TEMPERATURE (°C)	17.0	17.0	17.0	
CONDUCTIVITY (uS/cm)	112.1	112.0	112.2	
pH	6.63	6.59	6.58	
DO (ppm)	8.75	8.72	8.74	
REDOX (mV)	140.8	130.3	124.6	

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available)

CROSS SECTION WIDTH (m)

DEPTH (m)

OTHER

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW03-1	6	Vaning	QCI	-
SW03-2	6			
SW03-3	6			

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) R.W. 22/3/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18

PROJECT NAME: FBB PC TIME: 1:00

CLIENT: RMS SAMPLING OFFICERS: JL. Rh

SITE: SW04

COORDINATES/GPS (If Applicable) -

SAMPLING METHOD (ie grab, bucket) Grab

DETAILED SAMPLE LOCATION DESCRIPTION Bed & Breakfast

### ENVIRONMENTAL OBSERVATIONS

WEATHER Sunny & partly cloudy

VEGETATION no change / see photo

SLOPE u u

EROSION u u

OTHER low flow, trace sediment, slight brown to clear organic odour, insect on water

### FIELD MEASUREMENTS

SAMPLE	SW04-1 1pm	SW04-2 1:10	SW04-3 1:20
TEMPERATURE (°C)	17.4	17.4	17.4
CONDUCTIVITY (uS/cm)	103.3	103.4	103.8
pH	6.70	6.64	6.62
DO (ppm)	7.64	7.75	7.76
REDOX (mV)	122.4	121.5	122.0

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available)

CROSS SECTION WIDTH (m)

DEPTH (m)

OTHER

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW04-1	6	Varing	NO.	-
SW04-2	6			
SW04-3	6			

FIELD SUPERVISOR I.C. CHECKED (SIGN & DATE) 22/3/18





# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18  
 PROJECT NAME: FBB PC TIME: 12:00  
 CLIENT: RMS SAMPLING OFFICERS: I.L. RW  
 SITE: SW05  
 COORDINATES/GPS (If Applicable): -  
 SAMPLING METHOD (ie grab, bucket): Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION: under bridge.

## ENVIRONMENTAL OBSERVATIONS

WEATHER: partly cloudy  
 VEGETATION: no change / see photo  
 SLOPE: u  
 EROSION: u  
 OTHER: low flow, hi med sediment, some debris

## FIELD MEASUREMENTS

SAMPLE	SW05		
17 TEMPERATURE (°C)	17.0		
112 CONDUCTIVITY (uS/cm)	112.2		
6.6 pH	<del>6.66</del> 6.66		
8.73 DO (ppm)	7.9		
130 REDOX (mV)	138.4		

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available):  
 CROSS SECTION WIDTH (m):  
 DEPTH (m):  
 OTHER:

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW05	6	Various	No	

FIELD SUPERVISOR: I.L. CHECKED (SIGN & DATE): I.L. 22/3



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18

PROJECT NAME: FBB PC TIME: 12:35

CLIENT: RMS SAMPLING OFFICERS: LL, R.W

SITE: SW06

COORDINATES/GPS (If Applicable) -

SAMPLING METHOD (ie grab, bucket) Grab

DETAILED SAMPLE LOCATION DESCRIPTION Fulton Keyen site, near bridge.

### ENVIRONMENTAL OBSERVATIONS

WEATHER Sunny + partly cloudy

VEGETATION no change / see photo

SLOPE u

EROSION u

OTHER med strength flow, some sediment, slight brown

### FIELD MEASUREMENTS

SAMPLE	SW06-1 12:35	SW06-2 12:45	SW06-3 12:55
TEMPERATURE (°C)	18.1	18.1	18.1
CONDUCTIVITY (uS/cm)	158.7	158.2	158.2
pH	6.67	6.58	6.57
DO (ppm)	7.10	6.92	7.09
REDOX (mV)	128.4	126.8	126.4

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available)

CROSS SECTION WIDTH (m)

DEPTH (m)

OTHER

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW06-1	6	Vanua	NO	-
SW06-2	6			
SW06-3	6			

FIELD SUPERVISOR JL. CHECKED (SIGN & DATE) JL 22/3/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18  
 PROJECT NAME: FBB PC TIME: 1:20  
 CLIENT: RMS SAMPLING OFFICERS: L.L. R.L.W.  
 SITE: SW07

COORDINATES/GPS (If Applicable)  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION Bowling Club

ENVIRONMENTAL OBSERVATIONS  
 WEATHER Sunny & partly cloudy  
 VEGETATION no change (see photo)  
 SLOPE u  
 EROSION u  
 OTHER med flow, no sediment, clear water

## FIELD MEASUREMENTS

SAMPLE	SW07-1 1:20	SW07-2 1:50	SW07-3 1:40
TEMPERATURE (°C)	17.7	17.7	17.7
CONDUCTIVITY (uS/cm)	128.0	127.4	128.9
pH	6.58	6.55	6.54
DO (ppm)	8.03	7.45	7.40
REDOX (mV)	124.3	125.8	123.8

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available)  
 CROSS SECTION WIDTH (m)  
 DEPTH (m)  
 OTHER

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW07-1	6	UVIw	no	
SW07-2	6		u	
SW07-2	6		u	

FIELD SUPERVISOR L.L. CHECKED (SIGN & DATE) L.L. 22/3/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18  
 PROJECT NAME: FBB PC TIME: 2:35  
 CLIENT: RMS SAMPLING OFFICERS: J.C. RW  
 SITE: SW08  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION Stoney Creek, over fence

## ENVIRONMENTAL OBSERVATIONS

WEATHER Cloudy  
 VEGETATION more vegetation  
 SLOPE NO CHANGE - SEE PHOTOS  
 EROSION "  
 OTHER higher flow, faster flow rate, clear water

## FIELD MEASUREMENTS

SAMPLE	SW08 2:35		
TEMPERATURE (°C)	18.1		
CONDUCTIVITY (uS/cm)	150.6		
pH	6.80		
DO (ppm)	8.47		
REDOX (mV)	96.8		

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) \_\_\_\_\_  
 CROSS SECTION WIDTH (m) \_\_\_\_\_  
 DEPTH (m) \_\_\_\_\_  
 OTHER \_\_\_\_\_

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW08	6	None	No	-

FIELD SUPERVISOR J.C. CHECKED (SIGN & DATE) J.C. 22/3/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18  
 PROJECT NAME: FBB PC TIME: 12:10  
 CLIENT: RMS SAMPLING OFFICERS: I.L. R.W.  
 SITE: SW09  
 COORDINATES/GPS (If Applicable) —  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION New Fulton Mogan, through long grass/shrub

## ENVIRONMENTAL OBSERVATIONS

WEATHER Sunny & partly cloudy  
 VEGETATION  no change / see photo  
 SLOPE   
 EROSION   
 OTHER Just flow, no sediment, some rubbish in water (around tree)

## FIELD MEASUREMENTS

QC2

SAMPLE	SW09-1 12:10	SW09-2 12:20	SW09-3 12:30
TEMPERATURE (°C)	18	18	18
CONDUCTIVITY (uS/cm)	158.1	158.2	158.3
pH	6.56	6.52	6.52
DO (ppm)	8.21	8.15	8.15
REDOX (mV)	128.8	120.6	199.4

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available)

CROSS SECTION WIDTH (m) \_\_\_\_\_

DEPTH (m) \_\_\_\_\_

OTHER \_\_\_\_\_

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW09-1	6	None	Yes <del>QC2</del>	—
SW09-2	6	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		—
SW09-3	6	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>		—

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) I.L. 22/3/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18  
 PROJECT NAME: FBB PC TIME: 2:40  
 CLIENT: RMS SAMPLING OFFICERS: I.L R.W.  
 SITE: SW10  
 COORDINATES/GPS (If Applicable) —  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION next to fence

ENVIRONMENTAL OBSERVATIONS  
 WEATHER Cloudy  
 VEGETATION same no change / see photo  
 SLOPE n ''  
 EROSION v h  
 OTHER n clear, medium flow, some rubble forming broad some bubbles forming around edges

FIELD MEASUREMENTS

SAMPLE	SW10-1 2:40	2:50	3:00
TEMPERATURE (°C)	20.7	20.7	20.7
CONDUCTIVITY (uS/cm)	214.1	214.2	214.0
pH	6.68	6.66	6.66
DO (ppm)	6.87	6.87	6.89
REDOX (mV)	118.4	118.5	118.6

HYDROLOGICAL DATA  
 FLOW MEASUREMENT (or stream height if rating table available)  
 CROSS SECTION WIDTH (m)  
 DEPTH (m)  
 OTHER

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW10-1	6	Varing	no	—
SW10-2	6			
SW10-3	6			

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) I.L. 22/3/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18  
 PROJECT NAME: FBB PC TIME: 2:00pm  
 CLIENT: RMS SAMPLING OFFICERS:  
 SITE: SWH  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION Old creek ON CORNER.

**ENVIRONMENTAL OBSERVATIONS**  
 WEATHER Sunny + Cloudy  
 VEGETATION # Paddock DIRECTLY ABOVE SAMPLE LOCATION HAS GRASS / TOPSOIL  
 SLOPE REMOVED. DARK, ORGANIC SOIL MATERIAL HAS BEEN STOCKPILED CLOSE TO  
 EROSION CREEK. MAY BE REASON FOR CLOUDY BROWN WATER.  
 OTHER low-no flow cloudy + brown water, vegetation mid creek

**FIELD MEASUREMENTS**

SAMPLE	SWH.1 2pm	SWH.2 2:00pm	SWH.3 2:30pm
TEMPERATURE (°C)	21.4	21.3	21.4
CONDUCTIVITY (uS/cm)	389.9	395.1	396.1
pH	6.56	6.57	6.53
DO (ppm)	3.15	3.82	3.85
REDOX (mV)	120.0	113.3	100.7

**HYDROLOGICAL DATA**  
 FLOW MEASUREMENT (or stream height if rating table available)  
 CROSS SECTION WIDTH (m)  
 DEPTH (m)  
 OTHER

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SWH-1	6	Vanig	NO	-
SWH-2	6			
SWH-3	6			

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) I.L. 22/3/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18

PROJECT NAME: FBB PC TIME: 3:05pm

CLIENT: RMS SAMPLING OFFICERS: I.L.

SITE: SW12

COORDINATES/GPS (If Applicable) -

SAMPLING METHOD (ie grab, bucket) Grab

DETAILED SAMPLE LOCATION DESCRIPTION Through fence, next to rocks

### ENVIRONMENTAL OBSERVATIONS

WEATHER cloudy

VEGETATION no change / see photo

SLOPE u

EROSION u

OTHER Heavy, clear, very slight greasy look, low flow

### FIELD MEASUREMENTS

SAMPLE	SW12-1 3:05	SW12-2 3:15	SW12-3 3:25
TEMPERATURE (°C)	19.2	19.2	19.2
CONDUCTIVITY (uS/cm)	415.8	416.2	416.5
pH	7.00	7.03	7.04
DO (ppm)	5.32	5.26	5.33
REDOX (mV)	106.7	99.1	95.3

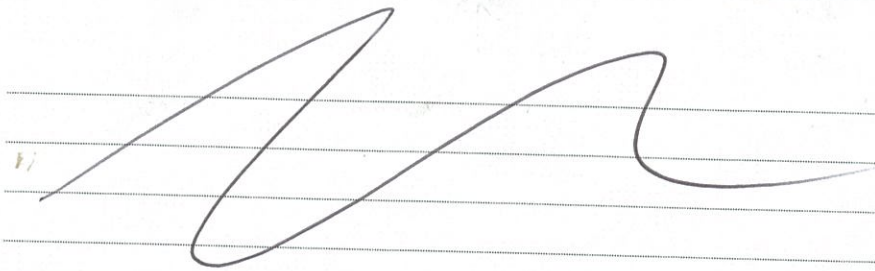
### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available)

CROSS SECTION WIDTH (m)

DEPTH (m)

OTHER



SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW12-1	6	None	no	
SW12-2	6			
SW12-3	6			

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) I.L. 22/3/18





# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18

PROJECT NAME: FBB PC TIME:

CLIENT: RMS SAMPLING OFFICERS: R.W. IL

SITE: SW13

COORDINATES/GPS (If Applicable)

SAMPLING METHOD (ie grab, bucket) Grab

DETAILED SAMPLE LOCATION DESCRIPTION Under bridge near retirement village

### ENVIRONMENTAL OBSERVATIONS

WEATHER

VEGETATION no change / see photo

SLOPE "

EROSION "

OTHER slight brown, medium flow, no sediment

### FIELD MEASUREMENTS

SAMPLE	SW13-1	SW13-2	SW13-3
TEMPERATURE (°C)	19.4	19.4	19.4
CONDUCTIVITY (uS/cm)	463.7	464.6	466.9
pH	7.11	7.12	7.15
DO (ppm)	7.26	7.33	7.36
REDOX (mV)	78.5	71.3	70.3

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available)

CROSS SECTION WIDTH (m)

DEPTH (m)

OTHER

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW13-1	6	None	No	-
SW13-2	6			
SW13-3	6			

FIELD SUPERVISOR IL

CHECKED (SIGN & DATE) IL 22/3/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18  
 PROJECT NAME: FBB PC TIME: 16:08  
 CLIENT: RMS SAMPLING OFFICERS: IC, RW  
 SITE: SW14  
 COORDINATES/GPS (If Applicable) —  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION TOP SIDE OF BYPASS

## ENVIRONMENTAL OBSERVATIONS

WEATHER CLOUDY  
 VEGETATION NO CHANGE - SEE PHOTOS  
 SLOPE " "  
 EROSION " "  
 OTHER PALE BROWN CLOUDY WATER, LOW FLOW

## FIELD MEASUREMENTS

21.2  
380  
6.97  
6.00  
70

SAMPLE	16:10		
TEMPERATURE (°C)	22.0		
CONDUCTIVITY (uS/cm)	<del>349.4</del> 349.7		
pH	6.84		
DO (ppm)	5.48		
REDOX (mV)	84.3		

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) \_\_\_\_\_  
 CROSS SECTION WIDTH (m) \_\_\_\_\_  
 DEPTH (m) \_\_\_\_\_  
 OTHER \_\_\_\_\_

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW14	6	Varing	NO	—

FIELD SUPERVISOR IC CHECKED (SIGN & DATE) IC 24/3/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18  
 PROJECT NAME: FBB PC TIME: 3:40  
 CLIENT: RMS SAMPLING OFFICERS: I.L. R.W.  
 SITE: SWIS  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION Retirement village

### ENVIRONMENTAL OBSERVATIONS

WEATHER Cloudy  
 VEGETATION No change / see photo  
 SLOPE n  
 EROSION n  
 OTHER low flow, cloudy, vegetation in bed, slight brown

### FIELD MEASUREMENTS

SAMPLE	SWIS-1 3:40	SWIS-2 3:50	SWIS-2 4:00
TEMPERATURE (°C)	21.2	21.2	21.2
CONDUCTIVITY (uS/cm)	382.7	381.5	380.9
pH	6.97	6.96	6.98
DO (ppm)	6.01	6.03	5.98
REDOX (mV)	73.0	69.9	67.9

### HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) \_\_\_\_\_  
 CROSS SECTION WIDTH (m) \_\_\_\_\_  
 DEPTH (m) \_\_\_\_\_  
 OTHER \_\_\_\_\_

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SWIS-1	6	Vanig	No	-
SWIS-2	6			
SWIS-3	6			

FIELD SUPERVISOR I.L. CHECKED (SIGN & DATE) I.L. 22/3/18



# SURFACE WATER SAMPLING RECORD

PROJECT NO. 23-16261-01 DATE: 22/3/18  
 PROJECT NAME: FBB PC TIME: 16:45  
 CLIENT: RMS SAMPLING OFFICERS: IL, RW  
 SITE: SW16  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION UNDER BRIDGE

## ENVIRONMENTAL OBSERVATIONS

WEATHER CLOUDY  
 VEGETATION NO CHANGE - SEE PHOTOS.  
 SLOPE " "  
 EROSION " "  
 OTHER CLEAR WATER, FLOWING, NO SEDIMENT

## FIELD MEASUREMENTS

SAMPLE	16:45		
TEMPERATURE (°C)	18.9		
CONDUCTIVITY (uS/cm)	236.1		
pH	6.61		
DO (ppm)	7.52		
REDOX (mV)	113.0		

## HYDROLOGICAL DATA

FLOW MEASUREMENT (or stream height if rating table available) \_\_\_\_\_  
 CROSS SECTION WIDTH (m) \_\_\_\_\_  
 DEPTH (m) \_\_\_\_\_  
 OTHER \_\_\_\_\_

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW16	6	Vanig	no	-

FIELD SUPERVISOR I.C. CHECKED (SIGN & DATE) 21/3/18



# SURFACE WATER SAMPLING RECORD

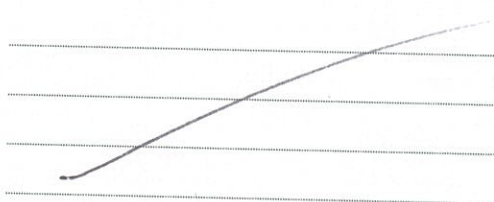
PROJECT NO. 23-16261-01 DATE: 22/3/18  
 PROJECT NAME: FBB PC TIME: 16:45  
 CLIENT: RMS SAMPLING OFFICERS: JL, RW  
 SITE: SW17  
 COORDINATES/GPS (If Applicable) -  
 SAMPLING METHOD (ie grab, bucket) Grab  
 DETAILED SAMPLE LOCATION DESCRIPTION UNDER BRIDGE

**ENVIRONMENTAL OBSERVATIONS**  
 WEATHER CLOUDY - SAME AS SW16  
 VEGETATION " "  
 SLOPE " "  
 EROSION " "  
 OTHER " "

**FIELD MEASUREMENTS**

SAMPLE	1819 16:45		
TEMPERATURE (°C)	18.9		
CONDUCTIVITY (uS/cm)	237.0		
pH	6.72		
DO (ppm)	7.46		
REDOX (mV)	105.3		

**HYDROLOGICAL DATA**  
 FLOW MEASUREMENT (or stream height if rating table available)  
 CROSS SECTION WIDTH (m)  
 DEPTH (m)  
 OTHER



SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
SW17	6	None	NO	-

FIELD SUPERVISOR JL. CHECKED (SIGN & DATE) JL. 22/3/18

## **Appendix C Air Quality Monitoring Results**

			DMG1	DMG2	DMG3	DMG4	DMG5	DMG6	DMG Control 1	DMG Control 2	DMG 7	
Month	Date Started	Date Finished	455 Princes Hwy, Broughton Village	25 Austral Park Rd, Broughton	200 Princes Hwy, Berry	104 North St, Berry	5 Kangaroo Valley Rd, Berry	PENWOOD 215A Princes Highway Jaspers Brush	89 Toolijooa Rd, Toolijooa	170B Woodhill Mountain Rd, Berry	Smart/Austral Park Crushing Area	Monthly Project Average
October 2017	10/09/17	10/10/17	Monitoring Concluded			0.5	Monitoring Concluded			0.6	Monitoring Concluded	0.6
November 2017	10/10/17	10/11/17	Monitoring Concluded			Missing gauge	Monitoring Concluded			Missing gauge	Monitoring Concluded	N/A
December 2017	10/11/17	11/12/17	Monitoring Concluded			1.3	Monitoring Concluded			0.8	Monitoring Concluded	1.1
January 2018	11/12/17	11/01/18	Monitoring Concluded			Missing gauge	Monitoring Concluded			1.5	Monitoring Concluded	1.5
February 2018	11/01/18	12/02/18	Monitoring Concluded			0.3	Monitoring Concluded			0.6	Monitoring Concluded	0.5

## **Appendix D Ecological Monitoring Results**



# Aquatic Monitoring Annual Report 2017

FOXGROUND AND BERRY BYPASS



MARCH 2018



## Document Verification



Project Title:

Foxground and Berry Bypass

Project Number: 5837

Project File Name: Aquatic Monitoring Annual Report 2017

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
Draft	07/03/18	Elijah Elias Aleksi Atkin Freya Gordon	Zeina Jokadar	Freya Gordon
Final	13/3/18	Natascha Arens	Minor edits	Natascha Arens

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# 1 INTRODUCTION

Roads and Maritime Services (Roads and Maritime) have contracted Fulton Hogan to upgrade 12.5 km of the Princess Highway between Toolijooa Road north of Foxground, to Schofields Lane (the Foxground and Berry Bypass Project), and between Croziers Lane south of Berry (the Southern Extension).

NGH Environmental were engaged by Fulton Hogan to provide ecological services during the construction period. Ecological services broadly include the following:

- Pre-clearing and clearing services
- Ecological monitoring including:
  - Nest box monitoring
  - Aquatic monitoring
  - Weed monitoring
- Specialist advice on ecological matters as required by Fulton Hogan

## 1.1 PURPOSE OF THE REPORT

A number of requirements regarding aquatic monitoring during the construction period are outlined in the following documents:

- Minister's Conditions of Approval (CoA)
- The Roads and Maritime Statement of Commitments (SoC)
- Construction Flora and Fauna Management Plan sub-plan (CFFMP) (Fulton Hogan, 2014)

The Construction Flora and Fauna Management sub-plan (CFFMP) (Fulton Hogan 2014) and Ecological Monitoring Program (EcMP) (PB 2014) prepared for the project detail the actions that need to be taken to meet those requirements.

In accordance with Section 6.2 of the Ecological Monitoring Program (EcMP) (PB 2014), annual reporting is to be completed for all monitoring surveys outlined in the EcMP. This includes aquatic monitoring during the construction period.

The aquatic monitoring has been undertaken at eight sites:

- 13 – Broughton Creek
- 16 – Broughton Creek
- 17 – Broughton Creek
- 22 – Bundewallah Creek
- 25 – Broughton Mill Creek
- 27 – Bundewallah Creek
- Control 1 – Broughton Mill Creek
- Control 2 – Broughton Creek

Additionally, the diversion channel between Town Creek and Bundewallah Creek has been monitored.

Surveys were undertaken directly downstream of the creek crossings to monitor downstream impacts of construction. Upstream water quality monitoring via sampling control sites will provide background water quality levels. Surveys were undertaken twice in Autumn and twice in Spring. All results are included in this Annual Monitoring Report.

Table 1-1 Aquatic monitoring requirements as stated in the EcMP.

Monitoring method	Data to be collected
<b>Habitat assessments</b> – at each creek to determine the suitability of the site to support listed species and based on AUSRIVAS protocols.	Identify habitat variables such as benthic substrate, water depth and vegetation/water % coverage (including shading).
<b>Water quality</b> – will be measured with a Yoekal hand held multi-probe at each site undertaken in accordance with the appropriate guidelines (AS/NZS 6557.1:1998, AS/NZS 5667.6:1998 and Australian Guidelines for Water Quality Monitoring and Reporting (2000).	pH, turbidity (NTU), conductivity (s/cm), temperature (°C) and dissolved oxygen (% saturation and mg/L).
<b>Macrophyte and emergent vegetation</b> – will be identified and mapped at each site. Species abundance will also be quantitatively surveyed using five metre wide 25 m long transects.	Species identified, mapping and species abundance.
<b>Macroinvertebrates</b> – at each site following the AUSRIVAS protocols for NSW.	Macroinvertebrates would be sampled and identified to family species level and enumerated.
<b>Fish assessment</b> - at each site a single wing fyke net (12mm or 20mm) and six bait traps would be deployed and set to ensure a diversity of structural habitats are surveyed where possible. Mesh seine nets (5-6mm bar) can also be used.	Fish would be identified to species, enumerated, weighed and measured.

The annual reports must include the following information:

- **Introduction** – background description of the monitoring session (refer to Section 1)
- **Methodology** – description of methodology undertaken including site location and specific survey site locations (refer to Section 2)
- **Results and discussion** – description of monitoring results and comparison of results to performance indicators (refer to Section 3)
- **Review of mitigation measures** – the effectiveness of each mitigation measure will be reviewed (where appropriate) at the end of the monitoring period (refer to Section 4)
- **Recommendations** – suggestion of adaptive responses and contingency measures potentially required (where appropriate) based on the results of the monitoring session such as the implementation of contingency measures or modification of monitoring timing, frequency or methodology (refer to Section 5).

This report provides the results of the third year of aquatic monitoring undertaken during the third and final year of construction (2017).

## 2 MONITORING METHODOLOGY

### 2.1 AQUATIC MONITORING SITES

Aquatic monitoring was undertaken twice during Autumn and twice during Spring in 2017 (Table 2-1). In accordance with AUSRIVAS aquatic monitoring protocols, Autumn is considered to be between 15 March and 15 June and Spring between 15 September and 15 December). Six downstream aquatic monitoring sites, 100 metres in length, were monitored. It should be noted that while the site identification numbers have been kept from previous reports, the location of sites 13 and 25 have been modified compared to the preconstruction aquatic assessment undertaken by JSA Environmental in Spring 2014 (JSA 2016) to account for access restrictions (Appendix A). In addition, two control sites were monitored as per the recommendations in the 2015 annual report: Control Site 1 along Broughton Mill Creek (upstream of site 25) and Control Site 2 along Broughton Creek (upstream of site 13).

Table 2-1 Dates of monitoring

	Pre-construction	Construction 1	Construction 2	Construction 3
Autumn	No monitoring undertaken	Session 1: 15 - 17 April 2015	Session 1: 17 - 19 May 2016	Session 1: 1 - 4 May 2017
	No monitoring undertaken	Session 2: 2 - 3 June 2015	Session 2: 14 - 16 June 2016	Session 2: 5 - 7 June 2017, and 13- 16 June 2017
Spring	Session 1: 23– 25 September 2014	Session 1: 14 - 15 October 2015	Session 1: 01– 03 November 2016	Session 1: 25 - 27 Sept 2017
	Session 2: 28– 30 September 2014	Session 2: 1-2 December 2015	Session 2: 06– 08 December 2016	Session 2: 16 - 18 Nov 2017

### 2.2 HABITAT ASSESSMENT

The AUSRIVAS field data sheets were completed for each site to obtain an overview of the site attributes. The following was recorded:

- Riparian vegetation structure
- Shading of river
- Water levels
- Description of natural substrate
- Detritus cover
- Percentage cover of Algae/Moss/Macrophytes in 100 metre section
- Other instream habitats
- Land use
- Visual assessment of disturbance related to human activities



## 2.3 WATER QUALITY

Water quality was monitored using a handheld multiparameter water quality meter. The following data was taken:

- Temperature °C
- pH
- Conductivity ms/cm
- Turbidity NTU
- Dissolved oxygen in mg/L and %

## 2.4 MACROPHYTE AND EMERGENT VEGETATION

Macrophyte and emergent aquatic vegetation within the creek were identified within the 100 metre section of creek at each site. Furthermore, a 25 metre by 5 metre transect within the creek was surveyed at each site and abundance recorded. The location of each transect is provided in Appendix B. A photograph of each transect was also taken for comparison purposes between monitoring sessions.

Cover/abundance assessments were based on visual estimates of foliage cover (after Carnahan 1997), scored using a modified Braun-Blanquet 6-point scale:

1. 1 to a few individuals present, less than 5% cover
2. many individuals present, but still less than 5% cover
3. 5 - < 20% cover
4. 20 - < 50% cover
5. 50 - < 75% cover
6. 75 - 100% cover

## 2.5 MACROINVERTEBRATES

Macroinvertebrates were sampled in edge and riffle habitats in accordance with the NSW AUSRIVAS Sampling and Processing Manual (Department of Environment and Conservation, 2004). A kick net (250 micron mesh size) was used and a 10 metre section of each type of habitat was sampled. The samples were then sorted in accordance with AUSRIVAS on site for a minimum 40 minutes and preserved in 70% ethanol. Macroinvertebrate samples were identified to family. The resulting data was analysed using SIGNAL and EPT to provide an assessment of the existing 'health' of the waterway based on the water quality and abundance and diversity of the macroinvertebrate families present.

### **SIGNAL score**

Families of aquatic invertebrates have been awarded sensitivity scores, according to their tolerance or intolerance to various pollutants. These scores have been determined by examining data from studies of various pollutants in south-eastern Australian streams. The scores are a compromise in cases where species within a family respond in different ways to a pollutant, and where the family responds differently to different types of pollutants. The index is calculated by totalling these scores and dividing by the number of graded families present (most, but not all, families have SIGNAL grades). Waterways with high SIGNAL scores are likely to have low levels of salinity, turbidity and nutrients such as nitrogen and phosphorus.

### **EPT score**

The EPT score is named for three orders of aquatic insects that are common in the benthic macroinvertebrate community: Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera

(caddisflies). The EPT score is equal to the total number of families represented within these three orders in the sample (Mandaville 2002). Any loss of families in these groups usually indicates disturbance.

The grading guidelines for each score that are used to describe the health of a stream or river are provided in Table 2-2.

Table 2-2 Grading guideline

SIGNAL Score	Stream health	EPT Score	Stream health
<4	Severe pollution	0-6	Poor
4-5	Moderate pollution	7-13	Fair
5-6	Mild pollution	14-20	Good-fair
6-7	Clean	21-27	Good
>7	Excellent	>27	Excellent

## 2.6 FISH ASSESSMENT

Fish surveys were undertaken using passive trapping and netting techniques. A single wing fyke net, and six bait traps were deployed at each site. All nets were set to ensure a diversity of habitat available to fish was sampled at each site. The surveys included:

- 1 x Single wing fyke net with a central wing with a stretched mesh size of 19 mm. The fyke nets were set with the cod end on one bank with the wing stretched across the creek. The nets were set across the creeks so that they funnel fish moving both upstream and downstream. The cod-end of the net was always suspended out of the water to avoid the mortality of captured air breathing vertebrates.
- 6 x Bait traps with a funnelled opening at each end were set close to emergent vegetation, submerged macrophytes and woody debris. Bait traps are a quick and easy method of sampling fish amongst woody debris, dense vegetation, steep banks and deep waters.

Fish were identified to species level, measured, weighed and released.

## 2.7 LIMITATIONS

The monitoring plan required that the diversion channel between Town Creek and Bundewallah Creek be monitored. This was not undertaken as it does not provide aquatic habitat that allows monitoring in accordance with the monitoring plan and was generally dry during the monitoring sessions. It should be noted that at the time when the monitoring plan was prepared, the diversion was meant to replicate a natural creek with a sequence of pools and riffles. The design was subsequently changed to a concrete and rock lined channel which does not contain the necessary habitat for macroinvertebrates.

The riffle zone at Site 27 was not sampled for macroinvertebrates in Spring 2016 because the water level was so low there was no riffle zone.

Water quality data in 2017 was compared with the preconstruction (2014), 2015, and 2016 data. It should be noted that this comparison provides very little value as water quality can vary greatly within short timeframes and therefore any differences may not be as a result of an impact but due to natural temporal

variability. Two control sites were monitored in 2017: Both control Site 1 and 2 were monitored in both Autumn and Spring.

Monitoring by JSA during preconstruction did not include the macrophyte and emergent vegetation monitoring as per the requirement of the aquatic monitoring plan. No comparisons could therefore be made with preconstruction data.

## **3 RESULTS AND DISCUSSION**

The results of the 2017 monitoring are compared with the results of the preconstruction surveys and previous monitoring where available and where meaningful comparisons can be made (refer to Section 2.7 for limitations). Two preconstruction surveys were undertaken in Spring 2014, with no Autumn surveys undertaken (JSA 2016). This was due to a limited timeframe where monitoring was only possible in Spring 2014 (Parsons Brinkerhoff 2014). The following, therefore, compares the results of the 2014 preconstruction monitoring (Spring 2014), the 2015 (Spring and Autumn) monitoring, the 2016 (Spring and Autumn) monitoring, and the 2017 (Spring and Autumn) monitoring.

### **3.1 HABITAT ASSESSMENT**

The following tables present the attributes of each site during each session. Photographs of each site are provided in Appendix C.

Table 3-1 Site 13 – Broughton Creek habitat assessment

Site13 – Broughton Creek														
Attributes	Preconstruction (Spring)		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
Riparian vegetation %	Trees <10m: 40 Shrubs/vines/rushes: 20 Grasses/herbs/ferns: 30	Trees <10m: 40 Shrubs/vines/rushes: 20 Grasses/herbs/ferns: 30	Trees <10m: 15 Shrubs/vines/rushes: 25 Grasses/herbs/ferns: 30	Trees <10m: 15 Shrubs/vines/rushes: 35 Grasses/herbs/ferns: 25	Trees <10m: 15 Shrubs/vines/rushes: 35 Grasses/herbs/ferns: 25	Trees <10m: 15 Shrubs/vines/rushes: 35 Grasses/herbs/ferns: 25	Trees <10m: 10 Shrubs/vines/rushes: 40 Grasses/herbs/ferns: 30	Trees <10m: 10 Shrubs/vines/rushes: 40 Grasses/herbs/ferns: 30	Trees <10m: 5 Shrubs/vines/rushes: 20 Grasses/herbs/ferns: 45	Trees <10m: 75 Shrubs/vines/rushes: 20 Grasses/herbs/ferns: 95	Trees <10m: 40 Shrubs/vines/rushes: 40 Grasses/herbs/ferns: 20	Trees <10m: 40 Shrubs/vines/rushes: 45 Grasses/herbs/ferns: 45	Trees <10m: 35 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 10	Trees <10m: 35 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 40
Shading	60%	60%	Moderate-Low	Moderate-Low	Moderate-Low	Moderate-Low	Moderate	High	High	High	High	High	High	High
Water level	Moderate/Low	Low	Moderate	Moderate	Low	Low	Low	Moderate	Low	Low	Moderate	Moderate	Low	Low
Substrate %	Cobble 80; Sand 20	Cobble 80; Sand 20	Boulder 10; Cobble 60; Pebble 20; Gravel 10	Boulder 10; Cobble 60; Pebble 20; Gravel 10	Boulder 10; Cobble 60; Pebble 20; Gravel 10	Boulder 10; Cobble 60; Pebble 20; Gravel 10	Boulder 10; Cobble 75; Pebble 15	Boulder 2; Cobble 85; Pebble 13	Boulder 5; Cobble 50; Pebble 35; Gravel 10.	Boulder 5; Cobble 75; Pebble 10; Gravel 10	Boulder 0; Cobble 1.5; Pebble 80; Gravel 5	Boulder 5; Cobble 60; Pebble 25; Gravel 5; Sand 5	Boulder 5; Cobble 70; Pebble 20; Gravel 5	Boulder 5; Cobble 70; Pebble 20; Gravel 5
Detritus cover	Data unavailable	Data unavailable	10	1	5	10	50	0	5	25	20	2	50	10
Instream vegetation	Some macrophytes present	Some macrophytes present	Algae: 10 Moss: 0 Macrophytes: 1	Algae: 25 Moss: 2 Macrophytes: 0	Algae: 70 Moss: 0 Macrophytes: 0	Algae: 70 Moss: 0 Macrophytes: 0	Algae: 90 Moss: 0 Macrophytes: 0	Algae: 2 Moss: 0 Macrophytes: 0	Algae: 25 Moss: 5 Macrophytes: 0	Data not collected	Algae: 60 Moss: 30 Macrophytes: 10	Algae: 75 Moss: 0 Macrophytes: 5	Algae: 30 Moss: 5 Macrophytes: <5	Algae: 30 Moss: 5 Macrophytes: 1
Instream habitats	Green and brown algae present, small riffle, site	Green and brown algae present, small riffle, site	Large woody debris, large pools and sequence	Large woody debris, large pools and sequence	Large woody debris, large pools and sequence	Large woody debris, large pools and sequence	High amounts of benthic filamentous algae	Large woody debris, large pools and sequence	Large woody debris, large pools and sequence	Large woody debris, large pools and sequence	Large woody debris, large pools and sequence	Large woody debris, large pools and sequence	Small woody debris, and low flow	Algae on rocks, <i>Casuarina</i> debris, very low flow

Site13 – Broughton Creek														
	associated with bridge, some macrophytes present <i>Potamogeton ochreatus and ovalis</i>	associated with bridge, some macrophytes present <i>Potamogeton ochreatus and ovalis</i>	of riffle zones	of riffle zones	of riffle zones	of riffle zones		of riffle zones	of riffle zones	of riffle zones	of riffle zones	of riffle zones		
Land Use	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing
Disturbances	High disturbance of water quality, instream habitat and riparian zone	High disturbance of water quality, instream habitat and riparian zone	Foam present, stock access to creek	Stock access to creek, algae, good water clarity	Stock access to creek, algae, good water clarity, rubbish	Stock access to creek, algae	Stock access to creek, algae, good water clarity	Stock access to creek – high disturbance of riparian habitat. Little disturbance of water quality and instream habitat.	Moderate disturbance of water quality (good clarity) and instream habitat (filamentous algae). Moderate to high disturbance of riparian zone (exotic vegetation, stock access).	Little disturbance of water quality (good clarity, no odour) and instream habitat (filamentous algae). Moderate disturbance of riparian zone (exotic vegetation, stock access).	Moderate disturbance - turbid, oil on surface, filamentous algae, exotic vegetation, evidence of stock access	Little disturbance of water quality (good clarity) and instream habitat. Moderate disturbance of riparian zone (exotic vegetation, stock access).	Little disturbance of water quality (average clarity, no odour), oily film near riffle zone, algae, rubbish.	Moderate disturbance on water quality (moderate to good clarity, thick beds of <i>Casuarina</i> needles), instream habitats (multiple intake pipes), riparian zone (exotic plants, degraded from stock access)

Site13 – Broughton Creek	
Comparison between seasons/session in 2016 and 2017	Water levels fell during Spring compared to Autumn likely a result of natural causes (i.e. rainfall). This is similar to previous years. Coincides with an increase in detritus cover. Oil slicks observed in Autumn and Spring 2017.

Table 3-2 Site 16 – Broughton Creek habitat assessment

Site 16 – Broughton Creek														
Attributes	Preconstruction (Spring) 2014		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
Riparian vegetation %	Trees <10m: 5 Shrubs/vines/rushes: 10 Grasses/herbs/ferns: 75	Trees <10m: 5 Shrubs/vines/rushes: 10 Grasses/herbs/ferns: 75	Trees <10m: 10 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 90	Trees <10m: 10 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 90	Trees <10m: 10 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 90	Trees <10m: 10 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 90	Trees <10m: 1 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 50	Trees <10m: 5 Shrubs/vines/rushes: 40 Grasses/herbs/ferns: 50	Trees <10m: 5 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 25	n/a	Trees <10m: 40 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 50	Trees <10m: 15 Shrubs/vines/rushes: 55 Grasses/herbs/ferns: 65	Trees <10m: 1 Shrubs/vines/rushes: 30 Grasses/herbs/ferns: 60	Trees <10m: <1 Shrubs/vines/rushes: 30 Grasses/herbs/ferns: 60
Shading	30%	30%	Low	Low	Low	Low	Low	Moderate	Low	Low	Low	Moderate	Low	Low
Water level	Moderate /Low	Low	Moderate	Low	Low	Low	Low	Moderate	Low	Low	Moderate	Moderate	Low	Low
Substrate %	Cobble 100	Cobble 100	Boulder 10; Cobble 50; Pebble 20; Gravel 20	Boulder 10; Cobble 50; Pebble 20; Gravel 20	Boulder 10; Cobble 50; Pebble 20; Gravel 20	Boulder 10; Cobble 50; Pebble 20; Gravel 20	Boulder 15; Cobble 55; Pebble 25; Gravel 5	Boulder 5; Cobble 50; Pebble 40; Gravel 5	Boulder 35; Cobble 25; Pebble 20; Gravel 20	Boulder 5; Cobble 25; Pebble 40; Gravel 20; Sand 5; Silt 5	Boulder 0; Cobble 40; Pebble 40; Gravel 10; Sand 5; Silt 5	Boulder 5; Cobble 40; Pebble 35; Gravel 15; Sand 5	Boulder 5; Cobble 60; Pebble 30; Gravel 5;	Boulder 5; Cobble 60; Pebble 30; Gravel 5;
Detritus cover %	Some detritus	Some detritus	5	5	1	2	n/a	0	15	10	5	5	40	5
Instream vegetation %	Data unavailable	Data unavailable	Algae: 50 Moss: 10 Macrophytes: 10	Algae: 80 Moss: 0 Macrophytes: 0	Algae: 60 Moss: 0 Macrophytes: 0	Algae: 60 Moss: 0 Macrophytes: 2	Algae: 50 Moss: 0 Macrophytes: 5	Algae: 2 Moss: 0 Macrophytes: 5	Algae: 45 Moss: 0 Macrophytes: 1	Algae: 60 Moss: 0 Macrophytes: 0	Algae: 70 Moss: 0 Macrophytes: 10	Algae: 75 Moss: 0 Macrophytes: 5	Algae: 70 Moss: 5 Macrophytes: 5	Algae: 70 Moss: 5 Macrophytes: 5

Instream habitats	Some detritus, some bank large woody debris, some deep pools and short riffles	Some detritus, some bank large woody debris, some deep pools and short riffles	Large woody debris, large pools and sequence of riffle zones	Large woody debris, large pools and sequence of riffle zones	Large woody debris, large pools and sequence of riffle zones	Large woody debris, large pools and sequence of riffle zones	Moderate amount of benthic algae, good water clarity, extremely low water flow, limited riffle zones	Large woody debris, large pools and sequence of riffle zones	Large woody debris, large pools and sequence of riffle zones	Large woody debris, large pools and sequence of riffle zones	Large woody debris, large pools and sequence of riffle zones	Large woody debris, large pools and sequence of riffle zones	Large woody debris, moderate amount of benthic algae,	Large woody debris, little to no little debris as no overhead canopy, Algae on rocks, low flow
Land Use	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing
Disturbances	Moderate disturbance of water quality, little disturbance of instream habitat, high disturbance of riparian zone	Moderate disturbance of water quality, little disturbance of instream habitat, high disturbance of riparian zone	Banks scoured/degraded, stock access	Banks scoured/degraded, stock access, slight sedimentation, algae present	Banks scoured/degraded, stock access, algae present	Banks scoured/degraded, stock access, algae present	Little disturbance of water quality, Moderate disturbance of instream habitat, and high disturbance of riparian zone (stock damage and high exotic plant abundance)	Little disturbance of water quality and instream habitat, high disturbance of riparian zone	Moderate disturbance of water quality (tannin-stained) and instream habitat (lots of benthic algae). High disturbance of riparian zone (exotic vegetation, stock access).	Moderate disturbance of water quality (stock access, algae, low flow) and instream habitat (rubbish present). Little disturbance of riparian zone (southern bank cleared).	Low disturbance of water quality (some foam bubbles), moderate disturbance of instream habitat (filamentous algae, rubbish present), high disturbance of riparian zone (exotic understorey)	Little disturbance of water quality (some foam bubbles), Instream habitats (algae). High disturbance of Riparian zone (Exotic vegetation mid and understorey)	Moderate disturbance of water quality (stock access, algae, low flow), average to good clarity.	Moderate disturbance of water quality (average to good clarity), instream habitat (low flow, little debris), and riparian zone (evidence of clearing for bridge construction, coral tree on northern bank)

Comparison between seasons/session in 2016 and 2017

Water levels fell during Spring compared to Autumn likely a result of natural causes (i.e. rainfall). This is similar to previous years. Coincides with an increase in detritus cover. Presence of algae is generally similar across all years.

Table 3-3 Site 17 – Broughton Creek habitat assessment

Site 17 – Broughton Creek														
Attributes	Preconstruction (Spring) 2014		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
Riparian vegetation %	Trees <10m: 50 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 45	Trees <10m: 50 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 45	N/A	Trees <10m: 20 Shrubs/vines/rushes: 35 Grasses/herbs/ferns: 25	Trees <10m: 20 Shrubs/vines/rushes: 35 Grasses/herbs/ferns: 25	Trees <10m: 20 Shrubs/vines/rushes: 35 Grasses/herbs/ferns: 25	Trees <10m: 0 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 50	Trees <10m: 20 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 40	Trees <10m: 0 Shrubs/vines/rushes: 25 Grasses/herbs/ferns: 45	Trees <10m: 70 Shrubs/vines/rushes: 30 Grasses/herbs/ferns: 0	Trees <10m: 70 Shrubs/vines/rushes: 70 Grasses/herbs/ferns: 40	Trees <10m: 75 Shrubs/vines/rushes: 65 Grasses/herbs/ferns: 50	Trees <10m: 10 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 50	Trees <10m: 10 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 50
Shading	50%	50%	N/A	Moderate	Moderate	Moderate	High	High	High	Moderate	High	Moderate	High	High
Water level	Moderate/low	Low	N/A	Low	Low	Low	Low	Moderate	Low	Low	Moderate	Low	Low	Low to moderate
Substrate %	Cobble 50; Silt 50	Cobble 50; Silt 50	N/A	Boulder 5; Cobble 70; Pebble 15; Gravel 10	Boulder 5; Cobble 70; Pebble 15; Gravel 10	Boulder 5; Cobble 70; Pebble 15; Gravel 10	Boulder 40; Cobble 60; Pebble 10; Gravel 10; Sand 5	Boulder 5; Cobble 70; Pebble 23; Gravel 2	Boulder 25; Cobble 45; Pebble 25; Gravel 5	Boulder 5; Cobble 70; Pebble 15; Gravel 5; Sand 5	Boulder 10; Cobble 60; Pebble 20; Gravel 5; Sand 5	Bedrock 5; Boulder 10; Cobble 60; Pebble 20; Gravel 5; Sand 5	Boulder 5; Cobble 80; Pebble 5; Gravel 5; Sand 5	Boulder 5; Cobble 80; Pebble 5; Gravel 5; Sand 5
Detritus cover	Some detritus	Some detritus	N/A	2	5	5	25	5	10	40	20	5	80	85
Instream vegetation	Data unavailable	Data unavailable	N/A	Algae: 40 Moss: 5 Macrophytes: 0	Algae: 70 Moss: 0 Macrophytes: 0	Algae: 80 Moss: 0 Macrophytes: 0	Algae: 40 Moss: 10 Macrophytes: 0	Data not collected	Algae: 35 Moss: 5 Macrophytes: 0	Algae: 40 Moss: 0 Macrophytes: 0	Algae: 5 Moss: 20 Macrophytes: 0	Algae: <5 Moss: 25 Macrophytes: 0	Algae: 80 Moss: 5 Macrophytes: 0	Algae: 80 Moss: 5 Macrophytes: 0
Instream habitats	Some detritus, good bank large	Some detritus, good bank large	N/A	Large woody debris, large	Large woody debris, large	Large woody debris, large	Extremely low water flow, limited riffle zones	Good bank large woody debris, deep pool, thick	Some detritus, good bank large woody	Large woody debris, large	Large woody debris, large pools	Large woody debris, large pools	Large woody debris, Extremely	Little debris, moderate flow,



Site 17 – Broughton Creek														
	woody debris, deep pool, thick anaerobic muds	woody debris, deep pool, thick anaerobic muds		pools and sequence of riffle zones	pools and sequence of riffle zones	pools and sequence of riffle zones		anaerobic muds	debris, deep pool, thick anaerobic muds	pools and sequence of riffle zones.	and sequence of riffle zones.	and sequence of riffle zones.	low water flow,	slower flowing pools
Land Use	Grazing	Grazing	N/A	Grazing	Grazing	Grazing	Grazing/residential	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing
Disturbances	Moderate disturbance of water quality, little disturbance of instream habitat, high disturbance of riparian zone	Moderate disturbance of water quality, little disturbance of instream habitat, high disturbance of riparian zone	N/A	Banks scoured/degraded, stock access, good water clarity, causeway blocking upstream fish migrations	Banks scoured/degraded, stock access, algae, causeway blocking upstream fish migrations	Banks scoured/degraded, stock access, algae, causeway blocking upstream fish migrations	Moderate disturbance of water quality (moderate clarity) and instream habitat (filamentous algae). High disturbance of riparian zone (exotic vegetation).	Little disturbance of water quality and instream habitat. Moderate disturbance of riparian zone (exotic vegetation).	Moderate disturbance of water quality (tannin-stained), instream habitat (moderate filamentous algae), and riparian zone (exotic vegetation and stock access).	Little disturbance to water quality (clear) and instream habitat (limited rubbish). Moderate disturbance of riparian zone (historical clearing and exotic vegetation).	Moderate disturbance of water quality (mostly clear, some detritus), little disturbance of instream habitat, high disturbance of riparian zone (exotic vegetation)	Little disturbance to water quality (clear, minimal algae) and instream habitat. High disturbance of riparian zone (Exotic vegetation, Bank degradation).	Moderate disturbance to water quality (clear in places, oil and scum near road crossing). Instream habitat (limited rubbish).	Moderate disturbance of water quality (moderate to good clarity, tannin discoloration in slow flowing pools), instream habitat (high Casuarina needle debris), and riparian zone (exotic plants, western slope exposed due to stock access)
Comparison between seasons/session in 2016 and 2017				Obvious increase in detritus cover. Filamentous algae increased during Spring 2017, potentially a result of increased water temperatures during warmer months and increased sunlight. First time oil is noted in Spring 2017.										

Table 3-4 Site 22 – Bundewallah Creek habitat assessment

Site 22 – Bundewallah Creek														
Attributes	Preconstruction (Spring) 2014		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
Riparian vegetation %	Trees <10m: 10 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 40	Trees <10m: 10 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 40	Trees <10m: 40 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 90	Trees <10m: 40 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 90	Trees <10m: 40 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 90	Trees <10m: 40 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 90	Trees <10m: 5 Shrubs/vines/rushes: 20 Grasses/herbs/ferns: 90	Trees <10m: 20 Shrubs/vines/rushes: 20 Grasses/herbs/ferns: 40	Trees <10m: 10 Shrubs/vines/rushes: 25 Grasses/herbs/ferns: 60	Trees <10m: 40 Shrubs/vines/rushes: 30 Grasses/herbs/ferns: 0	Trees <10m: 20 Shrubs/vines/rushes: 20 Grasses/herbs/ferns: 0	Trees <10m: 20 Shrubs/vines/rushes: 35 Grasses/herbs/ferns: 85	Trees <10m: 20 Shrubs/vines/rushes: 40 Grasses/herbs/ferns: 50	Trees <10m: 20 Shrubs/vines/rushes: 30 Grasses/herbs/ferns: 30
Shading	30%	30%	Moderate	Moderate	Moderate	Moderate	High	High	High	Moderate	Moderate	Moderate	Moderate	Moderate
Water level	Moderate /Low	Low	Moderate	Low	Moderate	Moderate	Low	Moderate	No flow – low	No flow	Moderate	Moderate	Low	No flow
Substrate %	Cobble 50; Silt 50	Cobble 50; Silt 50	Boulder 15; Cobble 50; Pebble 25; Silt 10	Boulder 15; Cobble 50; Pebble 25; Silt 10	Boulder 15; Cobble 50; Pebble 25; Silt 10	Boulder 15; Cobble 50; Pebble 25; Silt 10	Boulder 50; Cobble 25; Pebble 15; Gravel 10	Boulder 5; Cobble 80; Pebble 15	Boulder 20; Cobble 70; Pebble 10	No riffle	; Boulder 5; Cobble 60; Pebble 20; Gravel 5; Sand 5; Silt 5	Boulder 0; Cobble 65; Pebble 10; Gravel 10; Sand 5; Silt 10	Boulder 5; Cobble 80; Pebble 10; Silt 10	Boulder 5; Cobble 80; Pebble 10; Silt 5
Detritus cover %	Data unavailable	Data unavailable	25	20	30	15	25	10	45	20	20	10	50	60
Instream vegetation	Data unavailable	Data unavailable	Algae: 15 Moss: 0 Macrophytes: 5	Algae: 10 Moss: 0 Macrophytes: 0	Algae: 30 Moss: 0 Macrophytes: 0	Algae: 90 Moss: 2 Macrophytes: 5	Algae: 35 Moss: 0 Macrophytes: 25	Algae: 5 Moss: 0 Macrophytes: 15	Algae: 60 Moss: 0 Macrophytes: 20	Algae: 90 Moss: 0 Macrophytes: 5	Algae: 40 Moss: 0 Macrophytes: 4	Algae: 60 Moss: 0 Macrophytes: 5	Algae: 0 Moss: 0 Macrophytes: 5	Algae: 5 Moss: 0 Macrophytes: 0
Instream habitats	Some deeper pools, thick	Some deeper pools, thick	Large woody debris, large	Large woody debris, large	Large woody debris, large	Large woody debris, large	Extremely low water flow, limited	Large woody debris, large	Large woody debris, large	Series of isolated pools, no	Series of isolated pools, no	Large woody debris; large	Series of isolated pools, little riffle	No flow, No riffles,

Site 22 – Bundewallah Creek														
	anaerobic muds, small riffle upstream	anaerobic muds, small riffle upstream	pools; riffles	pools; riffles	pools; riffles	pools; riffles	riffle zones.	pools; riffles	pools; riffles	riffle zones.	riffle zones.	pools, small riffle zones. Moderate flow.	zones, very low flow	
Land Use	Dairy	Dairy	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing	Grazing
Disturbances	High disturbance of water quality, instream habitat and riparian zone	High disturbance of water quality, instream habitat and riparian zone	Banks degraded due to stock access	Banks degraded due to stock access, slight sedimentation, slightly turbid	Banks degraded due to stock access, slight sedimentation, algae	Banks degraded due to stock access, slight sedimentation, algae	High disturbance of water quality (low clarity and surface scum). Moderate disturbance of instream (filamentous algae present) and riparian zone habitat (exotic vegetation, livestock)	Little disturbance of water quality and instream habitat. High disturbance of riparian zone (exotic vegetation and erosion).	Moderate disturbance of water quality (good clarity) and instream vegetation (some filamentous algae present). High disturbance of riparian zone (exotic vegetation, stock access).	High disturbance of water quality (high turbidity, low flow, oil slicks), instream habitat (cattle grazing, high algae content, odour), and riparian zone habitat (exotic vegetation, erosion).	Moderate disturbance of water quality (Clear, Some rubbish, odour), instream vegetation (some filamentous algae present), and riparian zone (exotic vegetation, stock access).	Moderate disturbance of water quality (Bad odour, moderate flow, bank degradation), instream habitat (rocks with algae, low instream vegetation) and riparian zone habitat (exotic vegetation, erosion, stock access).	Moderate disturbance of water quality (No odour, moderate clarity, very low flow) and instream habitat. Moderate disturbance of riparian zone (exotic vegetation and erosion)	High disturbance of water quality (No flow, high level of cattle faeces, odour), Disturbance of instream habitats (turbidity, frequent disturbance). Moderate disturbance of riparian zone (No flow, cattle access)
Comparison between seasons/session in 2016 and 2017				Water levels fell during Spring 2017. This is similar to previous years and is likely a result of natural causes (i.e. rainfall). Coincides with an increase in detritus cover. Presence of oil, increased turbidity and noticeable odour in 2017 and Spring 2016, impacts from cattle crossing activities are more noticeable in 2017.										

Table 3-5 Site 25 – Broughton Mill Creek habitat assessment

Site 25 – Broughton Mill Creek														
Attributes	Preconstruction (Spring) 2014		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
Riparian vegetation %	Trees <10m: 30 Shrubs/vines/rushes: 20 Grasses/herbs/ferns: 50	Trees <10m: 30 Shrubs/vines/rushes: 20 Grasses/herbs/ferns: 50	Trees <10m: 15 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 95	Trees <10m: 25 Shrubs/vines/rushes: 60 Grasses/herbs/ferns: 75	Trees <10m: 25 Shrubs/vines/rushes: 60 Grasses/herbs/ferns: 75	Trees <10m: 25 Shrubs/vines/rushes: 60 Grasses/herbs/ferns: 75	Trees <10m: 5 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 45	Trees <10m: 0 Shrubs/vines/rushes: 60 Grasses/herbs/ferns: 5	Trees <10m: 20 Shrubs/vines/rushes: 25 Grasses/herbs/ferns: 0	Trees <10m: 15 Shrubs/vines/rushes: 40 Grasses/herbs/ferns: 25	Trees <10m: 15 Shrubs/vines/rushes: 40 Grasses/herbs/ferns: 25	Trees <10m: 15 Shrubs/vines/rushes: 30 Grasses/herbs/ferns: 70	Trees <10m: 20 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 50	Trees <10m: 20 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 60
Shading	40%	40%	Moderate	Moderate	Moderate	Moderate	High	High	High	High	Moderate	Low	Moderate	Moderate
Water level	Low	Low	Moderate	Low	Low	Low	Low	Moderate	Low	Low	Moderate	Low	Moderate	No flow
Substrate %	Cobble 75; Silt 25	Cobble 75; Silt 25	Boulder 5; Cobble 60; Pebble 30; Gravel/Sand 5	Boulder 5; Cobble 60; Pebble 30; Gravel/Sand 5	Boulder 5; Cobble 60; Pebble 30; Gravel/Sand 5	Boulder 5; Cobble 60; Pebble 30; Gravel/Sand 5	Boulder 25; Cobble 30; Pebble 20; Gravel 10; Sand 5; Silt 5	Boulder 75; Cobble 15; Pebble 10	Bedrock 5; Boulder 15; Cobble 35; Pebble 25; Gravel 15; Sand 5	Boulder 20; Cobble 40; Pebble 30; Gravel 10	Boulder 0; Cobble 60; Pebble 30; Gravel 5; Sand 5	Cobble 65; Pebble 25; Gravel 5; Sand 5	Boulder 5; Cobble 80; Pebble 15;	Boulder 5; Cobble 80; Pebble 15;
Detritus cover	Some detritus	Some detritus	10	2	5	2	10	10	30	35	20	15	90	90
Instream vegetation	Data unavailable	Data unavailable	Algae: 5 Moss: 5 Macrophytes: 15	Algae: 60 Moss: 2 Macrophytes: 5	Algae: 0 Moss: 1 Macrophytes: 10	Algae: 0 Moss: 1 Macrophytes: 10	Algae: 40 Moss: 15 Macrophytes: 45	Data not collected	Algae: 25 Moss: 0 Macrophytes: 30	Algae: 20 Moss: 5 Macrophytes: 35	Algae: 85 Moss: 0 Macrophytes: 15	Algae: 90 Moss: 0 Macrophytes: 10	Algae: 0 Moss: 5 Macrophytes: 5	Algae: 30 Moss: 0 Macrophytes: 35
Instream habitats	Some good large woody debris and detritus, pump downstream	Some good large woody debris and detritus, pump downstream	Large woody debris; large pools, small riffle zones	Large woody debris; large pools, small riffle zones	Large woody debris; large pools, small riffle zones	Large woody debris; large pools, small riffle zones	Extremely low water level. Large woody debris; large pools,	Large woody debris; large pools, small riffle zones. Flood event 1	Large woody debris; large pools, small riffle zones	Large woody debris; large pools, small riffle zones. Very low flow.	Large woody debris; large pools, small riffle zones. Very low flow.	Large woody debris; large pools, small riffle zones. Very low flow. High	Dense woody debris; abundant leaf litter, very turbid, low flow.	No flow, significant detritus algae, leaf litter accumulation

Site 25 – Broughton Mill Creek														
							small riffle zones	week earlier.				aquatic weed infestation		
Land Use	Commercial	Commercial	Agricultural	Agricultural	Agricultural	Agricultural	Road corridor/agricultural	Road corridor/agricultural	Road corridor/agricultural	Road corridor/agricultural	Road corridor/agricultural	Road corridor/agricultural	Road corridor/agricultural	Road corridor/agricultural
Disturbances	Moderate disturbance water quality and instream habitat, High disturbance riparian zone	Moderate disturbance water quality and instream habitat, High disturbance riparian zone	Turbid, rubbish present	Turbid, rubbish present			High disturbance to water quality (low clarity), moderate disturbance to instream habitat (rubbish present), extreme disturbance to riparian zone (exotic vegetation).	Moderate disturbance of water quality, little disturbance of instream habitat, high disturbance of riparian zone (exotic vegetation, erosion).	Little disturbance of water quality (low flow), moderate disturbance of instream habitat (high amounts of filamentous algae), high disturbance of riparian zone (exotic vegetation).	High disturbance of water quality (turbid), moderate disturbance of instream habitat (rubbish), high disturbance of riparian zone (exotic vegetation).	Moderate disturbance of water quality (low clarity), moderate disturbance of instream habitat (high algal content, some rubbish), moderate disturbance of riparian zone (undercut banks, exotic vegetation).	High disturbance of water quality (low clarity), moderate disturbance of instream habitat (high algal content, some rubbish), moderate disturbance of riparian zone (undercut banks, exotic vegetation).	High disturbance of water quality (very low flow, low clarity), Instream habitat (aquatic weeds). High disturbance of riparian zone (high weed growth, bank degradation)	High disturbance of water quality (no flow, moderate odour, improved (lower) turbidity). High disturbance of instream habitat (large accumulation of leaf litter), and riparian zone (dense exotic plants on all stratum)
Comparison between seasons/session in 2016 and 2017				An increase in algae cover is evident during Autumn sessions in both 2016 and 2017. Low flow and an increase in turbidity and detritus cover is common in Spring of 2016 and 2017.										

Table 3-6 Site 27 – Bundewallah Creek habitat assessment

Site 27 – Bundewallah Creek														
Attributes	Preconstruction (Spring) 2014		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1		Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
Riparian vegetation %	Trees <10m: 30 Shrubs/vines/rushes: 20 Grasses/herbs/ferns: 50	Trees <10m: 30 Shrubs/vines/rushes: 20 Grasses/herbs/ferns: 50	Trees <10m: 50 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 70	Trees <10m: 50 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 50	Trees <10m: 50 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 70	Trees <10m: 50 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 70	Trees <10m: 1 Shrubs/vines/rushes: 25 Grasses/herbs/ferns: 75	Riparian vegetation %	Trees <10m: 30 Shrubs/vines/rushes: 20 Grasses/herbs/ferns: 50	Trees <10m: 30 Shrubs/vines/rushes: 20 Grasses/herbs/ferns: 50	Trees <10m: 50 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 70	Trees <10m: 50 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 50	Trees <10m: 50 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 70	Trees <10m: 50 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 70
Shading	20%	20%	Moderate	Moderate	Moderate	Moderate	High	Shading	20%	20%	Moderate	Moderate	Moderate	Moderate
Water level	Low	Low	Moderate	High	Low	Low	Low	Water level	Low	Low	Moderate	High	Low	Low
Substrate %	Cobble 75; Silt 25	Cobble 75; Silt 25	Boulder 5; Cobble 60; Pebble 30; Gravel 5	Boulder 5; Cobble 60; Pebble 30; Gravel 5	Boulder 5; Cobble 60; Pebble 30; Gravel 5	Boulder 5; Cobble 60; Pebble 30; Gravel 5	Boulder 5; Cobble 25; Pebble 15; Gravel 5; Sand 5	Substrate %	Cobble 75; Silt 25	Cobble 75; Silt 25	Boulder 5; Cobble 60; Pebble 30; Gravel 5	Boulder 5; Cobble 60; Pebble 30; Gravel 5	Boulder 5; Cobble 60; Pebble 30; Gravel 5	Boulder 5; Cobble 60; Pebble 30; Gravel 5
Detritus cover	Data unavailable	Data unavailable	15	5	5	10	25	5	25	5	5	<1%	<1%	<5%
Instream vegetation	Data unavailable	Data unavailable	Algae: 5 Moss: 5 Macrophytes: 5	Algae: 10 Moss: 2 Macrophytes: 0	Algae: 50 Moss: 0 Macrophytes: 0	Algae: 50 Moss: 5 Macrophytes: 5	Algae: 45 Moss: 0 Macrophytes: 0	Algae: 10 Moss: 0 Macrophytes: 5	Algae: 0 Moss: 0 Macrophytes: 0	Algae: 95 Moss: 10 Macrophytes: 0	Algae: 85 Moss: 0 Macrophytes: 0	Algae: 40 Moss: 0 Macrophytes: 0	Algae: 10 Moss: 20 Macrophytes: 5	Algae: 15 Moss: 15 Macrophytes 5%
Instream habitats	Variable riffle runs, some small deeper pools. Lots of large woody debris	Variable riffle runs, some small deeper pools. Lots of large woody debris	Large woody debris, sequence of pools and riffles	Large woody debris, sequence of pools and riffles	Large woody debris, sequence of pools and riffles	Large woody debris, sequence of pools and riffles	Large woody debris, sequence of pools and riffles	Large woody debris, sequence of pools and riffles	Large woody debris, sequence of pools and riffles	Large woody debris, sequence of pools and riffles only	Large woody debris, sequence of pools and riffles	Large woody debris, sequence of pools and riffles	Low riffles due to low flow	No flow due to prolonged dry weather

Site 27 – Bundewallah Creek														
Land Use	Commercial	Commercial	Agricultural/recreational	Agricultural/recreational	Agricultural/recreational	Agricultural/recreational	Agricultural/recreational	Agricultural/recreational	Agricultural/recreational	Agricultural/recreational	Agricultural/recreational	Agricultural/recreational	Agricultural/recreational	Agricultural/recreational
Disturbances	High disturbance water quality, Moderate disturbance instream habitat, high disturbance riparian zone	High disturbance water quality, Moderate disturbance instream habitat, high disturbance riparian zone	Banks degraded/scoured; rubbish present; turbid water with some foam present	Banks degraded/scoured; rubbish present; clear water with some foam present	Banks degraded/scoured; High algal cover	Banks degraded/scoured; High algal cover	Little disturbance of water quality (good clarity) and instream habitat (minimal rubbish), and moderate disturbance of riparian zone (exotic vegetation).	No evidence of disturbance to water quality (clear). Little disturbance of instream habitat, and high disturbance of riparian zone (exotic vegetation).	Little disturbance of water quality (good clarity), High disturbance of instream habitat (abundance of algae), moderate disturbance of riparian zone (exotic vegetation).	Extreme disturbance of water quality (turbid, low clarity, high algae), high disturbance of instream habitat (algae) and riparian zone (exotic vegetation).	Little disturbance of water quality (clear water, minimal odour, some algae), little disturbance of instream habitat and riparian zone (some exotic vegetation)	Little disturbance of water quality (clear water, gentle flow, some algae), little disturbance of instream habitat and riparian zone (some exotic vegetation)	Little disturbance of water quality (no odour, clear), and instream habitat (small amounts of filamentous algae). Moderate disturbance of riparian zone.	Little disturbance of water quality (No odour, good clarity, No flow (due to prolonged dry weather), Instream habitats (increased amounts of filamentous algae. Moderate disturbance of riparian zone (Exotic vegetation on banks)
Comparison between seasons/session in 2016 and 2017				Water levels fell during Spring 2017 compared to Autumn, resulting in no flow. Little disturbance in 2017 compared to 2016, but this could be due to the absence of flowing water. The presence of filamentous algae indicates that the water was high in nutrients, and therefore of poor quality.										

Table 3-7 Control Site 1 habitat assessment

Control Site 1								
Attributes	Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
Riparian vegetation %	Trees <10m: 15 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 25	Trees <10m: 10 Shrubs/vines/rushes: 80 Grasses/herbs/ferns: 15	Trees <10m: 25 Shrubs/vines/rushes: 10 Grasses/herbs/ferns: 50	Trees <10m: 10 Shrubs/vines/rushes: 25 Grasses/herbs/ferns: 45	Trees <10m: 10 Shrubs/vines/rushes: 25 Grasses/herbs/ferns: 45	Trees <10m: 60 Shrubs/vines/rushes: 10 Grasses/herbs/ferns: 40	Trees <10m: 40 Shrubs/vines/rushes: 5 Grasses/herbs/ferns: 75	Trees <10m: 50 Shrubs/vines/rushes: 10 Grasses/herbs/ferns: 80
Shading	20%	High	Moderate	Moderate	Moderate	Low	Moderate	Moderate
Water level	Low	Moderate	Low	Low	Moderate	Low	Low	Low
Substrate %	Boulder 20; Cobble 25; Pebble 25; Gravel 10; Sand 10; Silt 5; Clay 5	Bedrock 10; Boulder 5; Cobble 80; Pebble 5	Bedrock 10; Boulder 5; Cobble 30; Pebble 20; Gravel 20; Sand 15	Boulder 15; Cobble 30; Pebble 30; Gravel 20; Sand 10	Bedrock 60; Boulder 10; Cobble 20; Pebble 5; Gravel 2; Sand 2; Silt 1	Bedrock 50; Boulder 5; Cobble 25; Pebble 5; Gravel 5; Sand 5; Silt 5	Bedrock 60; Boulder 20; Cobble 20	Bedrock 60; Boulder 20; Pebble 20
Detritus cover	5	5	25	25	2	5	10	30
Instream vegetation	Algae: 15 Moss: 5 Macrophytes: 5	Algae: 15 Moss: 5 Macrophytes: 20	Algae: 25 Moss: 0 Macrophytes: 10	Algae: 10 Moss: 5 Macrophytes: 10	Algae: 98 Moss: 0 Macrophytes: 15	Algae: 95 Moss: 0 Macrophytes: 10	Algae: 70 Moss: 5 Macrophytes: 10	Algae: 10 Moss: 0 Macrophytes: 10
Instream habitats	One riffle run with some deep pools, low flow.	One riffle run	Trailing vegetation, extremely low flow.	Trailing vegetation, low flow, turbid.	Data not collected	Calm water with low flow	Low water level, low flow, some rubbish	Low water levels with very low flow and large amounts of leaf litter
Land Use	Agricultural	Agricultural	Agricultural/residential	Agricultural	Agricultural	Agricultural	Agricultural/residential	Agricultural/residential
Disturbances	High disturbance of water quality, little disturbance instream habitat, high disturbance	Moderate disturbance of water quality, Moderate disturbance instream habitat,	Moderate disturbance of water quality, moderate disturbance instream habitat,	Moderate disturbance of water quality, low disturbance of instream habitat, moderate to high	Moderate disturbance of water quality (oil residue, foam), moderate disturbance of	Moderate disturbance of water quality (rubbish and cloudy water clarity), instream	Moderate disturbance of water quality (average clarity, no odour), Instream habitat	Moderate disturbance of water quality (moderate clarity, low flow, no odour), Instream



Control Site 1								
	riparian zone (exotic plants)	high disturbance riparian zone (erosion, exotic plants)	high disturbance riparian zone (exotic plants)	disturbance of riparian zone (exotic plants)	instream habitat and riparian zone (rubbish, filamentous algae, exotic vegetation).	habitat and riparian zone (rubbish, filamentous algae, exotic vegetation).	(some rubbish present), and riparian zone (exotic plants).	habitat (accumulation of leaf litter), and Riparian zone (abundant <i>Tradescantia albifolia</i> on banks)
Comparison between seasons/session in 2016 and 2017			Water levels decreased in Spring 2017, and detritus cover increased. Disturbances were similar across all years					

Table 3-8 Control Site 2 habitat assessment

Control Site 2								
Attributes	Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
Riparian vegetation %	n/a	n/a	Trees <10m: 10 Shrubs/vines/rushes: 25 Grasses/herbs/ferns: 45	Trees <10m: 20 Shrubs/vines/rushes: 15 Grasses/herbs/ferns: 0	Trees <10m: 20 Shrubs/vines/rushes: 15 Grasses/herbs/ferns: 0	Trees <10m: 65 Shrubs/vines/rushes: 70 Grasses/herbs/ferns: 90	Trees <10m: 5 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 40	Trees <10m: 10 Shrubs/vines/rushes: 50 Grasses/herbs/ferns: 40
Shading	n/a	n/a	Low	Moderate	Moderate	Moderate	Moderate	Moderate
Water level	n/a	n/a	Low	Low	Moderate	Moderate	Low	Low
Substrate %	n/a	n/a	Boulder 20; Cobble 45; Pebble 25; Gravel 10	Boulder 15; Cobble 70; Pebble 10; Gravel 5	Boulder 2; Cobble 75; Pebble 15; Gravel 3; Sand 5	Boulder 5; Cobble 70; Pebble 20; Gravel 3; Sand 1; Silt 1	Boulder 10; Cobble 80; Pebble 10	Boulder 10; Cobble 80; Pebble 10
Detritus cover	n/a	n/a	10	20	5	< 5%	40	30
Instream vegetation	n/a	n/a	Algae: 15	Algae: 70	Algae: 40	Algae: 50	Algae: 50	Algae: 50

Control Site 2								
			Moss: 0 Macrophytes: 10	Moss: 0 Macrophytes: 5	Moss: 0 Macrophytes: 15	Moss: 0 Macrophytes: 10	Moss: <5 Macrophytes: 5	Moss: 5 Macrophytes: 5
Instream habitats	n/a	n/a	One riffle zone, low water level, good water clarity, no obvious filamentous algae present.	One riffle zone, low water level, good water clarity, some algae present.	One riffle zone, good water clarity, no odour	One riffle zone, good water clarity, no odour	Large woody debris, very low flow, low water level, some riffles, some algae present	Little woody debris, low flow, high accumulation of <i>Casuarina</i> needles
Land Use	n/a	n/a	Agricultural	Agricultural	Agricultural	Agricultural	Grazing	Grazing
Disturbances	n/a	n/a	Little disturbance of water quality, Little disturbance of instream habitat, moderate disturbance of riparian zone (exotic plants).	Little disturbance of water quality, Little disturbance of instream habitat, moderate disturbance of riparian zone (stock access, exotic plants).	Little disturbance of water quality (some foam, but clear with good flow), little disturbance of riparian and instream habitats (thin layer of filamentous algae, some exotic veg, and limited stock access)	Little disturbance of water quality (some foam, but clear with good flow, no rubbish), instream habitats and riparian zone (Some filamentous algae, some exotic veg, some bank degradation)	Moderate disturbance of water quality (oily film, clear, no odour), instream habitat (some rubbish and filamentous algae present), and riparian zone (exotic plants, bank degradation from stock access)	Moderate disturbance of water quality, good clarity, no odour, accumulation of <i>Casuarina</i> needles), Instream habitat (some woody branches), and Riparian zone (Exotic vegetation on lower banks, in addition to stock access)
Comparison between seasons/sessions in 2016 and 2017			Low flow and an increase in detritus cover is common in Spring of 2016 and 2017 An increase in disturbance during spring 2017 (session 1) with the presence of filamentous algae and an oily residue on the water's surface.					

The habitat assessment values at all the sites were generally considered moderate to low, reflective of historical clearing within riparian corridors and adjacent vegetation, and ongoing agricultural land uses adjacent to waterways. Filamentous algae were present constantly, and is generally higher in spring, likely caused by increased sunlight and water temperature, combined with low flow rates and high nutrient levels as a result of adjacent agricultural practices.

The following was observed during the 2017 monitoring period:

- Water flow rates in Spring were generally lower, with no flow being recorded at three sites (22, 25 and 27). These flow characteristics were reflected across all sites, including controls.
- Site substrates are generally dominated by cobbles, followed by boulders and pebbles. The composition of these substrates is not considered to have changed greatly since the initiation of monitoring. Bedrock is only present in proximity to one site, upstream of Control Site 2.
- Aquatic macrophytes were present at the majority of sites in low densities. Filamentous algae were present at all sites, with sites within Bundewallah Creek, Broughton Mill Creek and Control Site 1 recording up to 90% cover of algae.
- All sites recorded the presence of exotic riparian vegetation. Typically occurring species included Lantana *Lantana camara*, Small-leaf Privet *Ligustrum sinense* and Wandering Jew *Tradescantia fluminensis*. Though densities were not considered high, these weeds have the potential to invade riparian habitats, suppressing native species regeneration.
- Detritus cover was generally higher in 2017 than 2016, particularly during Spring which is likely a result of lower water flows leading to more boulders being exposed, thus trapping more detritus.
- Rubbish detected at sites did not increase in 2017, but was similar to 2016.
- Oil slicks were noted at 2 sites and Control 2 in 2017
- Reduced water clarity and turbidity was observed more frequently in 2017.

## 3.2 WATER QUALITY

The following presents the water quality of each site or location close to monitoring sites during each session.

Table 3-9 Site 13 – Broughton Creek water quality

Site13 – Broughton Creek															
	Preconstruction surveys Spring 2014 (JSA 2016)		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017		ANZECC/ RMCANZ Trigger value <sup>1</sup>
	2014 Spring session 1	2014 Spring session 2	Session 1 <sup>2</sup> 24/4/20 15	Session 2 <sup>2</sup> 17/6/20 15	Session 1 <sup>2</sup>	Session 2	Session 1 <sup>2</sup>	Session 2	Session 1 <sup>2</sup>	Session 2	Session 1	Session 2	Session 1	Session 2	
Temperature °C	16.3	17.4	15.7	13.2	NA	16.7	14.7	12.26	17.3	21.2	14.77	13.6	14.69	18.57	NA
pH	6.9	7.21	6.3*	6.4	NA	7.1	7.2	6.64	6.39	6.67	7.66	6.39	7.36	6.7	6.5-8
Conductivity µs/cm	114	113	78.3	82.7	NA	142	150	128	111	162	144	127	179	187	200-300
Turbidity NTU	19.3	10.7	NA	5.3	NA	1.4	0.5	0	0	0	1.1	0.3	1.5	1.1	6-50 <sup>4</sup>
Dissolved oxygen saturation %	67.3	72.2	91	86.4	NA	178.9 <sup>3</sup>	86.5	98.6	64.2	24	62.43	79.8	32.1	24.36	859-110%

\*Coloured cells denote values that fall outside the ANZECC/ARMCANZ Guideline trigger values. Red indicates a negative condition, and green indicates a positive condition with respect to the trigger value.

Note 1: Trigger Values are derived from the ANZECC/ARMCANZ Guidelines for South Eastern Australia: slightly disturbed ecosystems: lowland river (no current trigger values for wetlands). NA denotes trigger values not available under the ANZECC/ARMCANZ guidelines.

Note 2: Representative data provided is from nearby sites at indicated dates. NA signifies no data was available.

Note 3: Dissolved oxygen unusually high and may be a result of meter malfunction

Note 4: Turbidity in lowland rivers can be extremely variable. Values at the low end of the range would be found in rivers flowing through well vegetated catchments and at low flows. Values at the high end of the range would be found in rivers draining slightly disturbed catchments and in many rivers at high flows

Table 3-10 Site 16 – Broughton Creek water quality

Site16 – Broughton Creek															
	Preconstruction surveys Spring 2014 (JSA 2016)		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017		ANZECC/ARMCANZ Trigger value <sup>1</sup>
	2014 Spring session 1	2014 Spring session 2	Session 1 <sup>2</sup> 24/4/2015	Session 2 <sup>2</sup> 17/6/2015	Session 1 <sup>2</sup>	Session 2	Session 1 <sup>2</sup>	Session 2	Session 1 <sup>2</sup>	Session 2	Session 1	Session 2	Session 1	Session 2	
Temperature °C	17.1	19.1	NA	NA	NA	17.2	15.8	11.1	17.4	21.6	15.63	12.02	17.14	21.11	NA
pH	6.4	5.47	NA	NA	NA	6.8	7.23	7.01	6.31	6.56	7.31	6.36	7.35	7.02	6.5-8
Conductivity ms/cm	96	97	NA	NA	NA	144	152	131	110	167	131	132	177	205	200-300
Turbidity NTU	15.3	20.4	NA	NA	NA	6.5	0.8	0	0.9	1.1	5.1	0.5	4.2	2.1	6-50 <sup>4</sup>
Dissolved oxygen saturation %	77.9	83.6	NA	NA	NA	120.1 <sup>3</sup>	95.5	86	73.6	29.6	77.66	76.75	73.2%	51.25	85-110%

\* Coloured cells denote values that fall outside the ANZECC/ARMCANZ Guideline trigger values. Red indicates a negative condition, and green indicates a positive condition with respect to the trigger value.

Note 1: Trigger Values are derived from the ANZECC/ARMCANZ Guidelines for South Eastern Australia: slightly disturbed ecosystems: lowland river (no current trigger values for wetlands). NA denotes trigger values not available under the ANZECC/ARMCANZ guidelines.

Note 2: Representative data provided is from nearby sites at indicated dates. NA signifies no data was available.

Note 3: Dissolved oxygen unusually high and may be a result of meter malfunction

Note 4: Turbidity in lowland rivers can be extremely variable. Values at the low end of the range would be found in rivers flowing through well vegetated catchments and at low flows. Values at the high end of the range would be found in rivers draining slightly disturbed catchments and in many rivers at high flows

Table 3-11 Site 17 – Broughton Creek water quality

Site 17 – Broughton Creek															
	Preconstruction surveys Spring 2014 (JSA 2016)		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017		ANZECC/AR MCANZZ Trigger value <sup>1</sup>
	2014 Spring session 1	2014 Spring session 2	Session 1 <sup>2</sup> 24/4/20 15	Session 2 <sup>2</sup> 17/6/20 15	Session 1 <sup>2</sup>	Session 2	Session 1 <sup>2</sup>	Session 2	Session 1 <sup>2</sup>	Session 2	Session 1	Session 2	Session 1	Session 2	
Temperature °C	15.21	17.2	15.9	13.1	NA	16.5	14.6	12.73	20.2	22.4	15.29	12.32	14.99	16.14	NA
pH	5.9	6.3	6.2	6.4	NA	6.9	7.62	6.62	6.88	7.04	7.67	6.73	7.39	7.28	6.5-8
Conductivity ms/cm	117	119	79.5	81.4	NA	146	158	131	108	171	143	147	182	211	200-300
Turbidity NTU	14.3	22.9	NA	6.8	NA	1.3	2	0	1.1	0	3.2	0.6	2.8	1.8	6-50 <sup>4</sup>
Dissolved oxygen % saturation	67.3	62.3	88.5	68.7	NA	122 <sup>3</sup>	96.7	79.5	75.3	50.9	74.61	65.5	84.5	24.48	85-110%

\* Coloured cells denote values that fall outside the ANZECC/ARMCANZ Guideline trigger values. Red indicates a negative condition, and green indicates a positive condition with respect to the trigger value

Note 1: Trigger Values are derived from the ANZECC/ARMCANZ Guidelines for South Eastern Australia: slightly disturbed ecosystems: lowland river (no current trigger values for wetlands). NA denotes trigger values not available under the ANZECC/ARMCANZ guidelines.

Note 2: Representative data provided is from nearby sites at indicated dates. NA signifies no data was available.

Note 3: Dissolved oxygen unusually high and may be a result of meter malfunction

Note 4: Turbidity in lowland rivers can be extremely variable. Values at the low end of the range would be found in rivers flowing through well vegetated catchments and at low flows. Values at the high end of the range would be found in rivers draining slightly disturbed catchments and in many rivers at high flows

Table 3-12 Site 22 – Bundewallah Creek water quality

Site 22 – Bundewallah Creek															
	Preconstruction surveys Spring 2014 (JSA 2016)		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017		ANZECC/ARMCANZ Trigger value <sup>1</sup>
	2014 Spring session 1	2014 Spring session 2	Session 1 <sup>2</sup> 24/4/2015	Session 2 <sup>2</sup> 17/6/2015	Session 1 <sup>2</sup>	Session 2	Session 1 <sup>2</sup>	Session 2	Session 1 <sup>2</sup>	Session 2	Session 1	Session 2	Session 1	Session 2	
Temperature °C	16.3	19.8	16.8	13.3	NA	20.7	16.6	14.0	16.9	21.3	15.86	12.5	16.32	18.33	NA
pH	5.3	4.79	6.3	6.4	NA	6.5	6.92	6.91	6.72	6.99	5.81	6.65	7.43	7.9	6.5-8
Conductivity ms/cm	127	127	101.2	110	NA	169	292	144	204	448	154	179	415	503	200-300
Turbidity NTU	22.4	50.1	NA	5.6	NA	4	6.5	1.5	0.1	9.6	2.6	3.6	19.3	15.2	6-50 <sup>4</sup>
Dissolved oxygen % saturation	81.3	98.1	91	86.2	NA	165.7 <sup>3</sup>	50.5	91.9	28.4	55.7	51.69	45.97	57.2	47.84	85-110%

\* Coloured cells denote values that fall outside the ANZECC/ARMCANZ Guideline trigger values. Red indicates a negative condition, and green indicates a positive condition with respect to the trigger value

Note 1: Trigger Values are derived from the ANZECC/ARMCANZ Guidelines for South Eastern Australia: slightly disturbed ecosystems: lowland river (no current trigger values for wetlands). NA denotes trigger values not available under the ANZECC/ARMCANZ guidelines.

Note 2: Representative data provided is from nearby sites at indicated dates. NA signifies no data was available.

Note 3: Dissolved oxygen unusually high and may be a result of meter malfunction

Note 4: Turbidity in lowland rivers can be extremely variable. Values at the low end of the range would be found in rivers flowing through well vegetated catchments and at low flows. Values at the high end of the range would be found in rivers draining slightly disturbed catchments and in many rivers at high flows

Table 3-13 Site 25 – Broughton Mill Creek water quality

Site 25 – Broughton Mill Creek															
	Preconstruction surveys Spring 2014 (JSA 2016)		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017		ANZECC/ARMCANZ Trigger value <sup>1</sup>
	2014 Spring session 1	2014 Spring session 2	Session 1 <sup>2</sup> 24/4/2015	Session 2 <sup>2</sup> 17/6/2015	Session 1 <sup>2</sup>	Session 2	Session 1 <sup>2</sup>	Session 2	Session 1 <sup>2</sup>	Session 2	Session 1	Session 2	Session 1	Session 2	
Temperature °C	15.2	16.6	NA	NA	NA	19.6	16.2	13.0	19.0	22.3	15.41	10.9	19.44	18.78	NA
pH	6.1	5.40	NA	NA	NA	6.5	6.9	6.97	6.43	6.88	6.32	6.84	5.89	6.97	6.5-8
Conductivity ms/cm	120	127	NA	NA	NA	158	132	119	134	155	125	128	158	191	200-300
Turbidity NTU	23.1	57.3	NA	NA	NA	3.1	5	0	0.1	4	1	1.1	300 <sup>3</sup>	3	6-50 <sup>4</sup>
Dissolved oxygen % saturation	58.3	59.2	NA	NA	NA	149.3 <sup>3</sup>	79.8	101.4	47.4	42.7	78.1	65.58	46.75	22.53	85-110%

\* Coloured cells denote values that fall outside the ANZECC/ARMCANZ Guideline trigger values. Red indicates a negative condition, and green indicates a positive condition with respect to the trigger value

Note 1: Trigger Values are derived from the ANZECC/ARMCANZ Guidelines for South Eastern Australia: slightly disturbed ecosystems: lowland river (no current trigger values for wetlands). NA denotes trigger values not available under the ANZECC/ARMCANZ guidelines.

Note 2: Representative data provided is from nearby sites at indicated dates. NA signifies no data was available.

Note 3: Dissolved oxygen and turbidity unusually high and may be a result of meter malfunction

Note 4: Turbidity in lowland rivers can be extremely variable. Values at the low end of the range would be found in rivers flowing through well vegetated catchments and at low flows. Values at the high end of the range would be found in rivers draining slightly disturbed catchments and in many rivers at high flows



Table 3-14 Site 27 – Bundewallah Creek water quality

Site 27 – Bundewallah Creek															
	Preconstruction surveys Spring 2014 (JSA 2016)		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017		ANZECC/ARMCANZ Trigger value <sup>1</sup>
	2014 Spring session 1	2014 Spring session 2	Session 1 <sup>2</sup> 24/4/2015	Session 2 <sup>2</sup> 17/6/2015	Session 1 <sup>2</sup>	Session 2	Session 1 <sup>2</sup>	Session 2	Session 1 <sup>2</sup>	Session 2	Session 1	Session 2	Session 1	Session 2	
Temperature °C	15.3	17.7	16	14	NA	17.4	17.8	13.5	19.5	21.5	17.22	14.17	19.14	16.35	NA
pH	5.3	4.7	6.4	6.3	NA	6.8	6.96	6.61	6.5	6.26	5.74	6.91	6.31	5.92	6.5-8
Conductivity ms/cm	122	127	108.4	118.2	NA	173	190	159	178	182	168	182	183	207	200-300
Turbidity NTU	18.9	17.5	NA	1.6	NA	2.8	2	0	0	5.8	1.5	1.5	2.2	1.8	6-50 <sup>4</sup>
Dissolved oxygen % saturation	61.3	53.2	88.5	80.1	NA	148.7 <sup>3</sup>	80.1	81.5	87.3	30.8	68.26	65.03	79.64	22.44	85-110%

\* Coloured cells denote values that fall outside the ANZECC/ARMCANZ Guideline trigger values. Red indicates a negative condition, and green indicates a positive condition with respect to the trigger value

Note 1: Trigger Values are derived from the ANZECC/ARMCANZ Guidelines for South Eastern Australia: slightly disturbed ecosystems: lowland river (no current trigger values for wetlands). NA denotes trigger values not available under the ANZECC/ARMCANZ guidelines.

Note 2: Representative data provided is from nearby sites at indicated dates. NA signifies no data was available.

Note 3: Dissolved oxygen unusually high and may be a result of meter malfunction

Note 4: Turbidity in lowland rivers can be extremely variable. Values at the low end of the range would be found in rivers flowing through well vegetated catchments and at low flows. Values at the high end of the range would be found in rivers draining slightly disturbed catchments and in many rivers at high flows

Table 3-15 Control Site 1 water quality

Control Site 1									
	Autumn 2016		Spring 2016		Autumn 2017		Spring 2017		ANZECC/ARMCANZ Trigger value <sup>1</sup>
	Session 1 17/05/2016	Session 2 14/06/2016	Session 1 1/11/2016	Session 2 17/6/2015	Session 1	Session 2	Session 1	Session 2	
Temperature °C	15.9	11.74	17.2	23.0	14.81	12.49	17.46	19.95	NA
pH	6.7	6.7	6.9	6.7	7.1	6.41	7.13	7.26	6.5-8
Conductivity ms/cm	132	115	133	156	124	123	159	201	200-300
Turbidity NTU	1.9	3.2	0.7	3.5	1.8	0.7	9.1	2.1	6-50 <sup>2</sup>
Dissolved oxygen % saturation	90	91.1	80.6	31	69.3	66.22	55.3	42.29	90-110%

\* Coloured cells denote values that fall outside the ANZECC/ARMCANZ Guideline trigger values. Red indicates a negative condition, and green indicates a positive condition with respect to the trigger value

Note 1: Trigger Values are derived from the ANZECC/ARMCANZ Guidelines for South Eastern Australia: slightly disturbed ecosystems: lowland river (no current trigger values for wetlands). NA denotes trigger values not available under the ANZECC/ARMCANZ guidelines.

Note 2: Turbidity in lowland rivers can be extremely variable. Values at the low end of the range would be found in rivers flowing through well vegetated catchments and at low flows. Values at the high end of the range would be found in rivers draining slightly disturbed catchments and in many rivers at high flows

Table 3-16 Control site 2 water quality

Control Site 2									
	Autumn 2016		Spring 2016		Autumn 2017		Spring 2017		ANZECC/ARMCANZ Trigger value <sup>1</sup>
	Session 1 17/05/2016	Session 2 14/06/2016	Session 1 1/11/2016	Session 2 17/6/2015	Session 1	Session 2	Session 1	Session 2	
Temperature °C	n/a	n/a	21.2	23.5	14.72	13.11	14.18	17.78	NA
pH	n/a	n/a	6.6	6.8	7.09	6.02	7.16	7.05	6.5-8
Conductivity ms/cm	n/a	n/a	116	158	143	136	170	188	200-300
Turbidity NTU	n/a	n/a	0.1	0	1	0.4	1.6	1	6-50 <sup>2</sup>
Dissolved oxygen saturation %	n/a	n/a	80.1	58.7	63.84	76.84	37.1	38.99	85-110%

\*Coloured cells denote values that fall outside the ANZECC/ARMCANZ Guideline trigger values. Red indicates a negative condition, and green indicates a positive condition with respect to the trigger value

Note 1: Trigger Values are derived from the ANZECC/ARMCANZ Guidelines for South Eastern Australia: slightly disturbed ecosystems: lowland river (no current trigger values for wetlands). NA denotes trigger values not available under the ANZECC/ARMCANZ guidelines.

Note 2: Turbidity in lowland rivers can be extremely variable. Values at the low end of the range would be found in rivers flowing through well vegetated catchments and at low flows. Values at the high end of the range would be found in rivers draining slightly disturbed catchments and in many rivers at high flows

The water quality values at all the sites generally fell outside the ANZECC/ARMCANZ Guideline levels (ANZECC 2000) for disturbed aquatic ecosystems. This occurred during both preconstruction surveys and during construction and is likely a reflection of the agricultural land uses in the catchment.

The following was observed during the 2017 monitoring period:

- Water temperatures recorded at the sites were between 10°C and 23°C, and varied according to the season and the conditions of the waterway. This variation was consistent throughout the pre-construction and construction period.
- pH was variable in 2017 in comparison to 2016 data, with some peaks and troughs. Soil and animal health will not generally be affected by water with pH in the range of 4-9, however values between 4 and 6 should be regarded with caution due to the potential for corrosion and fouling (ANZECC/ARMCANZZ 2000). Levels below 6 were seen at Site 22 and Site 27 in Autumn 2017, and at Site 25 and Site 27 in Spring 2017 (Figure 3-1).
- Conductivity was low across all sites and seasons, with the exception of Site 22, which recorded high conductivity in Spring 2017 and Spring 2016. Low conductivity values are often observed following seasonal rainfall (ANZECC/ARMCANZZ 2000), while high conductivity is an indication of low flow conditions.
- The turbidity levels are generally low and fall below the lower ANZECC/ARMCANZZ guidelines level (which is between 6-50), except at Control Site 1 in Spring 2017 (Session 1). The only exception was a score of 300 at Site 25 in Spring 2017 (Session 1); although site observations noted turbid water conditions, such a high reading would indicate muddy conditions, therefore this value is likely a result of a meter error. Low rainfall produces low water levels and low flows, which are a likely cause for low turbidity levels. Most of the turbidity levels in 2016 and 2017 were much lower than those recorded during the preconstruction monitoring in 2014. This is likely due to the below average rainfall for much of the state in 2017.
- The percent saturation of dissolved oxygen was lower than ANZECC/ARMCANZZ guidelines across all sites for 2017, as well as control sites. This is similar to the preconstruction monitoring results and 2016 results, however there are some exceptions. The low flow conditions and pooling of water would lower the dissolved oxygen which would result in potentially stressful conditions for some species, but due to consistency throughout the monitoring period this is unlikely to be attributed to construction activities.

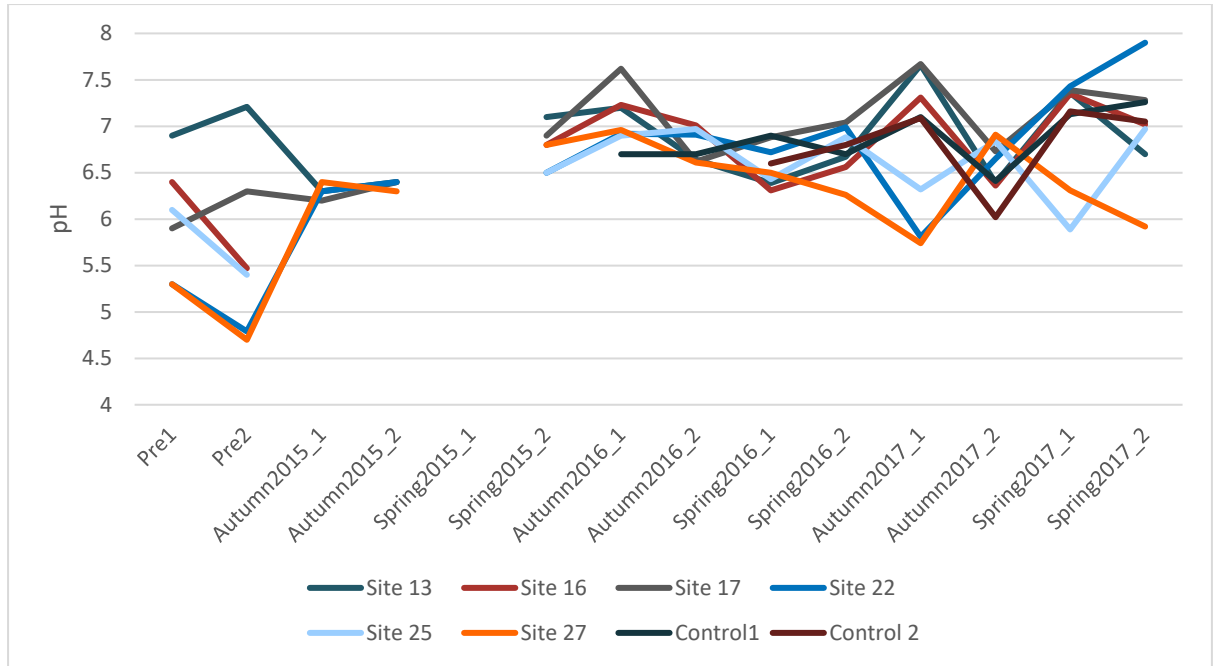


Figure 3-1 pH levels recorded through pre-construction (2014) and construction periods (2015-2017)

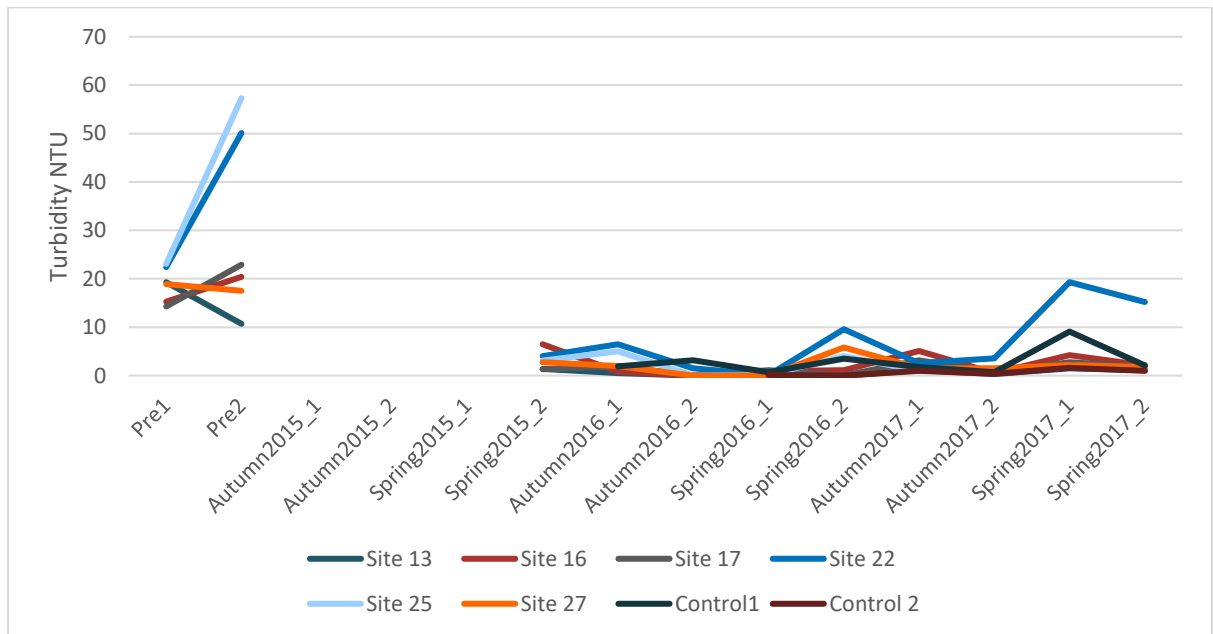


Figure 3-2 Turbidity levels recorded through pre-construction (2014) and construction periods (Spring 2015-2017)

### 3.3 MACROPHYTE AND EMERGENT VEGETATION

The following presents the macrophyte and emergent vegetation data of each site during each session as collected within the fixed quadrats (Appendix B).

Table 3-17 Site 13 – Broughton Creek macrophyte and emergent vegetation abundances according to Braun-Blanquet 6-point scale (refer to Section 2.4).

Site13 – Broughton Creek												
	Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
Species	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance
<i>Ottelia ovalifolia</i> Swamp lily	2											1
<i>Sagittaria platyphylla</i> * Sagittaria	2											1
<i>Colocasia sp.</i> * Elephants ear	2											
<i>Lemna disperma</i> Duckweed		1	1	2	1		1	2		1	1	

\*Exotic

Table 3-18 Site 16 – Broughton Creek macrophyte and emergent vegetation abundances according to Braun-Blanquet 6-point scale (refer to Section 2.4).

Site 16 – Broughton Creek												
	Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
Species	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance
<i>Persicaria hydropiper</i> Water pepper	2	2										
<i>Lemna disperma</i> Duckweed	1					1						
<i>Sagittaria platyphylla</i> * Sagittaria		1		1	1	1	1	2	2	1	1	1
<i>Colocasia sp.</i> * Elephants ear		1	1	1	1	1	1	1	1	1	1	1
<i>Damasonium minus</i> Starfruit					1	1						
* <i>Rorippa nasturtium-aquaticum</i> Watercress										1	1	1

\*Exotic

Table 3-19 Site 17 – Broughton Creek macrophyte and emergent vegetation abundances according to Braun-Blanquet 6-point scale (refer to Section 2.4).

Site 17 – Broughton Creek												
	Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
Species	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance
<i>Lemna disperma</i> Duckweed	NA	2		2			2	3		2		
<i>Juncus usitatus</i> Common rush	NA	2	2								1	1
<i>Maidenia rubra</i> Maidenia					1		1	2		1		1



Table 3-20 Site 22 – Bundewallah Creek macrophyte and emergent vegetation abundances according to Braun-Blanquet 6-point scale (refer to Section 2.4).

Site 22 – Bundewallah Creek												
	Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
Species	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance
<i>Persicaria hydropiper</i> Water pepper	2											
<i>Lemna disperma</i> Duckweed	2	2	2	3	2	1	2	1		3	1	
<i>Ludwigia peploides</i> Water primrose	1	1										
<i>Rorippa palustris*</i> Marsh watercress	1	1				1						
<i>Eleocharis acuta</i> Common Spike Rush	1	1	1	1								
<i>Vallisneria australis</i> Ribbonweed			2	3		1	1	3	1	1	1	
<i>Nasturtium officinale*</i> Watercress			3	3								
<i>Maidenia rubra</i>					1		1	1		1		

Site 22 – Bundewallah Creek												
Maidenia												

\*Exotic

Table 3-21 Site 25 – Broughton Mill Creek macrophyte and emergent vegetation abundances according to Braun-Blanquet 6-point scale (refer to Section 2.4).

Site 25 – Broughton Mill Creek												
	Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
Species	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance
<i>Ottelia ovalifolia</i> Swamp lily	2	2	1	1	2	3	2	3	3	2	3	2
<i>Sagittaria platyphylla</i> * Sagittaria	2	2	1	1			2	3	3	3	3	3
<i>Glyceria maxima</i> * Reed sweetgrass	2	2	2	2								
<i>Potamogeton crispus</i> Curly Pond Weed					3							
* <i>Elodea canadensis</i> Elodea					3	2	3	5	4	4	2	2
<i>Vallisneria australis</i> Ribbonweed							3	2	2	2	2	1

\*Exotic

Table 3-22 Site 27 – Bundewallah Creek macrophyte and emergent vegetation abundances according to Braun-Blanquet 6-point scale (refer to Section 2.4).

Site 27 – Bundewallah Creek												
	Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
Species	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance
<i>Persicaria dixeyana</i> Slender knotweed	3	3	2	3								
<i>Ludwigia peplodes</i> Water primrose	3	1	1	1								
<i>Lemna disperma</i> Duckweed	2	2	1	2	1	2	1	2	2	1	1	
<i>Juncus usitatus</i> Common rush		1										
* <i>Rorippa palustris</i> Marsh Watercress						1						

Table 3-23 Control Site 1 macrophyte and emergent vegetation abundances according to Braun-Blanquet 6-point scale (refer to Section 2.4)

Control Site 1								
	Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
Species	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance
<i>*Sagittaria platyphylla</i> Sagittaria	3	1	3	3	3	3	2	1
<i>Persicaria strigose</i> Knotweed	1	1	1	1	2	2	2	2
<i>Ottelia ovalifolia</i> Swamp Lily	1	1						
<i>Maidenia rubra</i> Maidenia	1	1	1	1	1	1		
<i>*Myriophyllum aquaticum</i> Parrots feather	1	1	1	1	1	1	1	
<i>Vallisneria australis</i> Ribbonweed	1	1	1	1	1	1	1	1
<i>Triglochin procerum</i> Water ribbon	1	1						
<i>Eleocharis acuta</i> Common Spike-rush		3	2	2	2	2	2	1

Table 3-24 Control Site 2 macrophyte and emergent vegetation abundances according to Braun-Blanquet 6-point scale (refer to Section 2.4)

Control Site 2								
Species	Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance	Session 1 Abundance	Session 2 Abundance
* <i>Sagittaria platyphylla</i> Sagittaria			2	2	2	2	2	1
<i>Eleocharis acuta</i> Common Spike-rush			1					
<i>Eleocharis sphacelata</i> Tall Spike-rush				2		1	1	1
* <i>Colocasia sp.</i> Elephant's Ear				1				
<i>Ottelia ovalifolia</i> Swamp Lily				3	2		1	

A total of 13 different species were recorded during 2017 across all sites, compared to 10 species in 2016, and 14 species during 2015. Of the 13 species recorded in 2017, five were exotic species. Sites included between 1 and 5 species at any one time. Overall abundance was generally similar to the 2016 results, however most sites showed a decrease in abundance or a lack of some species during the later (spring) survey sessions. It is considered likely that low water levels would be contributing to the changes in species composition and abundance, and potentially high rainfall events could wash away species not well established at sites. One new exotic species was identified at Site 16 (*Watercress Rorippa nasturtium-aquaticum*\*).

A total of eight species, including two exotic species, were recorded at the control sites in 2017. Six of these species occurred in Control Site 1 alone, which had a variable abundance of species throughout 2017 with some species such as *Sagittaria Sagittaria platyphylla*\* declining from autumn to spring.

No data was collected during the preconstruction surveys and therefore current data cannot be compared.

### 3.4 MACROINVERTEBRATES

The following presents the macroinvertebrate results of each site during each session.

Table 3-25 Site 13 – Broughton Creek macroinvertebrates

Site13 – Broughton Creek														
	Preconstruction survey <sup>1</sup>		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
<b>SIGNAL score<sup>2</sup></b>	Approx. 3.3 Severe	Approx. 4.2 Moderate	4.94 Moderate	4.75 Moderate	5.17 Mild	5.66 Mild	5.1 Mild	5.27 Mild	4.89 Moderate	4.49 Moderate	5.04 Mild	5.07 Mild	4.76 Moderate	5.13 Mild
<b>EPT score</b>	8 Fair	4 Poor	8 Fair	6 Poor	8 Fair	9 Fair	9 Fair	9 Fair	9 Fair	11 Fair	6 Poor	8 Fair	8 Fair	5 Poor
<b>Number of taxa</b>	6	6	21	18	25	20	22	24	31	29	23	23	26	23

Note 1 Site 13 during preconstruction was located upstream of 2015 surveys

Note 2 Preconstruction, 2016 and 2017 results are SIGNAL2 scores. 2015 results are SIGNAL scores

Table 3-26 Site 16 – Broughton Creek macroinvertebrates

Site 16 – Broughton Creek														
	Preconstruction survey		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
<b>SIGNAL score<sup>1</sup></b>	Approx. 4.2 Moderate	Approx. 2.9 Severe	4.47 Moderate	4.99 Moderate	4.66 Moderate	4.55 Moderate	4.84 Moderate	5.30 Mild	4.58 Moderate	4.63 Moderate	5.07 Mild	5.18 Mild	5.37 Mild	4.72 Moderate
<b>EPT score</b>	3 Poor	0 Poor	8 Fair	11 Fair	9 Fair	6 Poor	8 Fair	9 Fair	11 Fair	9 Fair	8 Fair	8 Fair	8 Fair	6 Poor
<b>Number of taxa</b>	8	4	20	22	30	15	16	24	37	26	28	26	17	19

Note 1 Preconstruction, 2016 and 2017 results are SIGNAL2 scores. 2015 results are SIGNAL scores



Table 3-27 Site 17 – Broughton Creek macroinvertebrates

Site 17 – Broughton Creek														
	Preconstruction survey		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
<b>SIGNAL score<sup>1</sup></b>	N/A	Approx.2.9 Severe	NA	5.28 Mild	4.88 Moderate	4.74 Moderate	4.96 Moderate	5.08 Mild	4.88 Moderate	4.24 Moderate	5.03 Mild	5.43 Mild	4.76 Moderate	4.86 Moderate
<b>EPT score</b>	N/A	7 Fair	NA	8 Fair	10 Fair	6 Poor	9 Fair	8 Fair	8 Fair	10 Fair	7 Fair	9 Fair	6 Poor	5 Poor
<b>Number of taxa</b>	N/A	N/A	NA	16	29	19	23	20	31	28	21	21	18	23

Note 1 Preconstruction, 2016 and 2017 results are SIGNAL2 scores. 2015 results are SIGNAL scores

Table 3-28 Site 22 – Bundewallah Creek macroinvertebrates

Site 22 – Bundewallah Creek														
	Preconstruction survey		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
<b>SIGNAL score<sup>1</sup></b>	Approx. 4.2 Moderate	Approx. 3 Severe	4.64 Moderate	4.26 Moderate	4.44 Moderate	3.71 Severe	5.27 Mild	4.23 Moderate	4.49 Moderate	3.63 Severe	4.05 Moderate	4.27 Moderate	3.82 Severe	3.11 Severe
<b>EPT score</b>	2 Poor	4 Poor	7 Fair	6 Poor	6 Poor	6 Poor	6 Poor	8 Fair	6 Poor	1 Poor	7 Fair	7 Fair	4 Poor	4 Poor
<b>Number of taxa</b>	4	8	24	17	27	17	21	25	28	10	23	22	17	17

Note 1 Preconstruction, 2016 and 2017 results are SIGNAL2 scores. 2015 results are SIGNAL scores

Table 3-29 Site 25 – Broughton Mill Creek macroinvertebrates

Site 25 – Broughton Mill Creek														
	Preconstruction survey <sup>1</sup>		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
<b>SIGNAL score<sup>2</sup></b>	Approx. 3.5 Severe	Approx. 3.3 Severe	4.46 Moderate	4.93 Moderate	4.70 Moderate	3.57 Severe	4.96 Moderate	5.03 Mild	4.88 Moderate	4.53 Moderate	4.93 Moderate	5.19 Mild	4.05 Moderate	4.01 Moderate
<b>EPT score</b>	4 Poor	1 Poor	7 Fair	8 Fair	8 Fair	5 Poor	6 Poor	10 Fair	10 Fair	10 Fair	8 Fair	12 Fair	7 Fair	3 Poor
<b>Number of taxa</b>	13	4	22	22	25	20	15	28	33	31	29	32	28	24

Note 1 Site 25 during preconstruction was located upstream of 2015 surveys

Note 2 Preconstruction, 2016 and 2017 results are SIGNAL2 scores. 2015 results are SIGNAL scores

Table 3-30 Site 27 – Bundewallah Creek macroinvertebrates

Site 27 – Bundewallah Creek														
	Preconstruction survey		Autumn 2015		Spring 2015		Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
<b>SIGNAL score<sup>1</sup></b>	Approx. 3.6 Severe	Approx. 2.9 Severe	4.96 Moderate	4.98 Moderate	4.79 Moderate	4.75 Moderate	4.98 Moderate	4.64 Moderate	4.63 Moderate	3.32 Severe	5.07 Mild	5.54 Mild	4.51 Moderate	4.61 Moderate
<b>EPT score</b>	2 Poor	0 Poor	9 Fair	8 Fair	9 Fair	6 Poor	5 Poor	9 Fair	8 Fair	3 Poor	9 Fair	10 Fair	6 Poor	5 Poor
<b>Number of taxa</b>	7	4	25	20	25	17	18	28	27	18	31	25	20	26

Note 1 Preconstruction, 2016 and 2017 results are SIGNAL2 scores. 2015 results are SIGNAL scores

Table 3-31 Control Site 1 macroinvertebrates

Control Site 1								
	Autumn 2016		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2 <sup>2</sup>	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
<b>SIGNAL 2 score<sup>1</sup></b>	4.9 Moderate	5.67 Mild	4.95 Moderate	4.55 Moderate	4.63 Moderate	5.46 Mild	4.44 Moderate	4.71 Moderate
<b>EPT score</b>	3 Poor	7 Fair	10 Fair	9 Fair	6 Poor	11 Fair	7 Fair	6 Poor
<b>Number of taxa</b>	6	27	37	33	27	28	28	20

Note 1 1 Preconstruction, 2016 and 2017 results are SIGNAL2 scores

Table 3-32 Control Site 2 macroinvertebrates

Control Site 2								
	Autumn 2016 <sup>2</sup>		Spring 2016		Autumn 2017		Spring 2017	
	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2	Session 1	Session 2
<b>SIGNAL 2 score<sup>1</sup></b>	N/A	N/A	4.7 Moderate	4.3 Moderate	4.74 Moderate	5.25 Mild	5.03 Mild	4.56 Moderate
<b>EPT score</b>	N/A	N/A	8 Fair	9 Fair	8 Fair	8 Fair	8 Fair	5 Poor
<b>Number of taxa</b>	N/A	N/A	32	29	25	28	23	23

Note 1 Preconstruction, 2016 and 2017 results are SIGNAL2 scores

Note 2 Access to Control Site 2 was not granted until Spring 2016

A total of 68 and 61 different taxa were sampled during Autumn and Spring 2017 respectively; this is higher than all previous surveys (31 taxa collected in Spring preconstruction surveys, 46 in Autumn 2015 and 56 in Spring 2015, and 49 in Autumn 2016 and 59 during Spring 2016). However, the number of taxa collected per site and session varied. In previous years there has often been an increase in taxa diversity during Spring, however in 2017 there was a general decline, similar to abundances in 2015 (Figure 3-3). This decline was also evident at the control sites, which indicates that the reasons behind this reduction in the diversity of taxa is unlikely to be related to construction activities. The full list of taxa collected is provided in Appendix D.

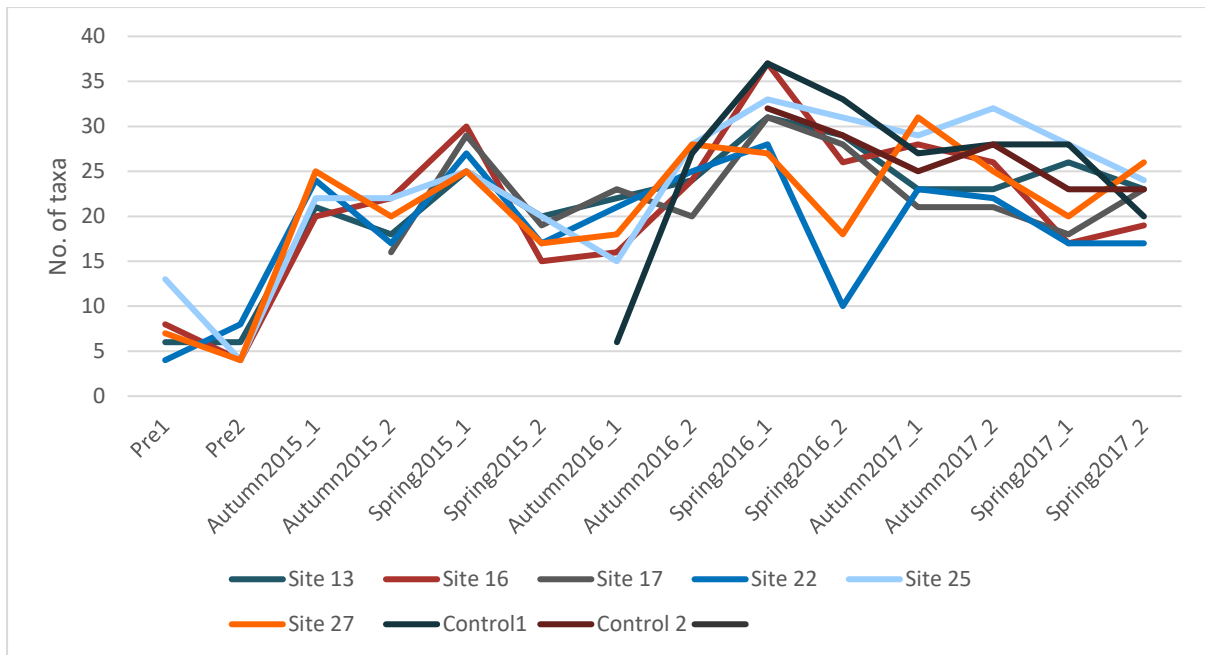


Figure 3-3 Taxa diversity throughout pre-construction and construction periods

The EPT scores indicate that in 2017 the majority of sites were in fair to poor condition and were similar to the 2015 and 2016 results. There was a decline in the EPT scores during Spring 2016 (Session 2) at Site 27 and Site 22, and across all sites in Spring 2017 (Session 2) (Figure 3-4). These reductions in EPT scores occurred when water levels were either low or when there was no flow. Site 22 and Site 27 continue to have low EPT scores, indicative of poor condition sites. The control sites were mostly in fair condition throughout 2017, except for Autumn 2017 where all sites had a reduced EPT score.

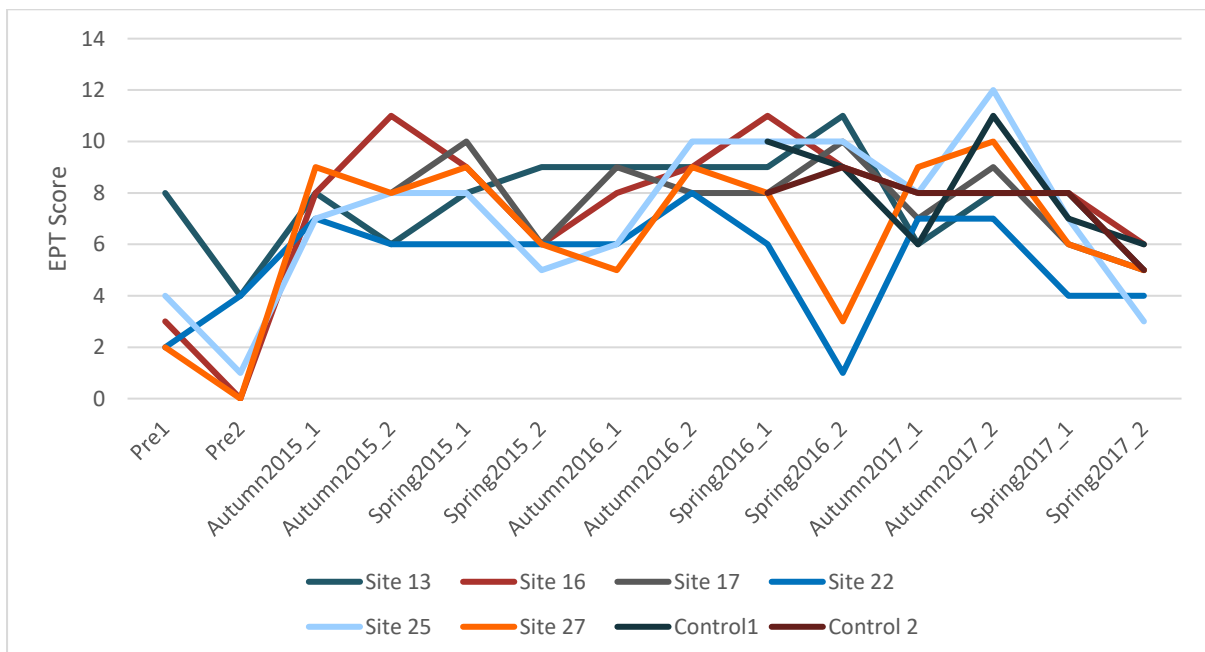


Figure 3-4 EPT Scores through construction and pre-construction periods

The SIGNAL 2 scores indicate the waterways to be generally in a mild or moderate condition, with only two severe pollution conditions occurring at site 22 in Spring 2017 (Session 2). This is similar to both the 2015 and 2016 results where there were severe pollution conditions during Spring at sites 22, 25 and 27. Control sites maintained mild to moderate conditions throughout 2017.

It is not possible to determine the reason for the large increase in diversity between preconstruction surveys and the first three years of construction. It is noted that EPT and SIGNAL scores have generally decreased since the 2016 survey, although they remain higher than the pre-construction period. The presence of water, flow levels, concentration of dissolved oxygen and absence of fish may all be influencing the diversity and abundance of macroinvertebrates.

### 3.5 FISH ASSESSMENT

The following presents the fish assessment results of each site during each session.

Table 3-33 Fish species and abundances recorded at each site (grey shading highlights the pre-construction period)

		Taxa	2015						2016								2017								
			Site 13	Site 16	Site 17	Site 22	Site 25	Site 27	Site 13	Site 16	Site 17	Site 22	Site 25	Site 27	CS1	CS2	Site 13	Site 16	Site 17	Site 22	Site 25	Site 27	CS1	CS2	
Preconstruction	Spring session 1	<i>Atherinosoma microstoma</i> Small-mouthed Hardyhead	2	0	0	0	0	0																	
		<i>Gobiomorphus coxii</i> Cox's Gudgeon	0	0	2	0	0	2																	
		<i>Hypseleotris galli</i> Firetail Gudgeon	1	0	0	5	0	0																	
		<i>Macquaria novemaculeata</i> Australian Bass	0	0	0	0	2	0																	
	Spring session 2	<i>Anguilla australis</i> Short-finned Eel	0	0	0	0	1	0																	
		<i>Atherinosoma microstoma</i> Small-mouthed Hardyhead	3	0	0	0	0	0																	
		<i>Gobiomorphus coxii</i> Cox's Gudgeon	4	0	4	0	0	1																	

			2015						2016						2017									
		<i>Macquaria novemaculeata</i> Australian Bass	0	0	0	0	2	0																
Construction	Autumn Session 1	<i>Macquaria novemaculeata</i> Australian Bass	0	0	N/A	1	3	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
		<i>Gobiomorphus australis</i> Striped Gudgeon	0	0	N/A	0	1	2	0	0	1	2	1	1	0	0	0	0	0	0	0	0	0	0
		<i>Philypnodon grandiceps</i> Flathead Gudgeon	0	0	N/A	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Autumn Session 2	<i>Gobiomorphus australis</i> Striped Gudgeon	1	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		<i>Anguilla reinhardtii</i> Long-finned Eel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Spring session 1	<i>Macquaria novemaculeata</i> Australian Bass	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		<i>Gobiomorphus australis</i> Striped Gudgeon	0	0	0	1	0	1	0	0	0	2	0	3	0	0	0	0	0	0	0	0	0	0
		<i>Philypnodon grandiceps</i> Flathead Gudgeon	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0



		2015						2016						2017									
Spring session 2	<i>Anguilla australis</i> Short finned eel	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1
	<i>Gobiomorphus coxii</i> Cox's Gudgeon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	
	<i>Macquaria novemaculeata</i> Australian Bass	0	0	3	0	0	0	0	0	2	0	2	0	1	0	0	0	0	0	0	0	0	
	<i>Gobiomorphus australis</i> Striped Gudgeon	1	0	0	1	1	3	3	0	1	2	1	1	1	0	0	0	0	0	0	0	0	
	<i>Anguilla australis</i> Short finned eel	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	
	<i>Gobiomorphus coxii</i> Cox's Gudgeon	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	3	1	0	1	
	<i>Philypnodon grandiceps</i> Flathead Gudgeon	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	
	<i>Atherinosoma microstoma</i> Small-mouthed Hardyhead	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
	<i>Anguilla reinhardtii</i> Long-finned Eel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	6	0	0	0	

A small number of fish (16) were collected/observed from three common fish species throughout 2017. A new species observation included the Long-finned Eel (*Anguilla reinhardtii*) which was recorded at Site 16 during Autumn (Session 2) and at Site 13 and Site 22 in Spring (Session 2). The only other fish species observed were Cox's Gudgeon recorded at Site 25, Control Site 1 and Control Site 2 during Spring 2017 (both sessions), and Short-finned Eel from Control Site 1 and Control Site 2 in Spring 2017 (Session 1). Species recorded in previous years that were not recorded in 2017 included Australian Bass, Striped Gudgeon, Firetail Gudgeon, and Small-mouthed Hardyhead.

One 15 cm fish (unidentified) was observed gulping at the surface of the water at Site 27 during Spring Session 2 which is an indication of low dissolved oxygen levels.

There was a reduction in species diversity and abundance recorded in 2017 compared to previous years. This trend was also evident at the control sites which is an indication that factors that may be affecting species diversity and abundance are not a result of construction activities, but may be attributed to conditions of this generally disturbed aquatic ecosystem. Factors that typically influence aquatic ecosystems include water supply, water quality, turbidity, pollution and alien species.

### **3.5.1 Other aquatic fauna**

No additional aquatic fauna were observed during 2017 surveys. A Red-bellied Black Snake (*Pseudechis porphyriacus*) was recorded at Control Site 2 during Spring 2017 (Session 2). A mature Diamond Python *Morelia spilota* was identified in riparian vegetation at Site 17 during Spring 2016. Platypus and a long-necked turtle were recorded in 2015.

### 3.6 COMPARISON WITH PERFORMANCE CRITERIA

The following performance criteria relevant to aquatic monitoring are taken from the EcMP (PB 2014). It should be noted that these do not relate specifically to the construction period monitoring rather they relate to the lifetime of the monitoring program, including post construction.

Table 3-34 Performance criteria

Measure	Performance criteria	Performance target	Comment
Aquatic and riparian monitoring	Water quality maintained between impact sites and control sites as a result of the Project's operations	Water quality is maintained at preconstruction data levels, or increases. Any decrease in water quality does not exceed 10% difference when compared to preconstruction data levels.	The sites are highly disturbed as a result of surrounding land uses. The water quality values at all the sites generally fell outside the ANZECC/ARMCANZ Guideline levels (ANZECC 2000) for disturbed aquatic ecosystems. This occurred during both preconstruction surveys and during construction and is likely a reflection of the agricultural land uses in the catchment.  Control site 1 was monitored in Autumn and Spring 2016, however Control site 2 was only approved for survey by Fulton Hogan during Spring 2016.
	No emergent vegetation or macrophyte dieback	None observed during the life of the monitoring program.	A total of 13 different species were recorded during 2017 across all sites, compared to 10 species in 2016, and 14 species during 2015. Some sites seemed to experience some dieback with some species disappearing and reappearing and/or other species appearing. This could be due to natural temporal variations. No data from preconstruction monitoring on macrophytes and emergent vegetation was available to make comparisons.
	Macroinvertebrates maintained	Macroinvertebrates are maintained at preconstruction data levels, or increase during the life of the monitoring program. Any decrease in macroinvertebrates does not exceed 20% difference when compared to preconstruction data levels.	Diversity at each site was higher than during preconstruction surveys.  The EPT scores of the current survey indicate that the majority of the sites were in fair to poor condition, which is similar to the 2015 and 2016 surveys, and better than preconstruction surveys.  The SIGNAL scores indicate the waterways are generally in a mild or moderate condition, with only two severe pollution conditions occurring at site 22 during Spring 2017 (Session 2). This is comparable with the preconstruction, 2015 and 2016 survey results.
	Native fish species diversity maintained	Fish species diversity is maintained at preconstruction data levels, or increases during the life of the monitoring program. Any decrease	Compared to preconstruction, 2015 and 2016 surveys, there was a reduction in the abundance and diversity of fish species observed. Only the Short-finned Eel, Long-finned Eel and Cox's Gudgeon were recorded. This species diversity of 3 is compared to a species diversity of 4 during pre-construction monitoring, which would be considered a 25% loss.

Measure	Performance criteria	Performance target	Comment
		in fish species diversity does not exceed 20% difference when compared to preconstruction data levels.	However, this reduction in species diversity and abundance is also evident at the Control Sites, therefore it is unlikely to be as a result of construction activities.

## 4 REVIEW OF MITIGATION MEASURES

The EcMP and the CFFMP, including the Weed Management Plan, include a number of mitigation measures and actions from the environmental assessment and Statement of Commitments to be undertaken to avoid and/or minimise water quality and aquatic biodiversity impacts during construction. These are detailed in Table 4-1 along with notes on whether these have been implemented.

Table 4-1 Mitigation measures

Mitigation measure	Implementation
<b>EcMP</b>	
Consider lopping or relocation of large woody debris in streams as a first priority before removal. Should removal of large woody debris be necessary, consider the introduction of engineered woody debris as compensation within the offset strategy for residual impacts.	Cut stump methodology has been used to retain root balls in situ around waterways. Coarse woody debris has been salvaged and has been re-introduced to the project during stream rehabilitation works.
Consult with the DPI (Fishing and Aquaculture) for input in relation to matters relevant to Fisheries, where appropriate	DPI and Fisheries attended the project four times in 2015 and on at least three occasions in 2016 and 2017. They have also been consulted periodically via email and on the telephone for all creek works.
Where feasible use low hollow-core bridges or short lengths of pipe culverts for temporary crossings to maintain fish passage with reference to guidelines for the design and construction of waterway crossings to maintain fish passage.	Fish passage in the major creeks of the project has been maintained through the construction of temporary bridges. These bridges allow for full connectivity of upstream and downstream flows and have been installed at; Broughton Creek 1, Broughton Creek 2, Broughton Mill Creek, The other main creek on the project Bundewallah Creek had piped culverts installed below the waterline so passage for fish is maintained. This crossing was approved by NSW DPI Fisheries. All other waterways on the project are ephemeral.
Manage weeds where identified	Weed management is ongoing across the site in accordance with the CFFMP and relevant legislation. Specific details on weed management can be assessed in the Weed monitoring report.
Minimise impacts to water quality during operation of the project through the combination of swales, water quality basins and biofiltration.	The operational design includes the following water quality features: Basins Bioswales Vegetated swales Hard rock scour protection

Mitigation measure	Implementation
	The effectiveness of these design features can be assessed during the operational phase of the project.
Implement erosion and scour protection in the design and construction of bridges and culverts. Manage erosion and sedimentation impacts and conduct surface water quality monitoring during construction of the project to monitor water quality	A PESCP has been prepared and implemented across the site. EWMS's have been prepared and implemented during works within and adjacent to waterways. All bridge structures have scour protection designed around them. Surface water quality monitoring completed throughout 2017 did not show any impacts on the receiving waterways which can be attributed to construction. Poor water quality is attributable to low water flows during spring 2017.
Design transverse drainage structures to allow unrestricted passage of most natural flows and allow for changes in the natural flow regime as a result of climate change. This would be achieved by designing bridges and culverts to provide flood immunity from the 100 year flood event and the 50 year flood event respectively.	This has been completed and is included in the design at Broughton Creek, Bundewallah Creek and Broughton Mill creek.
In areas close to or upstream from sensitive receiving waters, implement additional treatment measures to ensure no net increase in pollutant load from road runoff.	Pollution control basins and attenuation swales have been designed to manage long term road runoff pollutants.
Conduct regular water quality monitoring in accordance with the Foxground and Berry Bypass Water Quality Monitoring Program (GHD, 2014).	Ongoing. Monitoring completed to date.
Conduct aquatic ecology monitoring during the pre-construction, construction and operational periods.	Ongoing. Monitoring completed to date.
Periodically review and evaluate the results of the monitoring to identify improvements to existing mitigation measures or maintenance regimes. Use the results of the monitoring to identify the need for additional mitigation or management responses to address any unforeseen impacts on biodiversity.	Ongoing. Refer to this annual report and the 2015 and 2016 annual reports.
<b>CFFMP</b>	
Periodically review and evaluate the results of the monitoring to identify improvements to existing mitigation measures or maintenance regimes. Use the results of the monitoring to identify the need for additional mitigation or management responses to address any unforeseen impacts on biodiversity.	Additional controls will be put in place where monitoring shows they are required. Current results at this stage do not indicate that additional controls are required.
Retain stumps in riparian zones and aquatic habitats where practicable to reduce the potential for bank erosion. Even dead stumps and root systems may act to reduce erosion during construction and operation periods.	Cut stump clearing has been undertaken across the project within 5 m of waterways as a minimum.

Mitigation measure	Implementation
Subject to consultation with NOW and DPI (Fishing and Aquaculture), utilise trees removed as a consequence of the project for fish habitat and bank stability within the creeks of the project area.	Coarse woody debris has been salvaged and has been re-introduced to the project as part of the creek rehabilitation works. Riparian rehabilitation is complete, DPI (fisheries) and NSW Office of Water visited site in late 2017 for a completion inspection on all riparian corridors within the Project's boundary.
For temporary water crossings over all Class 1 and 2 waterways install temporary bridge structures instead of box culverts to reduce the potential for scouring.	Temporary bridge structures were installed over Broughton Creek crossing one and two, and Broughton Mill creek.
Follow the relevant EWMS and PESCP for the construction of all temporary bridges to minimise the potential of erosion and sedimentation impacts.	Adhered to.
Locate all refuelling areas at least 50 metres away from waterways.	Refuelling of mobile plant is undertaken more than 50 m from a waterway. Cranes, pilling rigs and other less mobile plant is refuelled closer than 50 m to the waterway in accordance with the Fulton Hogan refuelling procedure.
Progressively revegetate batters and other disturbed areas with cover crop species to stabilise the soil and provide vegetation cover as a method to minimise sedimentation of waterways and impacts on fish. Use Rye Corn during the months of April to August or Japanese Millet during the months of September to March. Also refer to the UDLP where necessary.	Cover crops are applied to temporarily stabilise batters, design seed is applied as efficiently as construction allows in all areas.

## 5 RECOMMENDATIONS

The safeguards detailed in Section 4 should continue to be implemented. No additional safeguards are currently required. Monitoring should continue in accordance with the Ecological monitoring program (Parsons Brinkerhoff 2014).

## 6 REFERENCES

- ANZECC/ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1 Chapters 1-7.
- Fulton Hogan (2014). Construction Flora and Fauna Management Sub-plan, Foxground and Berry bypass
- JSA (2016). Berry to Foxground Princes Highway upgrade pre-construction aquatic assessment.
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- NGH Environmental (2015). Foxground to Berry Bypass Aquatic Monitoring Annual Report 2015.
- NGH Environmental (2017). Foxground to Berry Bypass Aquatic Monitoring Annual Report 2016.
- Parsons Brinkerhoff (2014). Ecological Monitoring Program, Princess Highway Upgrade Foxground and Berry bypass
- Roads and Maritime Services (2011). Biodiversity Guidelines



## APPENDIX A MONITORING SITES

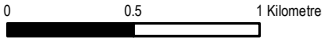


**Study sites**

Aquatic monitoring

- Monitoring sites
- Control sites

Notes:  
- Data collected by nghenvironmental (2016)  
- Client data courtesy of Client, received 2016  
- Base map Copyright © Esri and its data suppliers.



A3 @ 1:30000  
Ref: Study Sites 2016  
Author: MH






## **APPENDIX B MACROPHYTE AND EMERGENT VEGETATION TRANSECT LOCATIONS**



## Site 13

Aquatic monitoring

-  Vegetation transect locations
-  Project boundary
-  Water course

Notes:  
- Data collected by nghenvironmental (2016)  
- Client data courtesy of Client, received 2016  
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0 37.5 75 150 Meters

A3 @ 1:3000  
Ref: Site 13 2016  
Author: MH

 ngh environmental



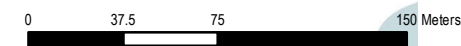
# Site 16

Aquatic monitoring



- Vegetation transect locations
- Project\_boundary
- Water course

Notes:  
- Data collected by nghenvironmental (2016)  
- Client data courtesy of Client, received 2016  
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A3 @ 1:3000  
Ref: Site 16 2016  
Author: MH



## Site 17

Aquatic monitoring

- Vegetation transect locations
- Project\_boundary
- Water course

Notes:  
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0 37.5 75 150 Meters

A3 @ 1:4000  
Ref: Site 17 2016  
Author: MH




ngh environmental





## Site 22

Aquatic monitoring

-  Vegetation transect locations
-  Project\_boundary
-  Watercourse

Notes:  
- Data collected by nghenvironmental (2016)  
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0 50 100 200 Meters

A3 @ 1:4000  
Ref: Site 22 2016  
Author: MH

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## Site 25 & 27

Aquatic monitoring



- Vegetation\_transect\_locations
- Project\_boundary
- Water course

Notes:  
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A3 @ 1:2500  
Ref: Site 25 & 27 2016  
Author: MH

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### Control site 1

Aquatic monitoring

- Vegetation\_transect\_locations
- Project\_boundary
- Water course

Notes:

- Data collected by nghenvironmental (2016)
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
A3 @ 1:2500  
 Ref: Control site 1 2016  
 Author: MH





## Control site 2

Aquatic monitoring

-  Vegetation transect locations
-  Project boundary
-  Water course

Notes:  
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A3 @ 1:4000  
Ref: Control site 2 2016  
Author: MH

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## APPENDIX C SITE PHOTOGRAPHS

Site 13 (Autumn Session 1)



Site 13 (Spring session 1)



Site 13 (Autumn Session 2)



Site 13 (Spring Session 2)



Site 16 (Spring Session 1)



Site 16 (Autumn Session 2)



Site 16 (Spring Session 2)



Site 17 (Autumn Session 1)



Site 17 (Spring Session 1)



Site 17 (Autumn Session 2)



Site 17 (Spring Session 2)



Site 22 (Autumn session 1)



Site 22 (Spring Session 1)



Site 22 (Autumn Session 2)



Site 25 (Autumn session 1)



Site 25 (Spring Session 1)



Site 25 (Autumn Session 2)



Site 25 (Spring Session 2)





Site 27 (Autumn Session 1)



Site 27 (Spring Session 1)



Site 27 (Autumn Session 2)



Site 27 (Spring Session 2)



<p>Control Site 1 (Autumn Session 1)</p>	<p>Control Site 1 (Spring Session 1)</p>
	
	<p>Control Site 1 (Spring Session 2)</p> 

Control Site 2 (Autumn session 1)	Control Site 2 (Spring Session 1)
 A photograph of a river flowing through a dense forest. The water is calm and reflects the surrounding green trees and sky. The banks are lined with rocks and lush vegetation.	 A photograph of a riverbank with a large, mature tree in the foreground. The water is dark and reflects the sky. The background shows a dense forest of trees.
Control Site 2 (Autumn Session 2)	Control Site 2 (Spring Session 2)
 A photograph of a river flowing through a dense forest. The water is calm and reflects the surrounding green trees and sky. The banks are lined with rocks and lush vegetation.	 A photograph of a riverbank with a large, mature tree in the foreground. The water is dark and reflects the sky. The background shows a dense forest of trees.

## APPENDIX D MACROINVERTEBRATE DATA





# Weed Monitoring 2017 Report

FOXGROUND AND BERRY BYPASS



MARCH 2018



## Document Verification



Project Title: Foxground and Berry Bypass

Project Number: 5837

Project File Name: Weed Monitoring Final Report 2017

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
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# 1 INTRODUCTION

Roads and Maritime Services (Roads and Maritime) contracted Fulton Hogan to upgrade 12.5 km of the Princes Highway between Toolijooa Road north of Foxground, to Schofields Lane (the Foxground and Berry Bypass Project) and between Schofields Lane to Croziers Lane south of Berry (the Southern Extension) (Figure 1-1).

NGH Environmental were engaged by Fulton Hogan to provide ecological services during the construction period. Services provided by NGH Environmental included the following:

- Preclearing and clearing services
- Ecological monitoring including:
  - Nest box monitoring
  - Aquatic monitoring
  - Weed monitoring
- Specialist advice on ecological matters as required by Fulton Hogan

## 1.1 PURPOSE OF THE REPORT

A number of requirements regarding the management of weeds during the construction period are outlined in the following documents:

- Minister’s Conditions of Approval (CoA)
- The Roads and Maritime Statement of Commitments (SoC)
- The mitigation measures listed in the Foxground and Berry bypass Environmental Assessment (EA) (AECOM, 2012)

The Construction Flora and Fauna Management sub-plan (CFFMP) (FH 2014) and Ecological Monitoring Program (EcMP) (PB 2014) prepared for the project details the actions that need to be taken to meet those requirements.

In accordance with Section 6.2 of the EcMP (PB 2014), annual reporting is to be completed for all monitoring surveys outlined in the EcMP. This includes weed monitoring during the construction period.

The EcMP requires that the following monitoring be undertaken during the construction period:

Timing and frequency	Monitoring method	Data to be collected	Reporting
Monitoring throughout the construction phase in accordance with CFFMP.	<p>Conduct construction monitoring of weeds during construction phase of the Project to identify the introduction/spread of weed species.</p> <p>Refer to CFFMP for additional detail on construction weed monitoring requirements.</p>	<p>On visual inspection of the study area the following weed data would be collected:</p> <ul style="list-style-type: none"> <li>• Species of weeds identified</li> <li>• Extent of infestations – cover and abundance</li> <li>• Extent of previously identified weed infestations – map if possible.</li> </ul>	Results included in Annual Monitoring Report

Appendix F of the CFFMP includes a weed management plan which provides further details on weed monitoring requirements. They include:

*The Environmental Manager/EO will undertake a 'joint inspection' with the Project Ecologist and Roads and Maritime Services Representative to inspect the area for weeds:*

- *prior to clearing and grubbing*
- *prior to drainage works or change in drainage that may facilitate the distribution of weed seeds or high level of nutrients*
- *when a potential weed infestation has been identified*
- *Before spring (around August) to identify weeds before they go to flower and seed*

*Infestations of noxious weeds and Weeds of National Significance (WONS) will be mapped with GPS by the Project Ecologist during the joint site inspection including noting the specie(s) degree of infestation and capturing an image for monitoring purposes.*

The annual reports must include the following information:

- Introduction – background description of the monitoring session (refer to Section 1)
- Methodology – description of methodology undertaken including site location and specific survey site locations (refer to Section 2)
- Results and discussion – description of monitoring results and comparison of results to performance indicators (refer to Section 3)
- Review of mitigation measures – the effectiveness of each mitigation measure will be reviewed (where appropriate) at the end of the monitoring period (refer to Section 4)
- Recommendations – suggestion of adaptive responses and contingency measures potentially required (where appropriate) based on the results of the monitoring session such as the implementation of contingency measures or modification of monitoring timing, frequency or methodology (refer to Section 5).

As this is the third and final year of construction for the project, this report not only details the results of the third year (2017) of monitoring but also discusses full construction period outcomes.

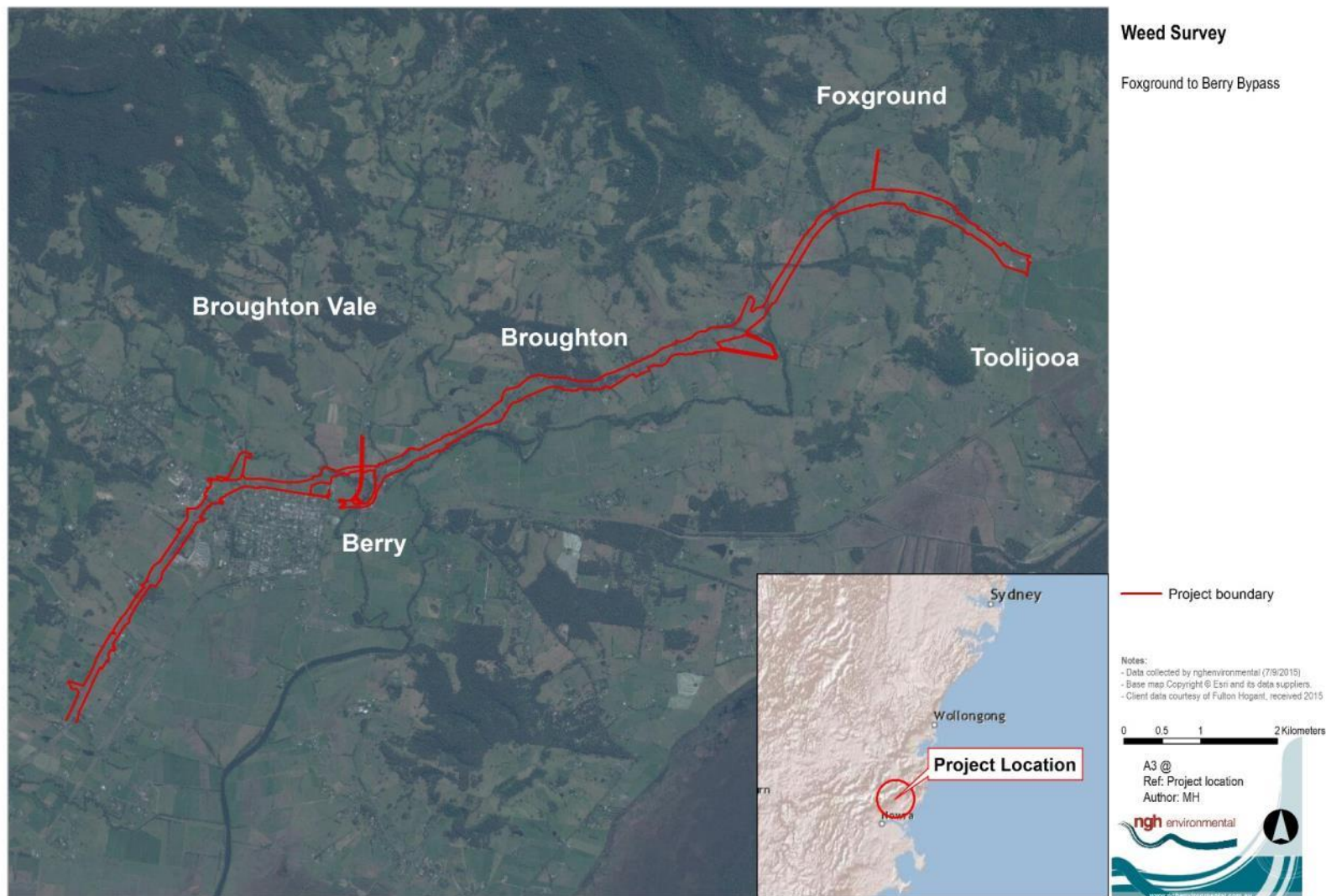


Figure 1-1 Location of the Foxground and Berry Bypass Project

## 2 MONITORING METHODOLOGY

### 2.1 ANNUAL SURVEY

A systematic weed survey was conducted at all survey locations by an ecologist on the 26<sup>th</sup> September 2017 for the third year of construction ( Figure 2-11 to Figure 2-4).

The survey was used to determine weed species presence, abundances, and to map the distribution of weed infestations. Data was collected using a Global Positioning System (GPS) enabled tablet running ESRI ArcGIS and GIS mapping software. The tablet was pre-loaded with topographic, aerial imagery and the project boundary base layer. At each survey point a photograph was taken in order to capture any temporal changes in land condition and weeds species composition for future monitoring events. Polygons were drawn around areas of weeds observed during the survey to capture the identity of weed species present and their abundances. The polygons were saved directly to a GIS shapefile. Weed species targeted in this survey included:

- those that were declared noxious in the Local Control Authority area of the Illawarra District Weeds Authority and Shoalhaven City Council under the repealed *Noxious Weeds Act 1993* (NW Act) for providing comparison with previous year's monitoring reports;
- those listed as Priority Weeds for the South-east region under the new *Biosecurity Act 2015* (BS Act);
- Weeds of National Significance (WoNS); and
- environmental weeds

Documented waypoints in this report signify the approximate location of each survey point where each site photograph was taken rather than the location of each individual weed. A brief site description was recorded where possible to aid with record keeping and as a basis for future management decisions.

Areas where there was no obvious evidence of weed infestation (i.e. areas that had recently been grubbed and graded and contained only bare soil) were not surveyed and have been mapped as indicating that no weeds were present. All non-native species that were used as cover crops for bank stabilisation purposes were not considered as weed species and have therefore not been mapped as such throughout this report.

### 2.2 SURVEY LIMITATIONS

The site presents varying degrees of non-uniformity for weed species that can change with seasons. Therefore, the results of this report are only indicative of the environmental conditions within the construction footprint at the time of survey. It should also be recognised that the time in which the survey was conducted was suitable to detect a range of weed species over the construction footprint.

As much of the construction for the project has been completed, some monitoring points were not as accessible as they had been before. This was due to various reasons including safety (at the time of the survey much of the road alignment had a speed limit of 80 kilometres per hour) or the presence of fauna exclusion fencing blocking access. In instances where a monitoring point could not be accessed, a photo was taken of the general area to which that monitoring point references and observations were made from a distance.

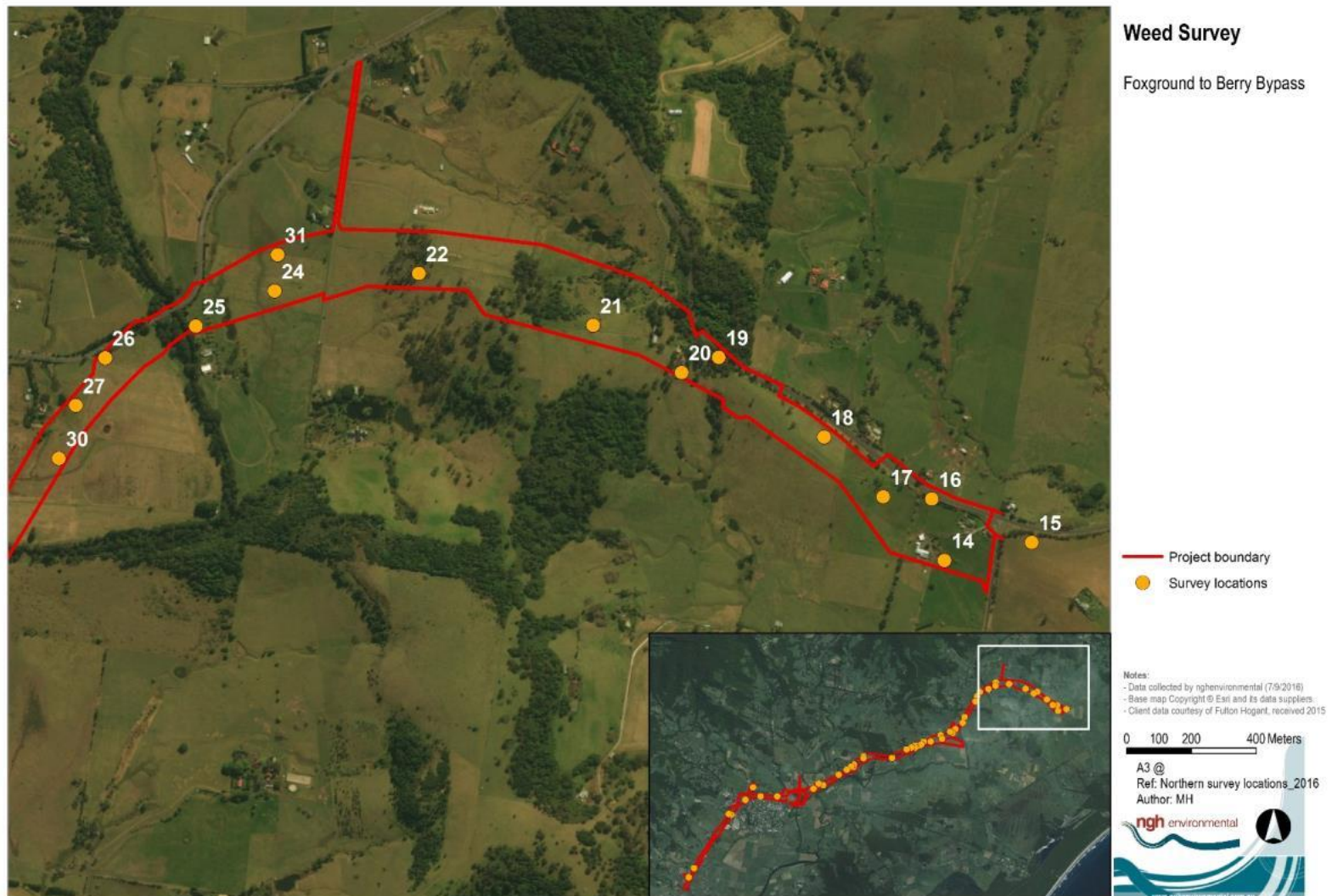


Figure 2-1 Northern survey locations

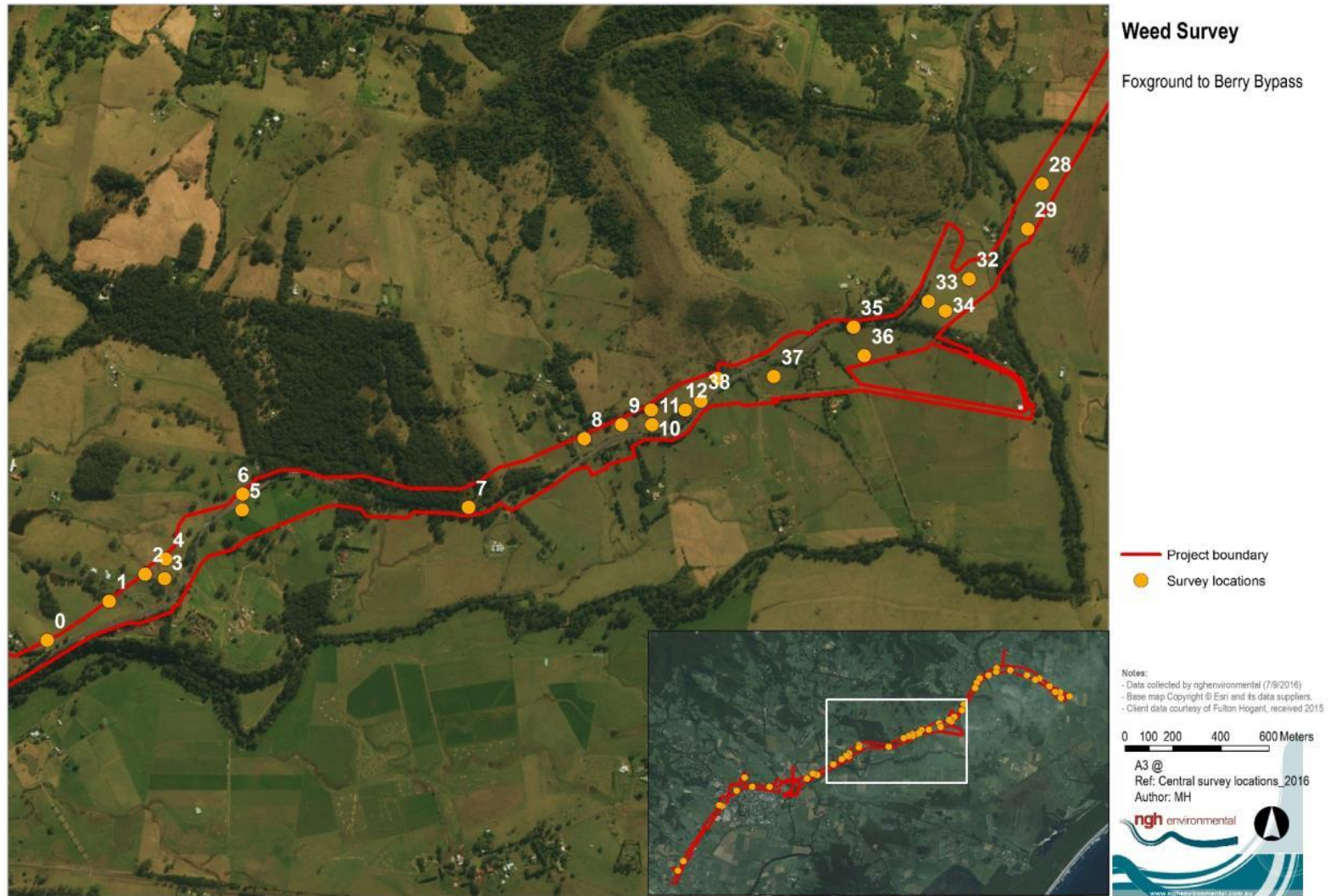


Figure 2-2 Central survey locations



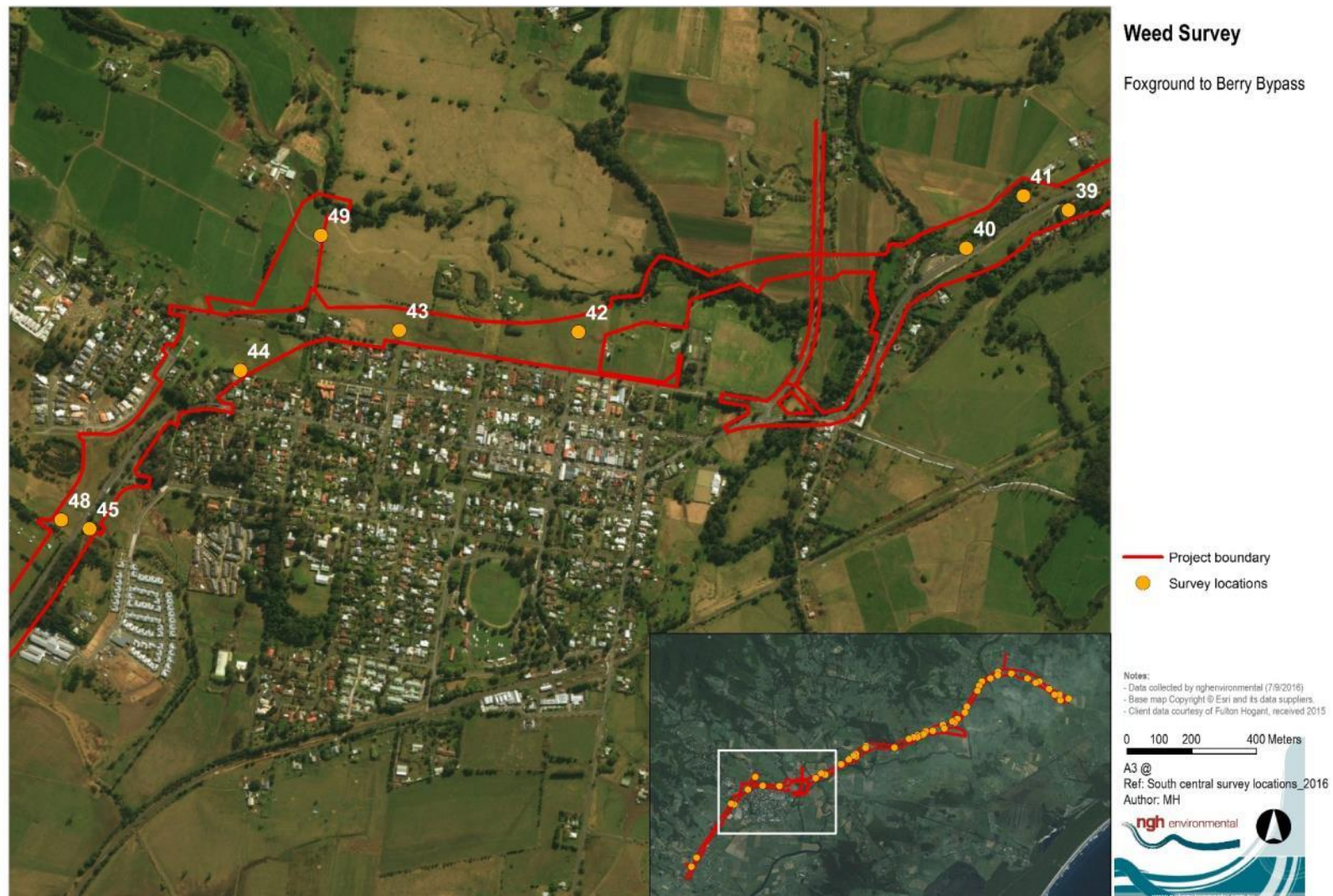


Figure 2-3 South central survey locations

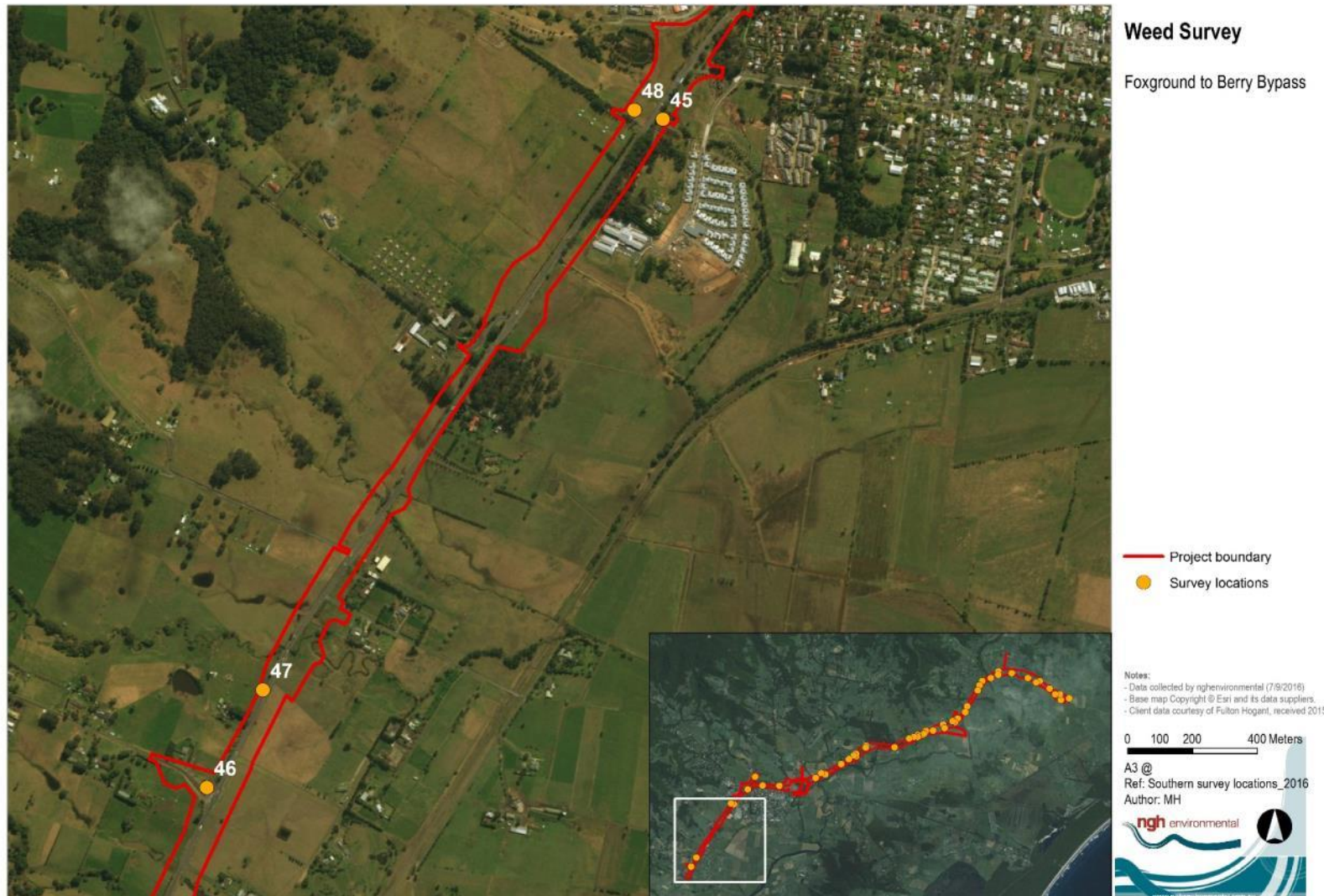


Figure 2-4 Southern survey locations

## 3 RESULTS AND DISCUSSION

### 3.1 PRECONSTRUCTION ENVIRONMENT

The CFFMP identified seventeen exotic weed species within the Foxground and Berry Bypass project area and surrounds during the planning stage of the project. These seventeen species were classified in accordance with the *Noxious Weeds Act 1993* (NW Act), of which nine were classified noxious (eight Class 4 and one Class 5) in the Illawarra and Shoalhaven LGAs. Four species were also noted as Weeds of National Significance (WoNS) and eight listed as environmental weeds (Table 3-1).

The NW Act has been repealed and replaced by the *Biosecurity Act 2015* (Biosecurity Act) as of July 1<sup>st</sup>, 2017. The Biosecurity Act allows for a different framework for classifying exotic flora, now referred to as Priority Weeds. Figure 3-1 below details the two different classifications for the seventeen species identified by the CFFMP, with Priority Weed listings drawn from the South-East region. Given that the previous two monitoring reports were prepared under the NW Act, classification is given for both pieces of legislation hereafter in this report.

Table 3-1 Weeds of National Significance, Noxious, Priority and environmental weed species previously recorded in the Foxground and Berry Bypass project area.

Weed Species	Common name	Environmental Weed	WoNS	Noxious Weed Class (pre-July 2017)	Priority Weed Duty (Biosecurity Act)
<i>Ageratina adenophora</i>	Crofton Weed	X			
<i>Ageratina riparia</i>	Mistflower	X			
<i>Bidens pilosa</i>	Cobbler's Pegs	X			
<i>Cinnamomum camphora</i>	Camphor Laurel	X			
<i>Cirsium vulgare</i>	Spear Thistle	X			
<i>Ehrharta erecta</i>	Panic Veldtgrass	X			
<i>Lantana camara</i>	Lantana		X	4	Prohibition on dealings
<i>Ligustrum lucidum</i>	Large-leaved Privet			4	
<i>Ligustrum sinense</i>	Small-leaved Privet			4	
<i>Lucidum ferocissimum</i>	African Boxthorn		X	3	Prohibition on dealings
<i>Pennisetum clandestinum</i>	Kikuyu Grass	X			

Weed Species	Common name	Environmental Weed	WoNS	Noxious Weed Class (pre-July 2017)	Priority Weed Duty (Biosecurity Act)
<i>Rubus fruticosus</i>	Blackberry		X	4	Prohibition on dealings
<i>Salix spp.</i>	Willow			4	Prohibition on dealings
<i>Senecio madagascariensis</i>	Fireweed		X	4	Prohibition on dealings
<i>Solanum mauritianum</i>	Wild Tobacco	X			
<i>Solanum pseudocapsicum</i>	Madeira Winter Cherry	X			
<i>Tradescantia fluminensis</i>	Wandering Jew	X			

WoNS – Weeds of National Significance

Noxious Weed Class – as listed under the repealed NW Act for listed the Illawarra and Shoalhaven LGAs

Priority Weed Duty – as listed under the Biosecurity Act for the South-east Region

## 3.2 2017 WEED MONITORING SURVEY RESULTS

The following sections provide the location, distribution and abundances of exotic species recorded during the third year of monitoring (2017).

### 3.2.1 Distribution Mapping

Figures 3-1 to 3-8 below illustrate the distribution of weeds recorded during the 2017 monitoring session.

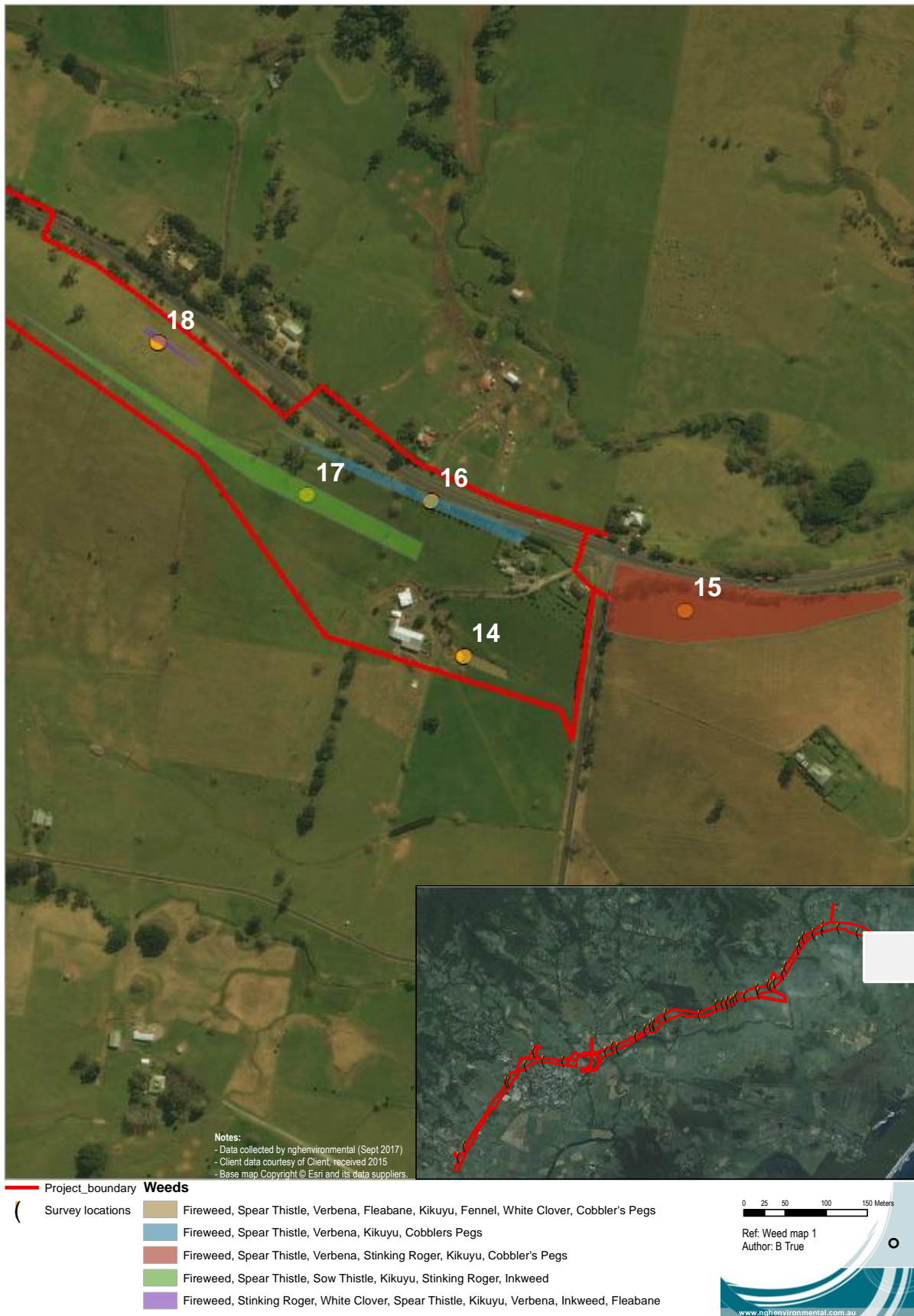


Figure 3-1 Weed distribution map 1

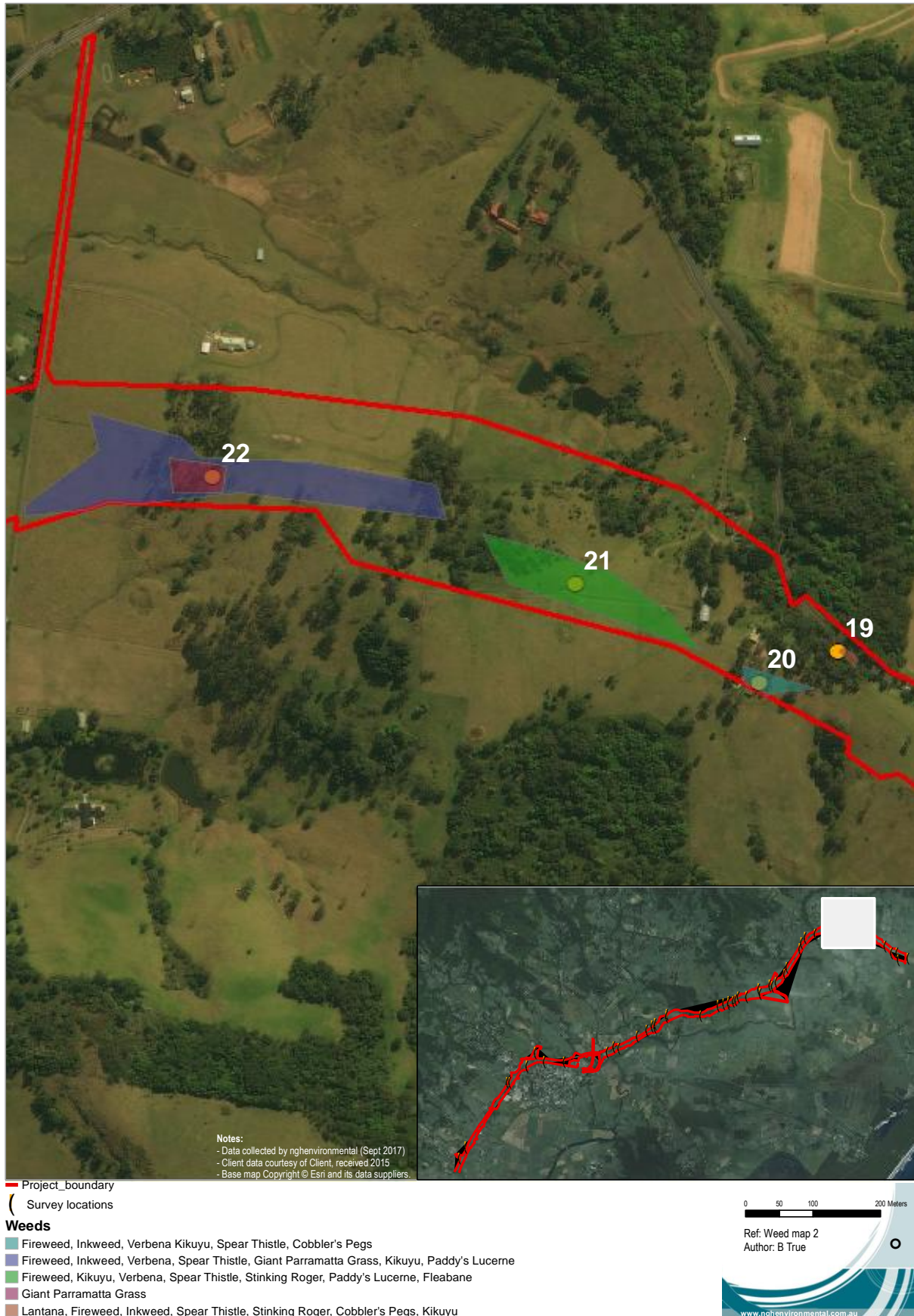


Figure 3-2 Weed distribution map 2

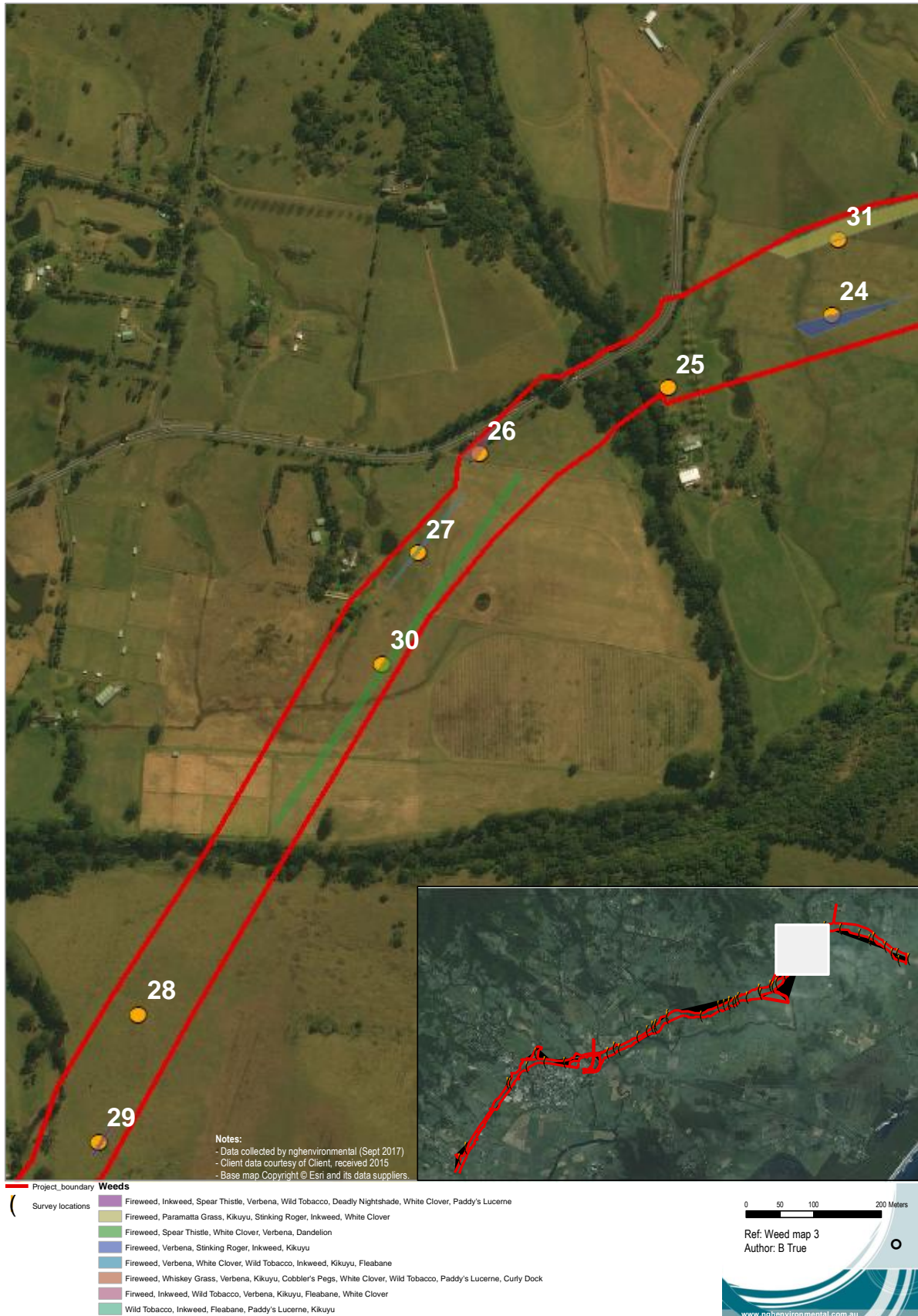


Figure 3-3 Weed distribution map 3

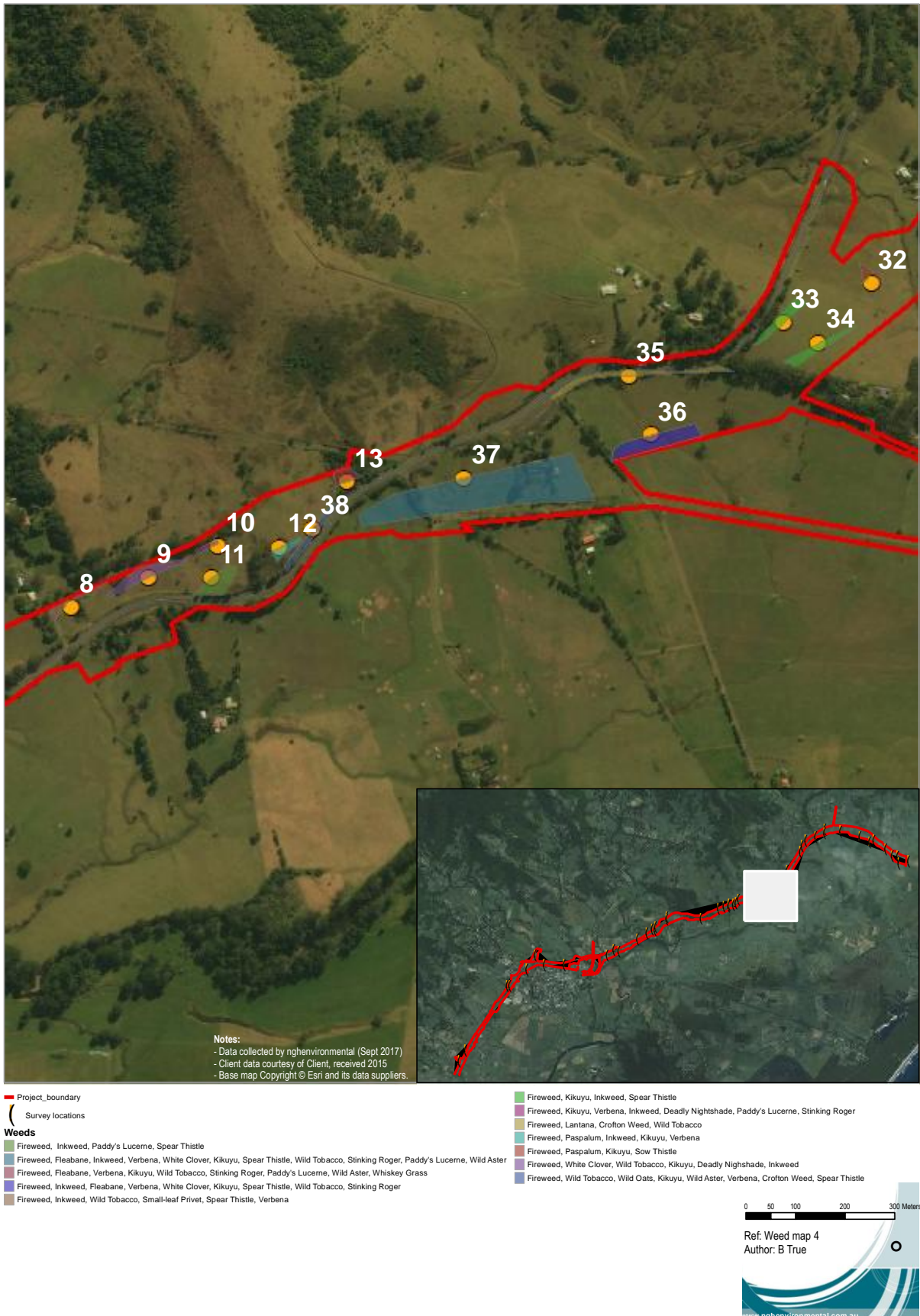


Figure 3-4 Weed distribution map 4



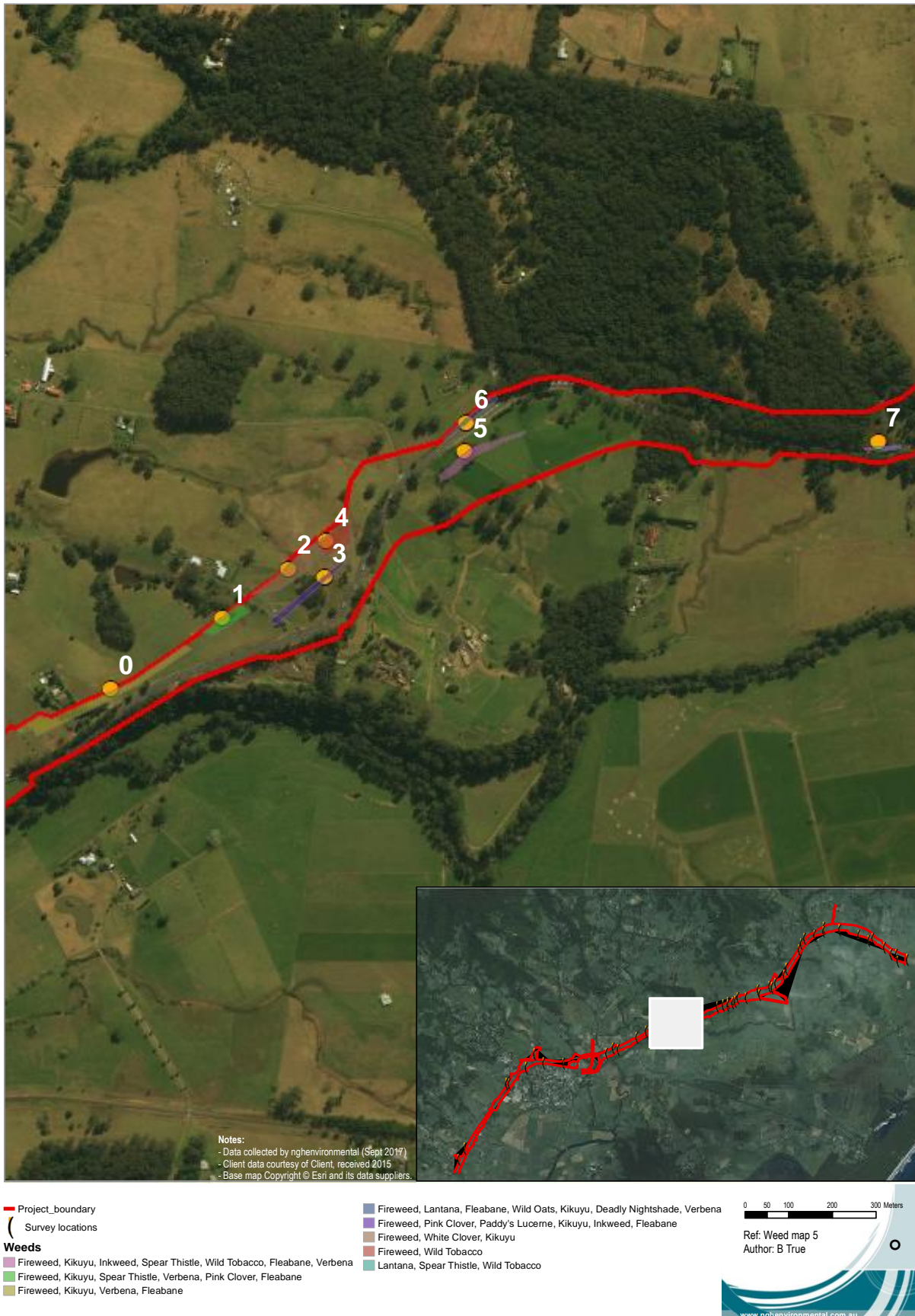


Figure 3-5 Weed distribution map 5



Figure 3-6 Weed distribution map 6



Figure 3-7 Weed distribution map 7



- Project\_boundary
- Survey locations
- Weeds**
- Fireweed, Coral Tree, Inkweed, Verbena
- Fireweed, Lantana

0 37.5 75 150 Meters

Ref: Weed map 8  
 Author: B True

[www.nghenvironmental.com.au](http://www.nghenvironmental.com.au)

Figure 3-8 Weed distribution map 8

### 3.2.2 Cover and abundances


Relative abundance is given by a cover abundance scale (modified Braun-Blanquet):



1. 1 to a few individuals present, less than 5% cover
2. many individuals present, but still less than 5% cover
3. 5 - < 20% cover
4. 20 - < 50% cover
5. 50 - < 75% cover
6. 75 - 100% cover



Table 3-2 Description of each survey location and dominant weeds



\* indicates Noxious Weed species

+ indicates a Priority Weed species



Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
15	297055	6152294	North of Toolijooa Rd	Batter	**Fireweed <i>Senecio madagascariensis</i> – 3 Kikuyu <i>Pennisetum clandestinum</i> – 5 Verbena <i>Verbena bonariensis</i> – 1 Stinking Roger <i>Tagetes minuta</i> – 1 Sow Thistle <i>Sonchus oleraceus</i> -1 Cobbler’s Pegs <i>Bidens pilosa</i> - 2	



Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
14	296835	6152244	Near turn around bay south of Toolijooa Rd	Construction area, with bare soil areas	**Fireweed <i>Senecio madagascariensis</i> – 2 Spear Thistle <i>Cirsium vulgare</i> – 1 Verbena <i>Verbena bonariensis</i> – 3 Fleabane <i>Conyza bonariensis</i> -1 Kikuyu <i>Pennisetum clandestinum</i> -5 Fennel <i>Foeniculum vulgare</i> -1 White Cover <i>Trifolium repens</i> -1 Cobbler’s Pegs <i>Bidens pilosa</i> -2	
16	296799	615239	South of Toolijooa Rd	Roadside area	**Fireweed <i>Senecio madagascariensis</i> – 2 Spear Thistle <i>Cirsium vulgare</i> - 1 Verbena <i>Verbena bonariensis</i> – 1 Kikuyu <i>Pennisetum clandestinum</i> -4 Cobbler’s Pegs <i>Bidens pilosa</i> -1	



Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
17	296675	6152401	South of Toolijooa Rd	Roadside batter	**Fireweed <i>Senecio madagascariensis</i> – 3 Spear Thistle <i>Cirsium vulgare</i> -1 Sow Thistle <i>Sonchus oleraceus</i> – 1 Kikuyu <i>Pennisetum clandestinum</i> – 5 Stinking Roger <i>Tagetes minuta</i> – 2 Inkweed <i>Phytolacca octandra</i> -2	
18	296523	6152549	South of Toolijooa Rd	Roadside batter	**Fireweed <i>Senecio madagascariensis</i> – 2 Stinking Roger <i>Tagetes minuta</i> – 1 White Clover <i>Trifolium repens</i> -3 Spear Thistle <i>Cirsium vulgare</i> -1 Kikuyu <i>Pennisetum clandestinum</i> – 5 Verbena <i>Verbena bonariensis</i> – 1 Inkweed <i>Phytolacca octandra</i> -1 Fleabane <i>Conyza bonariensis</i> -1	



Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
19	296251	6152744	Between BC1 and Toolijooa Rd	Roadside embankment	**Lantana <i>Lantana camara</i> – 4 **Fireweed <i>Senecio madagascariensis</i> – 3 Inkweed <i>Phytolacca octandra</i> -1 Spear Thistle <i>Cirsium vulgare</i> -1 Stinking Roger <i>Tagetes minuta</i> – 1 Cobbler’s Pegs <i>Bidens pilosa</i> -1 Kikuyu <i>Pennisetum clandestinum</i> – 3	
20	296157	6152704	Between BC1 and Toolijooa Rd	Access track between Toolijooa Rd and BC1	**Fireweed <i>Senecio madagascariensis</i> – 3 Inkweed <i>Phytolacca octandra</i> – 1 Verbena <i>Verbena bonariensis</i> -3 Kikuyu <i>Pennisetum clandestinum</i> – 5 Spear Thistle <i>Cirsium vulgare</i> -1 Cobbler’s Pegs <i>Bidens pilosa</i> -1	







Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
21	29593	6152819	Between BC1 and Toolijooa Rd	Top of cut	**Fireweed <i>Senecio madagascariensis</i> - 1 Kikuyu <i>Pennisetum clandestinum</i> – 5 Verbena <i>Verbena bonariensis</i> -4 Spear Thistle <i>Cirsium vulgare</i> -1 Stinking Roger <i>Tagetes minuta</i> – 1 Paddy’s Lucerne <i>Sida rhombifolia</i> -3 Fleabane <i>Conyza bonariensis</i> -1	
22	295486	6152939	Between BC1 and Toolijooa Rd	Light vehicle track	**Fireweed <i>Senecio madagascariensis</i> – 2 **Giant Parramatta Grass <i>Sporobolus fertilis</i> - 3 Inkweed <i>Phytolacca octandra</i> – 1 Verbena <i>Verbena bonariensis</i> – 3 Spear Thistle <i>Cirsium vulgare</i> – 3 Kikuyu <i>Pennisetum clandestinum</i> – 4 Paddy’s Lucerne <i>Sida rhombifolia</i> -2	



Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
24	295121	6152887	BC1	Adjacent to compound	**Fireweed <i>Senecio madagascariensis</i> – 2 Verbena <i>Verbena bonariensis</i> -1 Stinking Roger <i>Tagetes minuta</i> – 1 Inkweed <i>Phytolacca octandra</i> – 1 Kikuyu <i>Pennisetum clandestinum</i> – 5	
31	295126	6152978	BC1	Roadside batter	**Fireweed <i>Senecio madagascariensis</i> – 2 **Giant Parramatta Grass <i>Sporobolus fertilis</i> - 3 Kikuyu <i>Pennisetum clandestinum</i> – 5 Stinking Roger <i>Tagetes minuta</i> – 1 Inkweed <i>Phytolacca octandra</i> – 1 White Clover <i>Trifolium repens</i> - 1	



Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
25	294923	6152794	BC1	BC1	Wild Tobacco <i>Solanum mauritianum</i> - 1 Inkweed <i>Phytolacca octandra</i> – 3 Fleabane <i>Conyza bonariensis</i> - 1 Paddy's Lucerne <i>Sida rhombifolia</i> – 2 Kikuyu <i>Pennisetum clandestinum</i> - 4	
26	294695	6152708	Between BC1 and BC2	Road side	**Fireweed <i>Senecio madagascariensis</i> – 4 Verbena <i>Verbena bonariensis</i> -1 White Clover <i>Trifolium repens</i> - 2 Wild Tobacco <i>Solanum mauritianum</i> - 1 Inkweed <i>Phytolacca octandra</i> – 2 Kikuyu <i>Pennisetum clandestinum</i> - 5 Fleabane <i>Conyza bonariensis</i> - 1	

Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
27	294623	6152587	Between BC1 and BC2	Road side	**Fireweed <i>Senecio madagascariensis</i> – 4 Verbena <i>Verbena bonariensis</i> -1 White Clover <i>Trifolium repens</i> - 2 Wild Tobacco <i>Solanum mauritianum</i> - 1 Inkweed <i>Phytolacca octandra</i> – 2 Kikuyu <i>Pennisetum clandestinum</i> - 5 Fleabane <i>Conyza bonariensis</i> - 1	
30	294583	6152452	Between BC1 and BC2	Road side	**Fireweed <i>Senecio madagascariensis</i> - 5 Spear Thistle <i>Cirsium vulgare</i> - 1 White Clover <i>Trifolium repens</i> – 1 Verbena <i>Verbena bonariensis</i> -1 Dandelion <i>Taraxacum officinale</i> 1	



Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
28	294296	6152021	Between BC1 and BC2	Road side	**Fireweed <i>Senecio madagascariensis</i> - 5 Whiskey Grass <i>Andropogon virginicus</i> -6 Verbena <i>Verbena bonariensis</i> -3 Kikuyu <i>Pennisetum clandestinum</i> – 1 Cobbler’s Pegs <i>Bidens pilosa</i> -1 White Clover <i>Trifolium repens</i> - 1 Wild Tobacco <i>Solanum mauritianum</i> - 1 Paddy's Lucerne <i>Sida rhombifolia</i> – 1 Curly Dock <i>Rumex crispus</i> -1	
29	294250	6151865	Between BC1 and BC2	Road side	**Fireweed <i>Senecio madagascariensis</i> - 3 Inkweed <i>Phytolacca octandra</i> – 2 Spear Thistle <i>Cirsium vulgare</i> - 2 Verbena <i>Verbena bonariensis</i> - 2 Wild Tobacco <i>Solanum mauritianum</i> - 1 Deadly Nightshade <i>Solanum nigrum</i> - 2 White Clover <i>Trifolium repens</i> - 4 Paddy’s Lucerne <i>Sida rhombifolia</i> - 5	



Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
32	294059	6151679	Between Austral Park compound and BC3	Access track	**Fireweed <i>Senecio madagascariensis</i> - 3 Paspalum <i>Paspalum dilatatum</i> -3 Kikuyu <i>Pennisetum clandestinum</i> – 2 Sow Thistle <i>Sonchus oleraceus</i> -1	
33	293916	6151611	Between Austral Park compound and BC3	Batter	**Fireweed <i>Senecio madagascariensis</i> - 2 Kikuyu <i>Pennisetum clandestinum</i> – 1 Inkweed <i>Phytolacca octandra</i> – 1 Spear Thistle <i>Cirsium vulgare</i> - 1	



Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
34	293975	6151579	Between Austral Park compound and BC3	Batter	**Fireweed <i>Senecio madagascariensis</i> - 2 Kikuyu <i>Pennisetum clandestinum</i> – 5 Inkweed <i>Phytolacca octandra</i> – 3 Spear Thistle <i>Cirsium vulgare</i> - 1	
35	293661	6151517	Between Austral Park compound and BC3	Batter	**Fireweed <i>Senecio madagascariensis</i> - 2 **Lantana <i>Lantana camara</i> - 3 Crofton Weed <i>Ageratina adenophora</i> - 4 Wild Tobacco <i>Solanum mauritianum</i> – 2 Stinking Roger <i>Tagetes minuta</i> – 1 Whiskey Grass <i>Andropogon virginicus</i> -1	



Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
36	293699	6151420	Between Austral Park compound and BC3	Batter	**Fireweed <i>Senecio madagascariensis</i> - 4 Inkweed <i>Phytolacca octandra</i> – 2 Fleabane <i>Conyza bonariensis</i> - 2 Verbena <i>Verbena bonariensis</i> -2 White Clover <i>Trifolium repens</i> - 1 Kikuyu <i>Pennisetum clandestinum</i> – 4 Spear Thistle <i>Cirsium vulgare</i> - 1 Wild Tobacco <i>Solanum mauritianum</i> – 1 Stinking Roger <i>Tagetes minuta</i> – 1	
37	293391	6151342	Between Austral Park compound and BC3	Batter	**Fireweed <i>Senecio madagascariensis</i> - 3 Inkweed <i>Phytolacca octandra</i> – 2 Fleabane <i>Conyza bonariensis</i> - 1 Verbena <i>Verbena bonariensis</i> -2 White Clover <i>Trifolium repens</i> - 1 Kikuyu <i>Pennisetum clandestinum</i> – 3 Spear Thistle <i>Cirsium vulgare</i> - 1 Wild Tobacco <i>Solanum mauritianum</i> – 1 Stinking Roger <i>Tagetes minuta</i> – 1 Paddy's Lucerne <i>Sida rhombifolia</i> – 1 Wild Aster <i>Aster subulatus</i> -1	







Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
13	293197	6151331	Austral Park	Western side Princess Hwy	**Fireweed <i>Senecio madagascariensis</i> - 2 Fleabane <i>Conyza bonariensis</i> - 1 Verbena <i>Verbena bonariensis</i> -1 Kikuyu <i>Pennisetum clandestinum</i> – 1 Wild Tobacco <i>Solanum mauritianum</i> – 1 Stinking Roger <i>Tagetes minuta</i> – 1 Paddy’s Lucerne <i>Sida rhombifolia</i> – 2 Wild Aster <i>Aster subulatus</i> -1 Whiskey Grass <i>Andropogon virginicus</i> -	
38	293143	6151252	Austral Park	Western side Princess Hwy	**Fireweed <i>Senecio madagascariensis</i> – 2 Wild Oats <i>Avena fatua</i> -1 Kikuyu <i>Pennisetum clandestinum</i> – 4 Wild Aster <i>Aster subulatus</i> -1 Verbena <i>Verbena bonariensis</i> -1 Crofton Weed <i>Ageratina adenophora</i> - 2 Wild Tobacco <i>Solanum mauritianum</i> – 1 Spear Thistle <i>Cirsium vulgare</i> - 1	


Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
12	293089	6151221	Austral Park	Western side Princess Hwy	**Fireweed <i>Senecio madagascariensis</i> - 3 Paspalum <i>Paspalum dilatatum</i> -1 Inkweed <i>Phytolacca octandra</i> – 1 Kikuyu <i>Pennisetum clandestinum</i> – 1 Verbena <i>Verbena bonariensis</i> -1	
10	292987	6151220	Austral Park	Western side Princess Hwy	**Fireweed <i>Senecio madagascariensis</i> - 2 Kikuyu <i>Pennisetum clandestinum</i> – 5 Verbena <i>Verbena bonariensis</i> -1 Inkweed <i>Phytolacca octandra</i> – 1 Deadly Nightshade <i>Solanum nigrum</i> - 1 Paddy's Lucerne <i>Sida rhombifolia</i> – 1 Stinking Roger <i>Tagetes minuta</i> – 2	



Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
11	292977	6151168	Austral Park	Soil mound	**Fireweed <i>Senecio madagascariensis</i> - 3 Paddy's Lucerne <i>Sida rhombifolia</i> - 3 Inkweed <i>Phytolacca octandra</i> – 1 Spear Thistle <i>Cirsium vulgare</i> - 1	
9	292873	6151166	Austral Park	Batter	**Fireweed <i>Senecio madagascariensis</i> - 3 White Clover <i>Trifolium repens</i> - 4 Wild Tobacco <i>Solanum mauritianum</i> – 1 Kikuyu <i>Pennisetum clandestinum</i> – 3 Deadly Nightshade <i>Solanum nigrum</i> - 1 Inkweed <i>Phytolacca octandra</i> – 2	

Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
8	292746	6151115	Austral Park	Road side	**Fireweed <i>Senecio madagascariensis</i> - 2 Inkweed <i>Phytolacca octandra</i> - 2 Wild Tobacco <i>Solanum mauritianum</i> – 2 Small-leaf Privet <i>Ligustrum sinense</i> – 1 Spear Thistle <i>Cirsium vulgare</i> – 1 Verbena <i>Verbena bonariensis</i> -1	
7	292355	6150882	Central zone	Road side	*Lantana <i>Lantana camara</i> – 3 Spear Thistle <i>Cirsium vulgare</i> - 2 Wild Tobacco <i>Solanum mauritianum</i> – 3	



Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
6	291579	6150900	Tindall's Lane	Road side	**Fireweed <i>Senecio madagascariensis</i> – 2 **Lantana <i>Lantana camara</i> - 1 Fleabane <i>Conyza bonariensis</i> - 1 Wild Oats <i>Avena fatua</i> -1 Kikuyu <i>Pennisetum clandestinum</i> – 4 Deadly Nightshade <i>Solanum nigrum</i> - 1 Verbena <i>Verbena bonariensis</i> -1	
5	291578	6150845	Tindall's Lane	Batter	**Fireweed <i>Senecio madagascariensis</i> - 3 Kikuyu <i>Pennisetum clandestinum</i> – 4 Inkweed <i>Phytolacca octandra</i> - 1 Spear Thistle <i>Cirsium vulgare</i> - 1 Wild Tobacco <i>Solanum mauritianum</i> – 1 Fleabane <i>Conyza bonariensis</i> - 1 Verbena <i>Verbena bonariensis</i> -1	



Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
4	291320	6150671	Central zone Cut 6	Batter	**Fireweed <i>Senecio madagascariensis</i> - 2 Wild Tobacco <i>Solanum mauritianum</i> - 1	
3	291317	6150605	Central zone Cut 6	Batter	**Fireweed <i>Senecio madagascariensis</i> - 2 Pink Clover <i>Trifolium pratense</i> – 4 Paddy's Lucerne <i>Sida rhombifolia</i> - 2 Kikuyu <i>Pennisetum clandestinum</i> – 4 Inkweed <i>Phytolacca octandra</i> - 1 Fleabane <i>Conyza bonariensis</i> - 1	



Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
2	291251	6150619	Central zone Cut 6	Batter	**Fireweed <i>Senecio madagascariensis</i> - 1 White Clover <i>Trifolium repens</i> – 4 Kikuyu <i>Pennisetum clandestinum</i> – 4	
1	291130	6150523	Central zone Cut 6	Batter	**Fireweed <i>Senecio madagascariensis</i> - 3 Kikuyu <i>Pennisetum clandestinum</i> – 4 Spear Thistle <i>Cirsium vulgare</i> - 1 Verbena <i>Verbena bonariensis</i> -1 Pink Clover <i>Trifolium pratense</i> – 4 Fleabane <i>Conyza bonariensis</i> - 1	


Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
0	290920	6150386	Central zone	Batter	**Fireweed <i>Senecio madagascariensis</i> - 2 Kikuyu <i>Pennisetum clandestinum</i> - 1 Verbena <i>Verbena bonariensis</i> -1 Fleabane <i>Conyza bonariensis</i> - 1	
39	290499	6150097	Southern zone	Batter	**Fireweed <i>Senecio madagascariensis</i> - 3 Spear Thistle ( <i>Cirsium vulgare</i> ) - 1 Verbena ( <i>Verbena bonariensis</i> ) - 1 Inkweed ( <i>Phytolacca octandra</i> ) - 2 Dandelion <i>Taraxacum officinale</i> -2 Paspalum <i>Paspalum dilatatum</i> -1 Kikuyu <i>Pennisetum clandestinum</i> – 4 Fleabane <i>Conyza bonariensis</i> - 2	





Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
41	290384	6150131	Southern zone	Batter	**Lantana <i>Lantana camara</i> - 1 **Fireweed <i>Senecio madagascariensis</i> - 1 Fleabane <i>Conyza bonariensis</i> - 1 Cobbler's Pegs <i>Bidens pilosa</i> -1	 A photograph showing a grassy slope (batter) with various weeds. The foreground shows a concrete curb and pavement. The background shows a line of trees under a cloudy sky.
40	290237	6150006	Southern zone	Embankment	Nil	 A photograph of a highway embankment. In the foreground, there is a concrete curb and a gravel area. The embankment itself is covered in grass and has a metal guardrail. In the background, there are trees and a blue sky with white clouds.

Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
42	289262	6149761	Southern zone	Batter	**Fireweed <i>Senecio madagascariensis</i> - 4 Inkweed <i>Phytolacca octandra</i> - 1 Paddy's Lucerne <i>Sida rhombifolia</i> - 1 Sow Thistle <i>Sonchus oleraceus</i> -1 Spear Thistle <i>Cirsium vulgare</i> - 1 Wild Tobacco <i>Solanum mauritianum</i> - 1	
43	288808	6149755	Southern zone	Batter	**Fireweed <i>Senecio madagascariensis</i> - 1	

Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
49	288598	6149960	Southern zone	Town Creek Diversion, Rawling's Lane	**Lantana <i>Lantana camara</i> – 2 Cobbler's Pegs <i>Bidens pilosa</i> – 1 Plantain <i>Plantago lanceolata</i> – 2 Kikuyu <i>Pennisetum clandestinum</i> – 2 Curly Dock <i>Rumex crispus</i> -1 Verbena <i>Verbena bonariensis</i> - 2	
44	288407	6149644	Southern zone	Noise mound	**Fireweed <i>Senecio madagascariensis</i> - 2 Spear Thistle <i>Cirsium vulgare</i> - 1 Sow Thistle <i>Sonchus oleraceus</i> – 1 Deadly Nightshade <i>Solanum nigrum</i> – 1 Wild Tobacco <i>Solanum mauritianum</i> - 1	

Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
45	288031	6149263	Southern zone	Roadside	**Fireweed <i>Senecio madagascariensis</i> - 2 **Lantana <i>Lantana camara</i> – 2 **Blackberry <i>Rubus fruticosus</i> species aggregate -2 Deadly Nightshade <i>Solanum nigrum</i> – 1	
48	287971	6149266	Southern zone	Roadside	**Fireweed <i>Senecio madagascariensis</i> - 2 Spear Thistle <i>Cirsium vulgare</i> – 1 Fleabane <i>Conyza bonariensis</i> - 2 Paddy's Lucerne <i>Sida rhombifolia</i> - 1 Cobbler's Pegs <i>Bidens pilosa</i> – 1	

Way point	Eastings	Northings	General Location	Site Description	Weeds and abundances	Photograph
47	287054	6147773	Southern zone	Roadside	**Fireweed <i>Senecio madagascariensis</i> - 2 **Lantana <i>Lantana camara</i> - 1	
46	286918	6147524	Southern zone	Roadside	**Fireweed <i>Senecio madagascariensis</i> - 2 Coral Tree <i>Erythina x sykesii</i> - 1 Inkweed <i>Phytolacca octandra</i> - 3 Verbena <i>Verbena bonariensis</i> - 3	

### 3.3 SUMMARY OF SURVEY RESULTS AND COMPARISON WITH PREVIOUS SURVEYS

The 2017 annual survey identified a total of 29 weed species including 25 environmental weeds, one species categorised as Class 3 Noxious and three species listed as Priority Weeds for the South-East region under the Biosecurity Act, Class 4 Noxious weeds under the repealed NW Act, and WoNS. The 2017 annual survey identified seven more weed species than the 2016 annual survey, all of which are common environmental weeds.

Generally, there has been an increase in the abundance and cover of weed species with 40 of the 49 monitoring sites displaying this trend. Most of this increase comes by way of colonisation of common herbaceous and grass weeds prevalent in areas outside the project alignment. This finding is not surprising given the late stage of the project, time since construction, and that disturbance has occurred in most areas. As time has passed more weeds have colonised, either from source areas outside the alignment or from propagules in site soil used to construct roadside batters and the like.

Three Priority Weeds and WoNS still occur within the project alignment. Though there has been a decrease in the distribution of Blackberry and Lantana (both dense monoculture species) across the life of the project as areas are developed, Fireweed is highly prevalent having been recorded at 44 of 49 monitoring sites. Four of these sites did not contain Fireweed in the previous years' survey. The average relative abundance of Fireweed across the project alignment (according to modified Braun-Blanquet) increased marginally from 2.32 in 2016 to 2.49 in 2017. As mentioned above, this increase is down to time since development or disturbance. At the time of the 2016 survey, all four of these sites were either freshly revegetated or partially disturbed. Fireweed is quick to colonise, reproduces quickly and spreads easily via wind and anthropogenic means. It is very difficult to ascertain whether this spread of Fireweed originated from within or outside the project boundary. It's likely to be a combination of both. Fireweed is prevalent outside the project boundary though no increase outside the project boundary was documented.

Appendix D provide photographic comparisons between the 2016 and 2017 surveys.

Table 3-3 Priority Weeds, Weeds of National Significance, Noxious and environmental weed species recorded in the project area during the survey.

Weed Species	Common name	Weed listing	Noxious Weed Class	Detected during 2015 surveys	Detected during 2016 surveys	Detected during 2017 surveys
<i>*Rubus fruticosus</i>	Blackberry	WoNS, Noxious	4	Yes	Yes	Yes
<i>*Senecio madagascariensis</i>	Fireweed	WoNS , Noxious	4	Yes	Yes	Yes
<i>*Lantana camara</i>	Lantana	WoNS, Noxious	4	Yes	Yes	Yes
<i>Ligustrum lucidum</i>	Large-leaved Privet	Noxious	4	Yes	No	No

Weed Species	Common name	Weed listing	Noxious Weed Class	Detected during 2015 surveys	Detected during 2016 surveys	Detected during 2017 surveys
<i>Ligustrum sinense</i>	Small-leaved Privet	Noxious	4	Yes	Yes	Yes
* <i>Salix babylonica</i>	Weeping Willow	Noxious	4	Yes	No	No
<i>Lycium ferocissimum</i>	African Boxthorn	WoNS, Noxious	3	Yes	No	No
<i>Sporobolus fertilis</i>	Giant Parramatta Grass	Noxious	3	Yes	Yes	Yes
<i>Cinnamomum camphora</i>	Camphor Laurel	Environmental	Not listed	Yes	No	No
<i>Tecomaria capensis</i>	Cape Honey Suckle	Environmental	Not listed	Yes	No	No
<i>Ricinus communis</i>	Caster Oil Plant	Environmental	Not listed	No	Yes	No
<i>Hypochaeris radicata</i>	Cat's Ear	Environmental	Not listed	Yes	No	No
<i>Bidens pilosa</i>	Cobbler's Pegs	Environmental	Not listed	Yes	Yes	Yes
<i>Erythina x sykesii</i>	Coral Tree	Environmental	Not listed	No	Yes	Yes
<i>Elymus repens</i>	Couch Grass	Environmental	Not listed	Yes	No	No
<i>Ageratina adenophora</i>	Crofton Weed	Environmental	Not listed	Yes	Yes	Yes
<i>Dactyloctenium aegyptium</i>	Crowsfoot Grass	Environmental	Not listed	Yes	No	No
<i>Rumex crispus</i>	Curly Dock	Environmental	Not listed	Yes	No	Yes
<i>Solanum nigrum</i>	Deadly Nightshade	Environmental	Not listed	Yes	Yes	Yes
<i>Conyza bonariensis</i>	Fleabane	Environmental	Not listed	Yes	Yes	Yes

Weed Species	Common name	Weed listing	Noxious Weed Class	Detected during 2015 surveys	Detected during 2016 surveys	Detected during 2017 surveys
<i>Phytolacca octandra</i>	Inkweed	Environmental	Not listed	No	Yes	Yes
<i>Pennisetum clandestinum</i>	Kikuyu Grass	Environmental	Not listed	Yes	Yes	Yes
<i>Marsdenia rostrata</i>	Milk Vine	Environmental	Not listed	Yes	No	No
<i>Ageratina riparia</i>	Mistflower	Environmental	Not listed	Yes	Yes	No
<i>Xanthium occidentale</i>	Noongoora Burr	Environmental	Not listed	No	Yes	No
<i>Sida rhombifolia</i>	Paddy's Lucerne	Environmental	Not listed	Yes	Yes	Yes
<i>Ehrharta erecta</i>	Panic Veldtgrass	Environmental	Not listed	Yes	No	No
<i>Sporobolus africanus</i>	Parramatta Grass	Environmental	Not listed	Yes	Yes	No
<i>Paspalum dilatatum</i>	Paspalum	Environmental	Not listed	Yes	No	Yes
<i>Plantago lanceolata</i>	Plantain	Environmental	Not listed	Yes	Yes	Yes
<i>Sonchus oleraceus</i>	Sow Thistle	Environmental	Not listed	No	Yes	Yes
<i>Cirsium vulgare</i>	Spear Thistle	Environmental	Not listed	Yes	Yes	Yes
<i>Verbena boronariensis</i>	Verbena	Environmental	Not listed	No	Yes	Yes
<i>Tradescantia fluminensis</i>	Wandering Jew	Environmental	Not listed	Yes	No	No
<i>Trifolium repens</i>	White Clover	Environmental	Not listed	Yes	Yes	Yes
<i>Solanum mauritianum</i>	Wild Tobacco	Environmental	Not listed	Yes	Yes	Yes



Weed Species	Common name	Weed listing	Noxious Weed Class	Detected during 2015 surveys	Detected during 2016 surveys	Detected during 2017 surveys
<i>Holcus lanatus</i>	Yorkshire Fog	Environmental	Not listed	Yes	No	No
<i>Tagetes minuta</i>	Stinking Roger	Environmental	Not listed	No	No	Yes
<i>Foeniculum vulgare</i>	Fennel	Environmental	Not listed	No	No	Yes
<i>Trifolium pratense</i>	Pink Clover	Environmental	Not listed	No	No	Yes
<i>Traxacum officinale</i>	Dandelion	Environmental	Not listed	No	No	Yes
<i>Andropogon virginicus</i>	Whiskey Grass	Environmental	Not listed	No	No	Yes
<i>Aster subulatus</i>	Wild Aster	Environmental	Not listed	No	No	Yes
<i>Avena fatua</i>	Wild Oats	Environmental	Not listed	No	No	Yes

+ = Priority Weed for the South-east region.

WoNS – Weeds of National Significance

Noxious – Noxious weed species listed in the Illawarra and Shoalhaven LGAs

Environmental – Environmental weeds

### 3.4 COMPARISON WITH PERFORMANCE CRITERIA

The following performance criteria relevant to weed management was taken from the EcMP (PB 2014). It should be noted that these do not relate specifically to the construction period monitoring but for the lifetime of the monitoring program, including post construction. Comparison is given across the three years of monitoring.

Table 3-4 Comparison against performance criteria over three years of monitoring

Measure	Performance criteria	Performance target	2015 Assessment	2016 Assessment	2017 Assessment
Weed management	No evidence of weed invasion or spread to adjacent areas	No new weed species become problematic within 12 months post-construction	<p>There has been an increase in the number environmental weed species as well as an additional noxious weed (Giant Parramatta Grass) since the surveys conducted during the planning stage of the project were undertaken.</p> <p>Areas with the highest weed infestation were most prominent in zones where grubbing and clearing were yet to be undertaken and in areas just outside of the project boundary. There was also no evidence of invasion or spread to adjacent areas, which is evident by comparisons between preclearing mapping and annual survey mapping.</p> <p>Fireweed is a major and problematic noxious weed in the Shoalhaven and Illawarra</p>	<p>There has been an overall reduction in the number and abundance of environmental and noxious weed species across the project area. An additional five new weed species were detected during the 2016 annual survey.</p> <p>Areas with the highest weed infestation were most prominent adjacent to stockpile areas, in areas where slope stabilisation cover crops are yet to be planted and in areas just outside of the project area.</p> <p>Fireweed is a major and problematic noxious weed in the Shoalhaven and Illawarra districts. Survey results confirm that fireweed was the most abundant noxious weed throughout the project area with substantial evidence showing that fireweed has spread into the construction</p>	<p>This year’s monitoring survey identified that there has been an increase in the abundance and cover of weed species compared to the 2016 survey with seven more weed species recorded. None of these should be considered problematic, they are all relatively common environmental weed species.</p> <p>Those areas that have the highest presence of weeds are those that have had the longest time since disturbance and rehabilitation or planting. The passing of time has allowed weeds to colonise these areas.</p> <p>There was no evidence of weed invasion or spread to other areas.</p> <p>Survey results confirm that Fireweed remains the most prevalent weed issue across the project alignment as it has been recorded as being widespread in all three monitoring events. Fireweed was listed as Noxious (under the old NW Act) and is a Priority Weed for the</p>

Measure	Performance criteria	Performance target	2015 Assessment	2016 Assessment	2017 Assessment
			districts. Survey results confirm that fireweed was the most abundant noxious weed throughout the project area with substantial evidence showing that fireweed has spread into the construction site from outside the project area and/or through the disturbance of an existing seed bank during earthworks.	site from outside the project area and/or through the disturbance of an existing seed bank during earthworks.	South-east region under the Biosecurity Act.  Fireweed was prevalent prior to construction and though there was some decrease during construction as areas were stripped of vegetation, it is now recolonising revegetated areas adjacent to the new highway. Private land is likely to be a constant source of seed, thus making Fireweed particularly difficult to control.

## 4 REVIEW OF MITIGATION MEASURES

The EcMP and the CFFMP, including the Weed Management Plan, include a number of mitigation measures and actions to be undertaken to avoid and/or minimise the spread of weeds during construction. These are detailed in Table 4-1 along with notes on whether these have been implemented (information provided by Fulton Hogan).

Table 4-1 Mitigation measures and indication of effectiveness

Mitigation measure	Implementation
<b>CFFMP</b>	
Train staff in the identification and disposal of Alligator Weed.	<p>Fulton Hogan staff were trained in the identification of Alligator Weed. Fulton Hogan also use specialist landscaping contactors, weed control experts and the project botanist to assist in Alligator weed identification.</p> <p>Fulton Hogan staff were also trained in SMARTtrain chemical safety courses. The learning outcomes of the course are:</p> <ul style="list-style-type: none"> <li>• Apply, transport and store chemicals safely and meet the training requirements of: <ul style="list-style-type: none"> <li>○ the <i>NSW Pesticides Act 1999</i> (or equivalent legislation as relevant to your state).</li> <li>○ those using and exposed to substances that are classified as hazardous substances under the <i>NSW WHS Regulation 2001</i> (or equivalent legislation as relevant to your state).</li> <li>○ the Australian Pesticides and Veterinary Medicines Authority (APVMA) for those required to use restricted chemicals in NSW.</li> <li>○ industry quality assurance programs such as Freshcare.</li> </ul> </li> </ul>
If Alligator Weed is identified during Pre-clearing inspection, regularly inspect and clean heavy machinery before leaving the site to ensure that the species is not spread to new areas.	Alligator weed has not been recorded in the project area.
Report positive identifications of Alligator Weed within the construction footprint to the Environmental Manager. The Environmental Manager will notify Kiama Municipal Council/ Shoalhaven City Council (as applicable).	Alligator weed has not been recorded in the project area.

Mitigation measure	Implementation
<p>Stockpile in accordance with the Stockpile Management Protocol (refer CSWQMP) to ensure that stockpiling is restricted to areas already cleared of vegetation.</p>	<p>Fulton Hogan manages stockpiles in accordance with the Stockpile management protocol.</p>
<p>Progressively revegetate batters and other disturbed areas with cover crop species to stabilise the soil and provide vegetation cover as a method to control weeds.</p> <p>Use Rye Corn during the months of April to August or Japanese Millet during the months of September to March.</p> <p>Also refer to the UDLP where necessary.</p>	<p>Fulton Hogan uses cover crops to progressively revegetate batters and other disturbed areas.</p>
<p><b>Weed Management Plan</b></p>	
<p>Noxious and environmental weeds in the existing road corridor, construction areas and Ancillary Facility areas will be controlled in accordance with RMS Biodiversity Guidelines: Guide 6 Weed management and Guide 10 Aquatic habitats and riparian zones (RTA, 2011).</p>	<p>Weeds are being controlled in accordance with <i>Guide 6 Weed management</i> and <i>Guide 10 Aquatic habitats and riparian zones</i>.</p> <p>Weed monitoring occurs regularly. Spraying of weeds is completed as required.</p>
<p>Induction and training –</p> <p>All site personnel and subcontractors will be inducted in the existence of noxious weeds on the Project, including the identification and disposal of Alligator weed (<i>Alternanthera philoxeroides</i>); and management procedures for weeds. This training will occur on site during the Project induction and as required in toolbox talks.</p> <p>The training material on Alligator weed will be in accordance with the RMS Biodiversity Guidelines: Guide 10 Aquatic habitats and Riparian Zones (RTA 2011).</p> <p>Where work is scheduled in an area that contains weeds, personnel will be advised of this in toolbox talks. The controls that are required to be implemented to minimise weed spread (i.e. weed hygiene protocols) will be implemented prior to clearing and grubbing or ground disturbance.</p>	<p>Fulton Hogan provides education on weed management to staff and subcontractors at inductions, toolboxes and using visual tools.</p>
<p>Stakeholder consultation</p> <p>As required from the RMS <i>Specification D&amp;C G40 – Clearing and Grubbing</i> (RMS, 2013) the Environmental Manager/EO will undertake consultation with the relevant local Weeds Authority Officer on the presence of any noxious weed in areas to be cleared and to ascertain if any special precautions are required. This will include consultation with:</p>	<p>Shoalhaven City Council Noxious Weeds officer; Scott Galbraith and Illawarra District Noxious Weed Authority Chief Weeds Officer; Dave Pommerey attend the FBB project Bi-annually for the identification of noxious weeds and to inform the project on the councils expected management.</p>

Mitigation measure	Implementation
<ul style="list-style-type: none"> <li>the IDNWA Chief Weeds Officer or Noxious Weed Inspector/Operator for Kiama LGA, and</li> <li>the Shoalhaven City Council Noxious Weeds or a natural Area Officer.</li> </ul> <p>The Environmental Manager/EO will request from the above stakeholders a statement regarding the presence or otherwise of noxious weeds</p>	<p>Inspections by the council representatives led to management of numerous identified weeds:</p> <ul style="list-style-type: none"> <li>Ongoing weed management by Fulton Hogan.</li> <li>Giant Parramatta grass, spot sprayed by Fulton Hogan and weed contractor.</li> </ul> <p>The environmental manager/EO confirms any management actions following consultation with the stakeholder.</p>
<p>Exclusion zones</p> <p>Prior to any clearing and grubbing the Environmental Manager/EO will undertake a 'joint inspection' with the Project Ecologist and RMS Representative to establish clearing exclusion zones focusing on areas of threatened ecological communities (TEC's) and items of Aboriginal and non- Aboriginal cultural heritage significance as identified on the most current set of project Sensitive Area Plans prior to clearing and grubbing. This can be carried out concurrently with the joint inspection for weeds.</p>	<p>Exclusion zones were determined during the pre-clearing inspections. Pre-clearing inspections on FBB were attended by the project ecologist, project verifier, Fulton Hogan and RMS.</p>
<p>Weed inspection</p> <p>The Environmental Manager/EO will undertake a 'joint inspection' with the Project Ecologist and RMS Representative to inspect the area for weeds:</p> <ul style="list-style-type: none"> <li>prior to clearing and grubbing;</li> <li>prior to drainage works or change in drainage that may facilitate the distribution of weed seeds or high level of nutrients;</li> <li>when a potential weed infestation has been identified; and</li> <li>before spring (around August) to identify weeds before they go to flower and seed.</li> </ul> <p>Infestations of noxious weeds and WoNS will be mapped with GPS by the Project Ecologist during the joint site inspection including noting the specie(s) degree of infestation and capturing an image for monitoring purposes.</p>	<p>Weed inspections are completed during pre-clearing by the Environmental Manager/EO and project ecologist and recorded on pre-clearing checklists.</p> <p>Weeds have also been monitored across the project area at the onset of Spring (results presented in this report).</p> <p>Weeds are monitored prior to drainage works.</p> <p>Weed infestations are treated or removed.</p> <p>Drainage inspections are undertaken prior to clearing and grubbing. Ongoing daily/weekly inspection of drainage works review the works including any movement of weeds through the area and if detected are treated.</p> <p>Weeds are mapped with GPS as is presented in this report. Table 3-2 shows all the weed survey locations eastings and northings.</p>
<p>Weed treatment methodology</p>	<p>Weed monitoring occurs weekly and is recorded on the Foxground and Berry</p>

Mitigation measure	Implementation
<p>The Project Ecologist will identify areas of weed infestation; advise the appropriate weed control methods, and timing for each area of works.</p> <p>As a guide, control and management methods for noxious weeds are available at the websites identified in Table 7-2.</p>	<p>bypass environmental inspection record form.</p> <p>Additional inspections are undertaken with the local Noxious Weed Officer from IDNWA and Shoalhaven City Council</p>
<p>Pesticide application record</p> <p>The Environmental Manger/EO will follow the Pesticide Use Procedure (Appendix G of the CFFMP) and ensure that a Pesticide Application Record (Appendix H of the CFFMP) is completed and public notifications made in accordance with relevant legislation and the RMS Specification D&amp;C G36, where pesticides are to be used in areas that could be accessed by members of the public.</p> <p>Only pesticides registered for use near water may be used near any waterways.</p>	<p>Fulton Hogan uses the approved CFFMP and G36 procedures and records.</p> <p>No public notifications have been required to date however signage is displayed on site vehicles whilst spraying is undertaken.</p> <p>Pesticide records are kept within the Fulton Hogan environmental management system.</p>
<p>Follow-up inspection</p> <p>The Environmental Manger/EO will ensure that a follow-up inspection is undertaken of identified weed infestation sites to ensure treatment was successful.</p> <p>Where weeds cannot be effectively destroyed prior to topsoil stripping, weed-contaminated topsoil will be isolated and either encapsulated by deep burying, or disposed of at an approved offsite licensed facility as directed by the Environment Manager/EO.</p>	<p>Treatment of Noxious and Environmental Weeds identified in the last report and on-site inspections have been successful and on-going management of weeds will occur.</p>
<p>Vehicle, plant and equipment movement plan</p> <p>Site specific vehicle, plant and equipment movement plans will be prepared for each worksite that contains noxious weeds. The plans will be incorporated into Progressive Erosion and Sediment Control Plans and include identification of vehicles, plant, equipment, turning and parking areas.</p> <p>To prevent the spread of weeds throughout the construction site and surrounding areas, the movement of weed-contaminated plant and equipment will be monitored by Foreman.</p> <p>The Foreman will ensure that all plant and machinery entering the site is inspected and free of weeds applying standard weed hygiene protocols.</p> <p>Plant and equipment will be checked and cleaned before leaving a worksite that contains noxious weeds.</p> <p>Records of all construction plant screening checks will be recorded on the Mobile Plant Inspection Checklist and monitored by the Foreman.</p>	<p>Plant brought to site is clean and free of dirt and organic material.</p> <p>Areas of noxious weeds on the project were identified in association with the local council weed officers. They were buried under the road alignment.</p> <p>Topsoiled areas were stripped in winter with few weeds observed in the agricultural areas dominated by 'kikuyu'.</p> <p>No weed spreading from plant moving between zones has occurred on the project.</p> <p>Foreman check plant and equipment before it is moved between areas on the Princes Highway. Equipment is checked before being moved on the highway between zones.</p> <p>Movements within the project during bulk earthworks are considered low risk as the</p>

Mitigation measure	Implementation
	project is transporting sub soils or rock and no organic material is present.
<p><b>Weed disposal</b></p> <p>Where noxious weed areas are disturbed by the construction activities, weeds and topsoil potentially containing weed propagules will be removed and disposed of in consultation with Kiama Municipal Council or Shoalhaven City Council as applicable.</p> <p>Any weeds physically removed (particularly those bearing seeds) will be disposed of appropriately at a licensed facility in accordance with the Biosecurity Act.</p>	Weeds are disposed of in accordance with the local council requirements.
<p><b>Ongoing management and monitoring</b></p> <p>Monitoring of weed infestations will occur as part of the routine weekly inspections to determine the effectiveness of management controls. The presence of any weeds and the necessary management actions will be noted on the Environmental Inspection Checklist (Appendix A8 of the CEMP).</p>	Weed monitoring occurs weekly and is recorded on the Foxground and Berry bypass Environmental Inspection Checklist (Appendix A8 of the CEMP).
<b>EcMP</b>	
Control drainage that may contain weed seeds or high levels of nutrients	All site water is directed to site sediment basins and treated prior to discharge to the environment.
Use weed-free topsoil in landscaping and revegetate disturbed sites with locally indigenous species (local provenance). Revegetation using stockpiled soil would also include planting local native species to stabilise the soil as well as ongoing weed control. Non-native species would only be used for landscaping where culturally appropriate and in locations identified within the urban and landscape design strategy.	The revegetation of disturbed sites is undertaken progressively during construction as per the approved Landscape Design.
Monitor and control weed populations that establish in disturbed areas, with particular attention to eradication of noxious weeds. Weed invasions would be monitored and controlled by a person experienced in weed management.	Ongoing monitoring for the presence of environmental and priority weed species is being conducted by NGH Environmental ecologists and Fulton Hogan staff throughout the construction phase of the project.
Incorporate weed management strategies into the Vegetation Management Plan, detailing necessary weed control works, particularly in areas where the weeds may impact on threatened species and/or their habitats.	The vegetation management plan is incorporated in the Urban Design and Landscape plan, this plan details weed removal works.



#### **4.1.1 Overall effectiveness of mitigation measures**

The performance criteria established for weed management as outlined in Table 3-4 (PB 2014) are being met during the third year of construction, as they were for the previous two years. This indicates that mitigation measures implemented have been effective in controlling weeds.

As an overall trend, the areas with the highest weed infestations are those areas that have been constructed and revegetated the longest. Time since construction has allowed various common environmental weeds to colonise, meaning that regular weed management is necessary to keep weed densities to an acceptable level. There will always be a measurable increase in weed levels prior to conducting weed control, as is the case with this monitoring event.

The most abundant priority weed (previously a noxious weed) species occurring within the project area was Fireweed. Fireweed is a major and problematic priority weed in the Shoalhaven and Illawarra districts. Fireweed can quickly establish where the ground has been cultivated or disturbed (DPI 2014). These conditions are frequent throughout the construction period which has facilitated the spread of Fireweed throughout the project area. Most likely from outside the project area and/or through the disturbance of an existing seed bank during earthworks. Given the problematic nature of this species, it's spread should not be viewed as a failing of any mitigation measure.

## **5 RECOMMENDATIONS**

The results from this annual weed report have identified that the overall weed mitigation measures implemented have been effective. Weed management measures should continue as per the weed management plan.

This monitoring report did record a general increase in weed cover, however this is to be expected given the stage of the project, the time of year (spring) and that the survey was conducted prior to routine weed management. Nevertheless, immediate weed control is recommended. It is understood that since the time of survey one round of weed control has been conducted and another is scheduled. This should be sufficient to reduce weed coverage to acceptable levels.

To prevent the spread of weeds and the introduction of new weed species throughout the project area and the surrounds, hygiene protocols should be adhered to as per the mitigation measures outlined in the CFFMP. The continual use of cover crops on exposed batter, disturbed areas and stockpiles would further aid in suppressing weed germination and establishment.

Suppression of Fireweed and other priority weeds is an urgent matter. At this stage, targeted control of Fireweed should not be required as Fireweed does not occur in any area without the presence of other weeds. Fireweed will be treated as routine weed control is conducted in all areas. Should future weed monitoring record new outbreaks, immediate response is recommended as per the mitigation measures outlined in the CFFMP.

## 6 REFERENCES

Biodiversity Guidelines, Roads and Maritime Services, 2011

Construction Flora and Fauna Management Sub-plan, Foxground and Berry bypass, Roads and Maritime Services, 2014

Cropper, S.C. (1993). *Management of Endangered Plants*. CSIRO, East Melbourne, Victoria.

Ecological Monitoring Program, Princess Highway Upgrade Foxground and Berry bypass, Parsons Brinkerhoff, 2014

Environmental Assessment, Technical Paper: Terrestrial Flora and Fauna, Foxground and Berry bypass, AECOM, 2012

New South Wales Department of Primary Industries, 2014 <http://weeds.dpi.nsw.gov.au/Weeds/Details/53>  
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## APPENDIX A NOXIOUS WEED DECLARATIONS FOR SHOALHAVEN CITY COUNCIL

Table 6-1 Weed control classes and control measures

Control class	Weed type	Example control requirements
Class 1	Plants that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 2	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 3	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.	The plant must be fully and continuously suppressed and destroyed.*
Class 4	Plants that pose a potentially serious threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread*
Class 5	Plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.	There are no requirements to control existing plants of Class 5 weeds. However, the weeds are "notifiable" and a range of restrictions on their sale and movement exists.

Table 6-2 the following weeds are declared noxious in the control area of Shoalhaven City Council:

Weed	Class	Legal requirements
African boxthorn <i>Lycium ferocissimum</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
African feather grass <i>Cenchrus macrourus</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
African lovegrass <i>Eragrostis curvula</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed

Weed	Class	Legal requirements
African turnip weed - eastern <i>Sisymbrium thellungii</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
African turnip weed - western <i>Sisymbrium runcinatum</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Alligator weed <i>Alternanthera philoxeroides</i>	2	Regionally Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Anchored water hyacinth <i>Eichhornia azurea</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Annual ragweed <i>Ambrosia artemisiifolia</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Arrowhead <i>Sagittaria calycina</i> var. <i>calycina</i>	4	Locally Controlled Weed The plant must not be sold, propagated or knowingly distributed
Artichoke thistle <i>Cynara cardunculus</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Asparagus - asparagus fern <i>Asparagus virgatus</i>	2	Regionally Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Asparagus - climbing asparagus <i>Asparagus africanus</i>	2	Regionally Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Asparagus - climbing asparagus fern <i>Asparagus plumosus</i>	4	Locally Controlled Weed The plant must not be sold, propagated or knowingly distributed
Asparagus - ground asparagus <i>Asparagus aethiopicus</i>	4	Locally Controlled Weed The plant must not be sold, propagated or knowingly distributed
Asparagus - ming asparagus fern <i>Asparagus macowanii</i> var. <i>zuluensis</i>	2	Regionally Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Asparagus - sicklethorn <i>Asparagus falcatus</i>	2	Regionally Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Asparagus weeds <i>Asparagus</i> species	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Athel pine <i>Tamarix aphylla</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with

Weed	Class	Legal requirements
Bear-skin fescue <i>Festuca gautieri</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Bitou bush <i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed but only the part that is south of 35 06'37"S (known as the Bitou Bush National Containment Line)
Bitou bush <i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread but only the part that is north of 35 06'37"S (known as the Bitou Bush National Containment Line)
Black knapweed <i>Centaurea X moncktonii</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Black willow <i>Salix nigra</i>	2	Regionally Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Blackberry <i>Rubus fruticosus</i> species aggregate	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Blue hound's tongue <i>Cynoglossum creticum</i>	2	Regionally Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Boneseed <i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Bridal creeper <i>Asparagus asparagoides</i>	4	Locally Controlled Weed The plant must not be sold, propagated or knowingly distributed
Bridal veil creeper <i>Asparagus declinatus</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Broomrapes <i>Orobanche species</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Burr - Bathurst burr <i>Xanthium spinosum</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Burr - Californian burr <i>Xanthium orientale</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Burr - Italian cocklebur <i>Xanthium italicum</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread

Weed	Class	Legal requirements
Burr - South American burr <i>Xanthium cavanillesii</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Burr ragweed <i>Ambrosia confertiflora</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Cabomba <i>Cabomba caroliniana</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Cane needle grass <i>Nassella hyalina</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Cape broom <i>Genista monspessulana</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Cat's claw creeper <i>Dolichandra unguis-cati</i>	2	Regionally Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Cayenne snakeweed <i>Stachytarpheta cayennensis</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Chilean needle grass <i>Nassella neesiana</i>	2	Regionally Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Chinese violet <i>Asystasia gangetica subsp. micrantha</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Clockweed <i>Oenothera curtiflora</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Coolatai grass <i>Hyparrhenia hirta</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Corn sowthistle <i>Sonchus arvensis</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Creeping lantana <i>Lantana montevidensis</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed but only the part that is south of 35 11'42"S (known as the Lantana National Containment Line)
Creeping lantana <i>Lantana montevidensis</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread but only the

Weed	Class	Legal requirements
		part that is north of 35 11'42"S (known as the Lantana National Containment Line)
Dodder <i>Cuscuta</i> species	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Espartillo - broad kernel <i>Amelichloa caudata</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Espartillo - narrow kernel <i>Amelichloa brachychaeta</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Eurasian water milfoil <i>Myriophyllum spicatum</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Fine-bristled burr grass <i>Cenchrus brownii</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Fireweed <i>Senecio madagascariensis</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed but only those parts that are south of 35 11'42" S, or in the Parishes of Broughton, Bugong, Camberwarra, Moollatto and Wallaya, or in the Parishes or Burrawang and Yarrawa but only those parts within Shoalhaven City Council
Fireweed <i>Senecio madagascariensis</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread except those parts that are south of 35 11'42"S, or in the Parishes of Broughton, Bugong, Cambewarra, Moollatto and Wallaya, or in the Parishes of Burrawang and Yarrawa
Flax-leaf broom <i>Genista linifolia</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Fountain grass <i>Cenchrus setaceus</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Frogbit <i>Limnobium laevigatum</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Gallon's curse <i>Cenchrus biflorus</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Gamba grass <i>Andropogon gyanus</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Giant Parramatta grass <i>Sporobolus fertilis</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed

Weed	Class	Legal requirements
Giant rat's tail grass <i>Sporobolus pyramidalis</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed
Giant reed <i>Arundo donax</i>	4	Locally Controlled Weed The plant must not be sold, propagated or knowingly distributed
Glaucous starthistle <i>Carthamus leucocaulos</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Golden thistle <i>Scolymus hispanicus</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Gorse <i>Ulex europaeus</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed
Green cestrum <i>Cestrum parqui</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed
Grey sallow <i>Salix cinerea</i>	2	Regionally Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Groundsel bush <i>Baccharis halimifolia</i>	2	Regionally Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Harrisia cactus <i>Harrisia</i> species	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Hawkweeds <i>Hieracium</i> species	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Horsetails <i>Equisetum</i> species	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Hydrocotyl <i>Hydrocotyle ranunculoides</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Hymenachne <i>Hymenachne amplexicaulis</i> and hybrids	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Illyrian thistle <i>Onopordum illyricum</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed
Karoo thorn <i>Vachellia karroo</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Kidney-leaf mud plantain <i>Heteranthera reniformis</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant



Weed	Class	Legal requirements
Kochia <i>Bassia scoparia</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Koster's curse <i>Clidemia hirta</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Kudzu <i>Pueraria lobata</i>	2	Regionally Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Lagarosiphon <i>Lagarosiphon major</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Lantana <i>Lantana camara</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed but only the part that is south of 35 11'42"S (known as the Lantana National Containment Line)
Lantana <i>Lantana camara</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread but only the part that is north of 35 11'42"S (known as the Lantana National Containment Line)
Leafy elodea <i>Egeria densa</i>	4	Locally Controlled Weed The plant must not be sold, propagated or knowingly distributed
Lippia <i>Phyla canescens</i>	4	Locally Controlled Weed The plant must not be sold, propagated or knowingly distributed except incidentally in hay or lucerne
Long-leaf willow primrose <i>Ludwigia longifolia</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Mexican feather grass <i>Nassella tenuissima</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Mexican poppy <i>Argemone mexicana</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Miconia <i>Miconia</i> species	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Mikania vine <i>Mikania micrantha</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Mimosa <i>Mimosa pigra</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant

Weed	Class	Legal requirements
Mossman River grass <i>Cenchrus echinatus</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Mysore thorn <i>Caesalpinia decapetala</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed
Nodding thistle <i>Carduus nutans subsp. nutans</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed
Noogoora burr <i>Xanthium occidentale</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Pampas grass <i>Cortaderia</i> species	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Parthenium weed <i>Parthenium hysterophorus</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Pond apple <i>Annona glabra</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Prickly acacia <i>Vachellia nilotica</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Prickly pear - common pear <i>Opuntia stricta</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Prickly pear - Hudson pear <i>Cylindropuntia rosea</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Prickly pear - smooth tree pear <i>Opuntia monacantha</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Prickly pear - tiger pear <i>Opuntia aurantiaca</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Prickly pear - velvety tree pear <i>Opuntia tomentosa</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Privet - broad-leaf <i>Ligustrum lucidum</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread

Weed	Class	Legal requirements
Privet - narrow-leaf <i>Ligustrum sinense</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Red rice <i>Oryza rufipogon</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Rhus tree <i>Toxicodendron succedaneum</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Rubber vine <i>Cryptostegia grandiflora</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Sagittaria <i>Sagittaria platyphylla</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Salvinia <i>Salvinia molesta</i>	2	Regionally Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Scotch broom <i>Cytisus scoparius subsp. scoparius</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Scotch thistle <i>Onopordum acanthium</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed
Senegal tea plant <i>Gymnocoronis spilanthoides</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Serrated tussock <i>Nassella trichotoma</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Siam weed <i>Chromolaena odorata</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Silverleaf nightshade <i>Solanum elaeagnifolium</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed
Smooth-stemmed turnip <i>Brassica barrelieri subsp. oxyrrhina</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Soldier thistle <i>Picnoman acarna</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with

Weed	Class	Legal requirements
Spanish broom <i>Spartium junceum</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed
Spongeplant <i>Limnobiium spongia</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Spotted knapweed <i>Centaurea stoebe subsp. micranthos</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
St. John's wort <i>Hypericum perforatum</i>	4	Locally Controlled Weed The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed
Stemless thistle <i>Onopurdum acaulon</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed
Taurian thistle <i>Onopurdum tauricum</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed
Texas blueweed <i>Helianthus ciliaris</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with
Tropical soda apple <i>Solanum viarum</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Water caltrop <i>Trapa species</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Water hyacinth <i>Eichhornia crassipes</i>	3	Regionally Controlled Weed The plant must be fully and continuously suppressed and destroyed
Water lettuce <i>Pistia stratiotes</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Water soldier <i>Stratiotes aloides</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Willows <i>Salix species</i>	4	Locally Controlled Weed The plant must not be sold, propagated or knowingly distributed
Witchweeds <i>Striga species</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Yellow burrhead <i>Limnocharis flava</i>	1	State Prohibited Weed The plant must be eradicated from the land and that land must be kept free of the plant
Yellow nutgrass <i>Cyperus esculentus</i>	5	Restricted Plant The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with

## APPENDIX B NOXIOUS WEED DECLARATIONS FOR KIAMA CITY COUNCIL

Table 6-3 Weed control classes and control measures

Control class	Weed type	Example control requirements
Class 1	Plants that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 2	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.	The plant must be eradicated from the land and the land must be kept free of the plant. The weeds are also "notifiable" and a range of restrictions on their sale and movement exist.
Class 3	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.	The plant must be fully and continuously suppressed and destroyed.*
Class 4	Plants that pose a potentially serious threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread*
Class 5	Plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.	There are no requirements to control existing plants of Class 5 weeds. However, the weeds are "notifiable" and a range of restrictions on their sale and movement exists.

Table 6-4 the following weeds are declared noxious in the control area of Kiama City Council:

Weed	Class	Legal requirements
African boxthorn <i>Lycium ferocissimum</i>	3	Regionally Controlled Weed <i>The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed</i>
African feather grass <i>Cenchrus macrourus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
African turnip weed - eastern <i>Sisymbrium thellungii</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>

Weed	Class	Legal requirements
African turnip weed - western <i>Sisymbrium runcinatum</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Alligator weed <i>Alternanthera philoxeroides</i>	2	Regionally Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Anchored water hyacinth <i>Eichhornia azurea</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Annual ragweed <i>Ambrosia artemisiifolia</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Arrowhead <i>Sagittaria calycina</i> var. <i>calycina</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
Artichoke thistle <i>Cynara cardunculus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Asparagus - climbing asparagus fern <i>Asparagus plumosus</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
Asparagus - ground asparagus <i>Asparagus aethiopicus</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
Asparagus weeds <i>Asparagus</i> species	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
Athel pine <i>Tamarix aphylla</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Bear-skin fescue <i>Festuca gautieri</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Bitou bush <i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
Black knapweed <i>Centaurea X moncktonii</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Black willow <i>Salix nigra</i>	2	Regionally Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Blackberry <i>Rubus fruticosus</i> species aggregate	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>

Weed	Class	Legal requirements
Boneseed <i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Bridal creeper <i>Asparagus asparagoides</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
Bridal veil creeper <i>Asparagus declinatus</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Broomrapes <i>Orobanche</i> species	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Burr ragweed <i>Ambrosia confertiflora</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Cabomba <i>Cabomba caroliniana</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Cat's claw creeper <i>Dolichandra unguis-cati</i>	2	Regionally Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Cayenne snakeweed <i>Stachytarpheta cayennensis</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Chilean needle grass <i>Nassella neesiana</i>	3	Regionally Controlled Weed <i>The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed</i>
Chinese violet <i>Asystasia gangetica</i> subsp. <i>micrantha</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Clockweed <i>Oenothera curtiflora</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Coolatai grass <i>Hyparrhenia hirta</i>	3	Regionally Controlled Weed <i>The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed</i>
Corn sowthistle <i>Sonchus arvensis</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Creeping lantana <i>Lantana montevidensis</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
Dodder <i>Cuscuta</i> species	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>

Weed	Class	Legal requirements
Espartillo - broad kernel <i>Amelichloa caudata</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Espartillo - narrow kernel <i>Amelichloa brachychaeta</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Eurasian water milfoil <i>Myriophyllum spicatum</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Fine-bristled burr grass <i>Cenchrus brownii</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Fireweed <i>Senecio madagascariensis</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
Flax-leaf broom <i>Genista linifolia</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
Fountain grass <i>Cenchrus setaceus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Frogbit <i>Limnobium laevigatum</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Gallon's curse <i>Cenchrus biflorus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Gamba grass <i>Andropogon gyanus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Giant Parramatta grass <i>Sporobolus fertilis</i>	3	Regionally Controlled Weed <i>The plant must be fully and continuously suppressed and destroyed</i>
Giant reed <i>Arundo donax</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
Glaucous starthistle <i>Carthamus leucocaulos</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Golden thistle <i>Scolymus hispanicus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Gorse <i>Ulex europaeus</i>	3	Regionally Controlled Weed <i>The plant must be fully and continuously suppressed and destroyed</i>
Grey sallow <i>Salix cinerea</i>	2	Regionally Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Harrisia cactus <i>Harrisia species</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that</i>



Weed	Class	Legal requirements
		<i>continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
Hawkweeds <i>Hieracium</i> species	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Horsetails <i>Equisetum</i> species	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Hydrocotyl <i>Hydrocotyle ranunculoides</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Hymenachne <i>Hymenachne amplexicaulis</i> and hybrids	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Karoo thorn <i>Vachellia karroo</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Kidney-leaf mud plantain <i>Heteranthera reniformis</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Kochia <i>Bassia scoparia</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Koster's curse <i>Clidemia hirta</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Lagarosiphon <i>Lagarosiphon major</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Lantana <i>Lantana camara</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread</i>
Leafy elodea <i>Egeria densa</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
Lippia <i>Phyla canescens</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed except incidentally in hay or lucerne</i>
Long-leaf willow primrose <i>Ludwigia longifolia</i>	3	Regionally Controlled Weed <i>The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed</i>
Mexican feather grass <i>Nassella tenuissima</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Mexican poppy <i>Argemone mexicana</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>

Weed	Class	Legal requirements
Miconia <i>Miconia</i> species	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Mikania vine <i>Mikania micrantha</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Mimosa <i>Mimosa pigra</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Mossman River grass <i>Cenchrus echinatus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Pampas grass <i>Cortaderia</i> species	3	Regionally Controlled Weed <i>The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed</i>
Parthenium weed <i>Parthenium hysterophorus</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Pond apple <i>Annona glabra</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Prickly acacia <i>Vachellia nilotica</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Prickly pear - common pear <i>Opuntia stricta</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
Prickly pear - Hudson pear <i>Cylindropuntia rosea</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
Prickly pear - smooth tree pear <i>Opuntia monacantha</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
Prickly pear - tiger pear <i>Opuntia aurantiaca</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
Prickly pear - velvety tree pear <i>Opuntia tomentosa</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
Red rice <i>Oryza rufipogon</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>

Weed	Class	Legal requirements
Rhus tree <i>Toxicodendron succedaneum</i>	4	Locally Controlled Weed <i>The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed</i>
Rubber vine <i>Cryptostegia grandiflora</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Sagittaria <i>Sagittaria platyphylla</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
Salvinia <i>Salvinia molesta</i>	2	Regionally Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Scotch broom <i>Cytisus scoparius</i> subsp. <i>scoparius</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
Senegal tea plant <i>Gymnocoronis spilanthoides</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Serrated tussock <i>Nassella trichotoma</i>	3	Regionally Controlled Weed <i>The plant must be fully and continuously suppressed and destroyed and the plant must not be sold, propagated or knowingly distributed</i>
Siam weed <i>Chromolaena odorata</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Silverleaf nightshade <i>Solanum elaeagnifolium</i>	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
Smooth-stemmed turnip <i>Brassica barrelieri</i> subsp. <i>oxyrrhina</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Soldier thistle <i>Picnoman acarna</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Spongeplant <i>Limnobium spongia</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Spotted knapweed <i>Centaurea stoebe</i> subsp. <i>micranthos</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Texas blueweed <i>Helianthus ciliaris</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>
Tropical soda apple <i>Solanum viarum</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>

Weed	Class	Legal requirements
Water caltrop <i>Trapa</i> species	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Water hyacinth <i>Eichhornia crassipes</i>	3	Regionally Controlled Weed <i>The plant must be fully and continuously suppressed and destroyed</i>
Water lettuce <i>Pistia stratiotes</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Water soldier <i>Stratiotes aloides</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Willows <i>Salix</i> species	4	Locally Controlled Weed <i>The plant must not be sold, propagated or knowingly distributed</i>
Witchweeds <i>Striga</i> species	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Yellow burrhead <i>Limnocharis flava</i>	1	State Prohibited Weed <i>The plant must be eradicated from the land and that land must be kept free of the plant</i>
Yellow nutgrass <i>Cyperus esculentus</i>	5	Restricted Plant <i>The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with</i>

# APPENDIX C PRIORITY WEEDS FOR THE SOUTH EAST REGION

# Priority weeds for the South East

**Note:** this region includes the local council areas of Bega Valley, Eurobodalla, Goulburn Mulwaree, Hilltops (eastern), Kiama, Queanbeyan-Palerang Regional, Shellharbour, Shoalhaven, Snowy Monaro Regional, Upper Lachlan, Wingecarribee, Wollongong and Yass Valley.

[Select another region](#)

## Weed

## Duty

All plants

### General Biosecurity Duty

All plants are regulated with a **general biosecurity duty** to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

[African boxthorn](#)

*Lycium ferocissimum*

### Prohibition on dealings

Must not be imported into the State or sold

[African lovegrass](#)

*Eragrostis curvula*

### Regional Recommended Measure

Land managers should mitigate spread from their land.

[Alligator weed](#)

*Alternanthera philoxeroides*

### Prohibition on dealings

Must not be imported into the State or sold

[Alligator weed](#)

*Alternanthera philoxeroides*

### Biosecurity Zone

The Alligator Weed Biosecurity Zone is established for all land within the state except land in the following regions: Greater Sydney; Hunter (but only in the local government areas of City of Lake Macquarie, City of Maitland, City of Newcastle or Port Stephens).

Within the Biosecurity Zone this weed must be eradicated where practicable, or as much of the weed destroyed as practicable, and any remaining weed suppressed. The local control authority must be notified of any new infestations of this weed within the Biosecurity Zone

[Anchored water hyacinth](#)

*Eichhornia azurea*

### Prohibited Matter

A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries

Athel pine

*Tamarix aphylla*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Bellyache bush

*Jatropha gossypifolia*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Bitou bush

*Chrysanthemoides monilifera* subsp.  
*rotundata*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Bitou bush

*Chrysanthemoides monilifera* subsp.  
*rotundata*

**Biosecurity Zone**

The Bitou Bush Biosecurity Zone is established for all land within the State except land within 10 kilometres of the mean high water mark of the Pacific Ocean between Cape Byron in the north and Point Perpendicular in the south.

*Within the Biosecurity Zone this weed must be eradicated where practicable, or as much of the weed destroyed as practicable, and any remaining weed suppressed. The local control authority must be notified of any new infestations of this weed within the Biosecurity Zone*

Black knapweed

*Centaurea X moncktonii*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Black willow

*Salix nigra*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Blackberry

*Rubus fruticosus* species aggregate

**Prohibition on dealings**

*Must not be imported into the State or sold*

**All species in the *Rubus fruticosus* species aggregate have this requirement, except for the varieties Black Satin, Chehalem, Chester Thornless, Dirksen Thornless, Loch Ness, Murrindindi, Silvan, Smooth Stem, and Thornfree**

Blue hound's tongue

*Cynoglossum creticum*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Boneseed

*Chrysanthemoides monilifera* subsp.  
*monilifera*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Boneseed

*Chrysanthemoides monilifera* subsp.  
*monilifera*

**Control Order**

Boneseed Control Zone: Whole of NSW

*Boneseed Control Zone (Whole of NSW): Owners and occupiers of land on which there is boneseed must notify the local control authority of new infestations; immediately destroy the plants; ensure subsequent generations are destroyed; and ensure the land is kept free of the plant. A person who deals with a carrier of boneseed must ensure the plant (and any seed and propagules) is not moved from the land; and immediately notify the local control authority of the presence of the plant.*

Boxing glove cactus

*Cylindropuntia fulgida* var. *mamillata*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Bridal creeper

*Asparagus asparagoides*

**Prohibition on dealings**

*Must not be imported into the State or sold*

**\*this requirement also applies to the Western Cape form of bridal creeper**

Bridal creeper

*Asparagus asparagoides*

**Regional Recommended Measure**

Exclusion zone: whole region except the core infestation area of Wingecarribee, Wollongong, Kiama, Shellharbour, Shoalhaven, Eurobodalla and Bega  
*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Bridal veil creeper

*Asparagus declinatus*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*



Broomrapes

*Orobanche* species

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

**All species of *Orobanche* are Prohibited Matter in NSW, except the natives *Orobanche cernua* var. *australiana* and *Orobanche minor***

Cabomba

*Cabomba caroliniana*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Cabomba

*Cabomba caroliniana*

**Regional Recommended Measure**

*Exclusion zone: whole of region except the core infestation area of Wollongong, Shellharbour and Kiama councils.*

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Cane cactus

*Austrocyllindropuntia cylindrica*

**Prohibition on dealings**

*Must not be imported into the State or sold*

**All species in the *Austrocyllindropuntia* genus have this requirement**

Cane needle grass

*Nassella hyalina*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Cape broom

*Genista monspessulana*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Cape broom

*Genista monspessulana*

**Regional Recommended Measure**

*Core infestation: whole region except for the exclusion zone of Bega and Wingecarribee councils*

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Cat's claw creeper  
*Dolichandra unguis-cati*

**Prohibition on dealings**  
*Must not be imported into the State or sold*

Cat's claw creeper  
*Dolichandra unguis-cati*

**Regional Recommended Measure**  
*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. Notify local control authority if found.*

Chilean needle grass  
*Nassella neesiana*

**Prohibition on dealings**  
*Must not be imported into the State or sold*

Chilean needle grass  
*Nassella neesiana*

**Regional Recommended Measure**  
Exclusion zone: whole of region except core infestation area of Wollongong, Kiama, Shellharbour, Wingecarribee, Gouburn/Murwaree, and Queanbeyan/Palerang  
*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Climbing asparagus  
*Asparagus africanus*

**Prohibition on dealings**  
*Must not be imported into the State or sold*

Climbing asparagus  
*Asparagus africanus*

**Regional Recommended Measure**  
Exclusion zone: whole of region except core infestation areas. Core infestation area: Wollongong, Kiama, Shellharbour, Bega and Shoalhaven local government areas.  
*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant. Core infestation area: Land managers should mitigate spread from their land.*

Climbing asparagus fern  
*Asparagus plumosus*

**Prohibition on dealings**  
*Must not be imported into the State or sold*

Climbing asparagus fern

*Asparagus plumosus*

**Regional Recommended Measure**

Exclusion zone: whole region except the core infestation area.

Core infestation area: Wollongong, Kiama, and Shellharbour

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Plant should not be bought, sold, grown, carried or released into the environment.*

*Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant. Core infestation: Land managers should mitigate spread from their land.*

Common pear

*Opuntia stricta*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Common pear

*Opuntia stricta*

**Regional Recommended Measure**

Core infestation area: whole region except the exclusion zone of Wollongong, Kiama, and Shellharbour, and Eurobadalla

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant. Core infestation: Land managers should mitigate spread from their land.*

**\*This Regional Recommended Measure applies to all species of Opuntia except for Opuntia ficus-indica (Indian fig)**

Coolatai grass

*Hyparrhenia hirta*

**Regional Recommended Measure**

Exclusion zone: whole region except the core infestation area of Bigga, Crooked Corner and Narrawa in the Upper Lachlan local government area, and Wollongong local government area

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Plant should not be bought, sold, grown, carried or released into the environment.*

*Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Eurasian water milfoil

*Myriophyllum spicatum*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Fireweed

*Senecio madagascariensis*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Fireweed

*Senecio madagascariensis*

**Regional Recommended Measure**

Exclusion zone: whole region except the core infestation area of Wollongong, Kiama, Shellharbour, Eurobodalla, Shoalhaven, Bega Valley and Wingecaribee councils

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Flax-leaf broom

*Genista linifolia*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Flax-leaf broom

*Genista linifolia*

**Regional Recommended Measure**

Exclusion zone: whole region except for the core infestation areas of Wollongong, Shellharbour, Kiama, Shoalhaven and Eurobodalla councils

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Plant should not be bought, sold, grown, carried or released into the environment. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Frogbit

*Limnobium laevigatum*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

**All species of *Limnobium* are Prohibited Matter**

Gamba grass

*Andropogon gayanus*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Giant devil's fig

*Solanum chrysotrichum*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Giant Parramatta grass

*Sporobolus fertilis*

**Regional Recommended Measure**

Exclusion zone: whole of region except core infestation area of Wollongong, Kiama, Shellharbour, Eurobodalla, and Shoalhaven councils

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Plant should not be bought, sold, grown, carried or released into the environment.*

*Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Giant rat's tail grass

*Sporobolus pyramidalis*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Gorse

*Ulex europaeus*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Gorse

*Ulex europaeus*

**Regional Recommended Measure**

Exclusion zone: whole of region except the core infestation area of Upper Lachlan, Wollongong, Shellharbour, Kiama, Shoalhaven, Eurobodalla, Yass Valley and Bega Valley councils

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Grey sallow

*Salix cinerea*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Ground asparagus

*Asparagus aethiopicus*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Ground asparagus

*Asparagus aethiopicus*

**Regional Recommended Measure**

Exclusion zone: whole region except the core infestation area of Wollongong, Kiama, Eurobodalla, Shellharbour and Shoalhaven

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Groundsel bush

*Baccharis halimifolia*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Hawkweeds

*Hieracium* species

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

**All species in the genus *Hieracium* are Prohibited Matter**

Holly leaved senecio

*Senecio glastifolius*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Horsetails

*Equisetum* species

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Hudson pear

*Cylindropuntia rosea*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Hydrocotyl

*Hydrocotyle ranunculoides*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Hygrophila

*Hygrophila costata*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Hymenachne

*Hymenachne amplexicaulis* and hybrids

**Prohibition on dealings**

*Must not be imported into the State or sold*

Karoo thorn

*Vachellia karroo*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Kidney-leaf mud plantain

*Heteranthera reniformis*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Kochia

*Bassia scoparia*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

**Excluding the subspecies *trichophylla***

Koster's curse

*Clidemia hirta*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Lagarosiphon

*Lagarosiphon major*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Lantana

*Lantana camara*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Lantana

*Lantana camara*

**Regional Recommended Measure**

Exclusion zone: whole region excluding the core infestation area of Eurobodalla, Kiama, Shellharbour, Wollongong and the Shoalhaven local government area north of the Lantana Containment Line at 35°11'42" S

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Long-leaf willow primrose

*Ludwigia longifolia*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Ludwigia

*Ludwigia peruviana*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Madeira vine

*Anredera cordifolia*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Mesquite

*Prosopis species*

**Prohibition on dealings**

*Must not be imported into the State or sold*

**All species in the genus *Prosopis* have this requirement**

Mexican feather grass

*Nassella tenuissima*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Miconia

*Miconia species*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

**All species of *Miconia* are Prohibited Matter in NSW**



Mikania vine

*Mikania micrantha*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

**\*all species in the genus *Mikania* are Prohibited Matter in NSW**

Mimosa

*Mimosa pigra*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Ming asparagus fern

*Asparagus macowanii* var. *zuluensis*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Mysore thorn

*Caesalpinia decapetala*

**Regional Recommended Measure**

Exclusion zone: whole region except the core infestation area of Wollongong  
*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Plant should not be bought, sold, grown, carried or released into the environment. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Pampas grass

*Cortaderia* species

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

**This Regional Recommended Measure applies to *Cortaderia jubata* (pink pampas grass)**

Parkinsonia

*Parkinsonia aculeata*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Parkinsonia

*Parkinsonia aculeata*

**Control Order**

Parkinsonia Control Zone: Whole of NSW

*Parkinsonia Control Zone (Whole of NSW): Owners and occupiers of land on which there is parkinsonia must notify the local control authority of new infestations; immediately destroy the plants; ensure subsequent generations are destroyed; and ensure the land is kept free of the plant. A person who deals with a carrier of parkinsonia must ensure the plant (and any seed and propagules) is not moved from the land; and immediately notify the local control authority of the presence of the plant.*

Parthenium weed

*Parthenium hysterophorus*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Parthenium weed

*Parthenium hysterophorus*

**Prohibition on dealings**

*The following equipment must not be imported into NSW from Queensland: grain harvesters (including the comb or front), comb trailers (including the comb or front), bins used for holding grain during harvest operations, augers or similar for moving grain, vehicles used to transport grain harvesters, support vehicles driven in paddocks during harvest operations, mineral exploration drilling rigs and vehicles used to transport those rigs, unless set out as an exception in Division 5, Part 2 of the Biosecurity Order (Permitted Activities) 2017*

Pond apple

*Annona glabra*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Prickly acacia

*Vachellia nilotica*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Prickly pears - Austrocyllindropuntias

*Austrocyllindropuntia* species

**Prohibition on dealings**

*Must not be imported into the State or sold*

**All species in the *Austrocyllindropuntia* genus have this requirement**

Prickly pears - Cyllindropuntias

*Cyllindropuntia* species

**Prohibition on dealings**

*Must not be imported into the State or sold*

**All species in the *Cyllindropuntia* genus have this requirement**

Prickly pears - Opuntias

*Opuntia* species

**Prohibition on dealings**

*Must not be imported into the State or sold*

**Except for *Opuntia ficus-indica* (Indian fig)**

Prickly pears - Opuntias

*Opuntia* species

**Regional Recommended Measure**

Core infestation area: whole region except the exclusion zone of Wollongong, Kiama, and Shellharbour, and Eurobadalla  
*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant. Core infestation: Land managers should mitigate spread from their land.*

**This Regional Recommended Measure applies to all species of *Opuntia* except for *Opuntia ficus-indica* (Indian fig)**

Rope pear

*Cyllindropuntia imbricata*

**Prohibition on dealings**

*Must not be imported into the State or sold*

**All species in the *Cyllindropuntia* genus have this requirement**

Rubber vine

*Cryptostegia grandiflora*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Sagittaria

*Sagittaria platyphylla*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Sagittaria

*Sagittaria platyphylla*

**Regional Recommended Measure**

*Plant should not be allowed to be spread to priority sites of high environmental, economic or social value.*

Salvinia

*Salvinia molesta*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Salvinia

*Salvinia molesta*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. Notify local control authority if found.*

Scotch broom

*Cytisus scoparius* subsp. *scoparius*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Scotch broom

*Cytisus scoparius* subsp. *scoparius*

**Regional Recommended Measure**

Core infestation area: whole region except exclusion zone of :  
Bega council

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Plant should not be bought, sold, grown, carried or released into the environment. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Sea spurge

*Euphorbia paralias*

**Regional Recommended Measure**

Exclusion zone: whole region except for the core infestation area of Eurobodalla and Bega Valley councils

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Plant should not be bought, sold, grown, carried or released into the environment. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Senegal tea plant

*Gymnocoronis spilanthoides*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Serrated tussock

*Nassella trichotoma*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Serrated tussock

*Nassella trichotoma*

**Regional Recommended Measure**

Core infestation: whole region except the exclusion zone of Shoalhaven, Eurobodalla, Kiama, Wollongong, Bega Valley and Shellharbour councils

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: Land managers should mitigate spread from their land.*

Siam weed

*Chromolaena odorata*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Sicklethorn

*Asparagus falcatas*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Silverleaf nightshade

*Solanum elaeagnifolium*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Smooth tree pear

*Opuntia monacantha*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Smooth tree pear

*Opuntia monacantha*

**Regional Recommended Measure**

Core infestation area: whole region except the exclusion zone of Wollongong, Kiama, and Shellharbour, and Eurobadalla  
*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant. Core infestation: Land managers should mitigate spread from their land.*

**\*This Regional Recommended Measure applies to all species of Opuntia except for Opuntia ficus-indica (Indian fig)**

Snakefeather

*Asparagus scandens*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Spanish broom

*Spartium junceum*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Spanish heath  
*Erica lusitanica*

### **Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Spongeplant  
*Limnobium spongia*

### **Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

### **All species of *Limnobium* are Prohibited Matter**

Spotted knapweed  
*Centaurea stoebe* subsp. *micranthos*

### **Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

St. John's wort  
*Hypericum perforatum*

### **Regional Recommended Measure**

Core infestation area: whole region except the exclusion area of Bega, Eurobodalla, Shoalhaven, Wollongong, Shellharbour and Kiama

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Plant should not be bought, sold, grown, carried or released into the environment. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant.*

Tiger pear  
*Opuntia aurantiaca*

### **Prohibition on dealings**

*Must not be imported into the State or sold*

Tiger pear  
*Opuntia aurantiaca*

### **Regional Recommended Measure**

Core infestation area: whole region except the exclusion zone of Wollongong, Kiama, Shellharbour, and Eurobadalla

*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant. Core infestation: Land managers should mitigate spread from their land.*

**\*This Regional Recommended Measure applies to all species of *Opuntia* except for *Opuntia ficus-indica* (Indian fig)**

Tropical soda apple

*Solanum viarum*

**Control Order**

Tropical Soda Apple Control Zone: Whole of NSW

*Tropical Soda Apple Control Zone (Whole of NSW): Owners and occupiers of land on which there is tropical soda apple must notify the local control authority of new infestations; destroy the plants including the fruit; ensure subsequent generations are destroyed; and ensure the land is kept free of the plant. A person who deals with a carrier of tropical soda apple must ensure the plant (and any seed and propagules) is not moved from the land; and immediately notify the local control authority of the presence of the plant on the land, or on or in a carrier.*

Velvety tree pear

*Opuntia tomentosa*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Velvety tree pear

*Opuntia tomentosa*

**Regional Recommended Measure**

Core infestation area: whole region except the exclusion zone of Wollongong, Kiama, and Shellharbour, and Eurobadalla  
*Whole region: Land managers should mitigate the risk of new weeds being introduced to their land. Exclusion zone: The plant should be eradicated from the land and the land kept free of the plant. Core infestation: Land managers should mitigate spread from their land.*

**This Regional Recommended Measure applies to all species of Opuntia except for Opuntia ficus-indica (Indian fig)**

Water caltrop

*Trapa species*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

**All species in the *Trapa* genus are Prohibited Matter in NSW**

Water hyacinth

*Eichhornia crassipes*

**Prohibition on dealings**

*Must not be imported into the State or sold*

Water hyacinth

*Eichhornia crassipes*

**Biosecurity Zone**

The Water Hyacinth Biosecurity Zone applies to all land within the State, except for the following regions: Greater Sydney or North Coast, North West (but only the local government area of Moree Plains), Hunter (but only in the local government areas of City of Cessnock, City of Lake Macquarie, MidCoast, City of Maitland, City of Newcastle or Port Stephens), South East (but only in the local government areas of Eurobodalla, Kiama, City of Shellharbour, City of Shoalhaven or City of Wollongong).

*Within the Biosecurity Zone this weed must be eradicated where practicable, or as much of the weed destroyed as practicable, and any remaining weed suppressed. The local control authority must be notified of any new infestations of this weed within the Biosecurity Zone*

Water lettuce

*Pistia stratiotes*

**Regional Recommended Measure**

*Land managers should mitigate the risk of new weeds being introduced to their land. The plant should be eradicated from the land and the land kept free of the plant. The plant should not be bought, sold, grown, carried or released into the environment. Notify local control authority if found.*

Water soldier

*Stratiotes aloides*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

Willows

*Salix* species

**Prohibition on dealings**

*Must not be imported into the State or sold*

**All species in the *Salix* genus have this requirement, except *Salix babylonica* (weeping willows), *Salix x calodendron* (pussy willow) and *Salix x reichardtii* (sterile pussy willow)**

Witchweeds

*Striga* species

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*

**All species in the *Striga* genus are Prohibited Matter in NSW, except the native *Striga parviflora***



Yellow burrhead  
*Limnocharis flava*

**Prohibited Matter**

*A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries*





The content provided here is for information purposes only and is taken from the *Biosecurity Act 2015* and its subordinate legislation, and the Regional Strategic Weed Management Plans (published by each Local Land Services region in NSW). It describes the state and regional priorities for weeds in New South Wales, Australia.











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## APPENDIX D COMPARISON PHOTOS 2016/2017





Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
15	297055	6152294	North of Toolijooa Rd	Batter		
14	296835	6152244	Near turn around bay south of Toolijooa Rd	Construction area, with bare soil areas		





Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
16	296799	615239	South of Toolijooa Rd	Roadside area	 <p>A photograph showing a roadside area with a dirt shoulder, a concrete curb, and a road surface. The background features rolling green hills under a cloudy sky.</p>	 <p>A photograph showing a roadside area with a dirt shoulder, a concrete curb, and a road surface. The background features rolling green hills under a clear blue sky.</p>
17	296675	6152401	South of Toolijooa Rd	Roadside batter	 <p>A photograph showing a roadside batter with a dirt path, a concrete curb, and a road surface. The background features rolling green hills under a cloudy sky.</p>	 <p>A photograph showing a roadside batter with a dirt path, a concrete curb, and a road surface. The background features rolling green hills under a clear blue sky.</p>

Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
18	296523	6152549	South of Toolijooa Rd	Roadside batter		
19	296251	6152744	Between BC1 and Toolijooa Rd	Roadside embankment		




Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
20	296157	6152704	Between BC1 and Toolijooa Rd	Access track between Toolijooa Rd and BC1		
21	29593	6152819	Between BC1 and Toolijooa Rd	Top of cut		





Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
22	295486	6152939	Between BC1 and Toolijooa Rd	Light vehicle track		
24	295121	6152887	BC1	Adjacent to compound		

Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
31	295126	6152978	BC1	Roadside batter		
25	294923	6152794	BC1	BC1		

Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
26	294695	6152708	Between BC1 and BC2	Road side		
27	294623	6152587	Between BC1 and BC2	Road side		




Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
30	294583	6152452	Between BC1 and BC2	Road side		
28	294296	6152021	Between BC2 and BC3	Road side		





Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
29	294250	6151865	Between BC2 and BC3	Road side		
32	294059	6151679	Between Austral Park compound and BC3	Access track		

Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
33	293916	6151611	Between Austral Park compound and BC3	Batter		
34	293975	6151579	Between Austral Park compound and BC3	Batter		

Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
35	293661	6151517	Between Austral Park compound and BC3	Batter		
36	293699	6151420	Between Austral Park compound and BC3	Batter		





Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
37	293391	6151342	Between Austral Park compound and BC3	Batter		
13	293197	6151331	Austral Park	Western side Princess Hwy		

Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
38	293143	6151252	Austral Park	Western side Princess Hwy		
12	293089	6151221	Austral Park	Western side Princess Hwy		





Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
10	292987	6151220	Austral Park	Western side Princess Hwy		
11	292977	6151168	Austral Park	Soil mound		

Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
9	292873	6151166	Austral Park	Batter		
8	292746	6151115	Austral Park	Road side		







Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
7	292355	6150882	Central zone	Road side		
6	291579	6150900	Tindell's Lane	Road side		





Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
5	291578	6150845	Tindell's Lane	Batter		
4	291320	6150671	Central zone Cut 6	Batter		

Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
3	291317	6150605	Central zone Cut 6	Batter		
2	291251	6150619	Central zone Cut 6	Batter		

Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
1	291130	6150523	Central zone Cut 6	Batter		
0	290920	6150386	Central zone	Batter		





Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
39	290499	6150097	Southern zone	Batter		
41	290384	6150131	Southern zone	Batter		



Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
40	290237	6150006	Southern zone	Embankment		
42	289262	6149761	Southern zone	Batter		

Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
43	288808	6149755	Southern zone	Batter		
49	288598	6149960	Southern zone	Town Creek Diversion, Rawling's Lane		

Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
44	288407	6149644	Southern zone	Noise mound		
45	288031	6149263	Southern zone	Roadside		



Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
48	287971	6149266	Southern zone	Roadside		
47	287054	6147773	Southern zone	Roadside		

Way point	Eastings	Northings	General Location	Site Description	2016 Photograph	2017 Photograph
46	286918	6147524	Southern zone	Roadside		

# Nest Box Monitoring Annual Report 2017

FOXGROUND AND BERRY BYPASS

MARCH 2018



## Document Verification



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# 1 INTRODUCTION

Roads and Maritime Services (Roads and Maritime) contracted Fulton Hogan to upgrade 12.9 km of the Princes Highway between Toolijooa Road (north of Foxground) and Schofields Lane (the Foxground and Berry Bypass Project), and between Schofields Lane and Croziers Lane, south of Berry (the Southern Extension) (Figure 1-1).

NGH Environmental was engaged by Fulton Hogan to provide ecological services during the construction period. Ecological services provided include but are not limited to the following:

- Pre-clearing and clearing services
- Ecological monitoring including:
  - Nest box monitoring
  - Aquatic monitoring
  - Weed monitoring
- Specialist advice on ecological matters as required by Fulton Hogan

## 1.1 PURPOSE OF THE REPORT

Requirements regarding the installation and monitoring of nest boxes during the construction period are outlined in the following documents:

- Minister’s Conditions of Approval (CoA)
- The Roads and Maritime Statement of Commitments (SoC)
- Construction Flora and Fauna Management Plan sub-plan (CFFMP) (Roads and Maritime 2014)
- The mitigation measures listed in the Foxground and Berry Bypass Environmental Assessment (EA) (AECOM, 2012)

The Nest Box Management Plan (NBMP) (Parsons Brinckerhoff, 2014), Construction Flora and Fauna Management sub-plan (CFFMP) (Roads and Maritime 2014) and Ecological Monitoring Program (EcMP) (PB 2014) prepared for the project detail the actions that need to be taken to meet those requirements. The NBMP includes a three-year bi-annual monitoring program (this report).

In accordance with Section 6.2 of the Ecological Monitoring Program (EcMP) (PB 2014), annual reporting is to be completed for all monitoring surveys outlined in the EcMP. This includes nest box monitoring during the construction period.

The EcMP requires that the following monitoring be undertaken during the construction period.

Table 1-1 Nest box monitoring requirements as stated in the EcMP.

Timing and frequency	Monitoring method	Data to be collected	Reporting
Monitoring on all nest boxes at least once during the construction phase and following construction in accordance with the NBMP and CFFMP.	A visual inspection of each nest box would be conducted. Further details would be provided in the NBMP.	On visual inspection of the nest boxes the following data would be collected: <ul style="list-style-type: none"> <li>• Date of inspection</li> <li>• Weather conditions</li> <li>• Nest box ID</li> <li>• Nest box type</li> </ul>	Results included in Annual Monitoring Report

Timing and frequency	Monitoring method	Data to be collected	Reporting
		<ul style="list-style-type: none"> <li>• Nest box height and orientation</li> <li>• Presence/absence of occupation</li> <li>• If occupied, the species, age (juvenile/adult), number of individuals and whether it is native/feral.</li> <li>• Signs of use if not occupied</li> <li>• Condition of nest box and whether maintenance is required</li> <li>• Changes in surrounding habitat</li> </ul>	

The annual reports must include the following information:

- **Introduction** – background description of the monitoring session (refer to Section 1)
- **Methodology** – description of methodology undertaken including site location and specific survey site locations (refer to Section 2)
- **Results and discussion** – description of monitoring results and comparison of results to performance indicators (refer to Section 3)
- **Review of mitigation measures** – the effectiveness of each mitigation measure will be reviewed (where appropriate) at the end of the monitoring period. Considering the installation of nest boxes is in itself the mitigation measure and that the performance of the nest boxes has been assessed in Section 3, this section has not been included.
- **Recommendations** – suggestion of adaptive responses and contingency measures potentially required (where appropriate) based on the results of the monitoring session such as the implementation of contingency measures or modification of monitoring timing, frequency or methodology (refer to Section 4).

Annual nest box monitoring reports were prepared by NGH Environmental on behalf of Fulton Hogan in accordance with the EcMP and NBMP for the project for the 2015 and 2016 monitoring periods (NGH 2015, 2017).

NGH Environmental has prepared this 2017 annual nest box monitoring report on behalf of Fulton Hogan in accordance with the EcMP and NBMP for the project. The report provides operational guidance and recommendations for continued improvement for tree hollow replacement within the Foxground and Berry Bypass Project area and its immediate surrounds.

Due to the scale and geographical range of clearing on the FBB project, clearing was broken up into smaller areas which were cleared progressively over a 10 month period. Following this, other small sections of the project have also been cleared as required. For each catchment a corresponding location of suitable preserved native bushland was chosen and 70% of nest boxes were installed prior to the removal of the



trees from the clearing area. Nest box installation commenced in October 2014 and continued through to January 2016 as detailed in Table 1-2 below. This report provides the results of the third and final year (2017) of nest box monitoring and includes results obtained from all areas of the Project and surrounds where nest boxes have been installed including the following properties and land areas:

Table 1-2 Nest box locations and installation dates

Property	Number of nest boxes	Nest box types	Installation date
Broughton Creek BC1 Lots 415 and 416 DP882532/1 and DP3344/9	24	Microbats, arboreal mammals, birds, gliders	November 2014 January 2015 January 2016
Bundewallah Creek Lots 51 and 52 DP1108069/46 and DP815023/7	25	Birds, arboreal mammals, microbats	February 2015
Culvert (DP801512/4)	2	Microbat	Unknown
Cut 2 DP224377/2, DP255171/1, DP377518/A, DP255171/2	55	Birds, gliders, arboreal mammals, microbats	January 2015 January 2016
Cut 7 East DP1029979/33	10	Gliders, arboreal mammals, microbats	Unknown
Downes DP1098617/13	60	Birds, arboreal mammals, gliders, microbats, small terrestrial/arboreal mammals	November 2014 January 2015 January 2016
Gate 8 DP1098617/12	5	Bird	January 2016
Gembrooke Lane DP801512/4	18	Birds, arboreal mammals, gliders, small terrestrial/arboreal mammals	Unknown
Lot 11 DP1098617/11	5	Birds	January 2015 January 2016
Lot 177 DP801177/1	5	Birds	January 2015
Lot 81 DP1098617/12	24	Birds, arboreal mammals, microbats,	August 2015 January 2016
Mark Radium Park DP925241/1	5	Birds, arboreal mammals	January 2016
Vanini's DP596879/4	13	Birds, arboreal mammals, microbats, gliders, small terrestrial/arboreal mammals	January 2016
Simons DP615284/4	15	Birds, arboreal mammals, gliders	January 2016
Smarts DP628132/1	8	Birds, gliders, Microbats	January 2016
Tindalls Lane DP1098617/12	26	Birds, arboreal mammals, microbats, gliders, small terrestrial/arboreal mammals	August 2015 January 2016
<b>Total</b>	<b>300</b>		

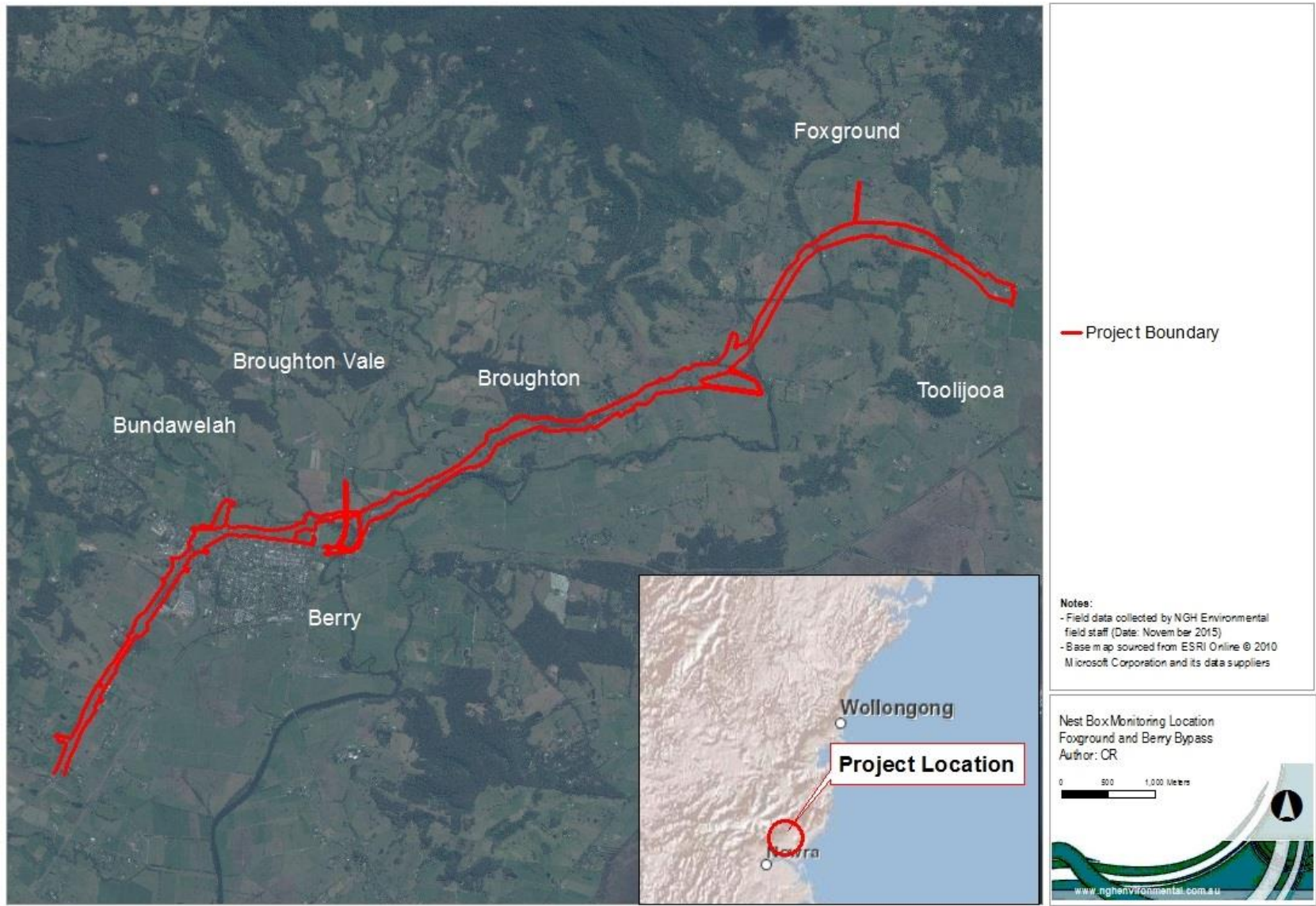


Figure 1-1 Location of the Foxground and Berry Bypass Project

## 2 SURVEY METHODOLOGY

In order to satisfy the commitments of the *Foxground and Berry Bypass Princes Highway Upgrade Nest Box Management Plan* (Parsons and Brinckerhoff, 2014), two nest box surveys were conducted by NGH Environmental over the entire project area on 1<sup>st</sup> - 4<sup>th</sup> of August (winter) and 6<sup>th</sup> – 9<sup>th</sup> November (spring) 2017. The purpose of undertaking separate surveys in winter and spring was to capture the breeding periods of all possible fauna species that may have been using the nest boxes. Fauna species likely to be using nest boxes for winter breeding included owls and antechinuses. Fauna groups likely to be using nest boxes for spring breeding included all other birds, arboreal mammals, gliders and microbats. Considering fauna may use all nest boxes for refuge purposes throughout the year, all nest boxes were inspected in both survey sessions.

### Winter Survey

Of the 300 nest boxes mapped as being installed, a total of 273 nest boxes were surveyed during the Winter 2017 survey. 11 boxes were not located, and 10 were unsuitable for habitation having fallen or been filled with debris. Of the 273 boxes surveyed, 209 were inspected with a camera and 8 m extendable pole through the entrance hole or the top opening under the covering lid. Nest boxes that were visible but were located higher than 6 m (totalling 59) could not be inspected using the camera and were watched during the day for birds or at dusk for arboreal mammals, gliders, microbats and owls to monitor usage. This watching period occurred for a period of approximately 30 minutes or until dark for dusk surveys. The data to be collected according to Table 1-1 was recorded at each nest box location, in accordance with the requirements of the NBMP. The results of the surveys are provided in Appendix A.

### Spring Survey

Of the 300 nest boxes mapped as being installed, a total of 286 nest boxes were surveyed during the Spring 2017 survey. 14 boxes were not located, and 19 were unsuitable for habitation having fallen, being loose or being filled with debris. 223 boxes were inspected with a camera and 8 m extendable pole through the entrance hole or the top opening under the covering lid. Nest boxes that were visible but were located higher than 8 m (totalling 56) were not inspected using the camera and were watched during the day for birds or at dusk for birds, arboreal mammals, gliders and microbats to observe usage. This watching period occurred for a period of approximately 30 minutes or until dark for dusk surveys. The data to be collected according to Appendix A was recorded at each nest box location, in accordance with the requirements of the NBMP. The results of the surveys are provided in Appendix A.

## 2.1 LIMITATIONS

### 2.1.1 Nest box survey

Although the nest box surveys were undertaken during the most appropriate survey conditions (during late spring as per the NBMP and during winter to capture winter breeding species), a number of survey limitations were apparent.

A total of 53 nest boxes could not be inspected using the camera during the 2017 survey due to height restrictions or vegetation intrusions surrounding the tree or within the nest box. These boxes were installed at a height above the reach of cameras for several reasons, including advice from ecologists that higher boxes may be more effective for some fauna, and the presence of only large mature trees containing high limbs in many areas. These nest boxes were watched either during the day or at dusk for approximately

30 minutes. This short time period may not have been sufficient for observing fauna using the nest box. 53 (approximately 18%) of the nest boxes installed were too high to be inspected by camera. Furthermore, a total of six nest boxes were missing at the time of the surveys.

Species identification or counts may not have been accurate as a result of the use of the inspection camera. As some boxes were difficult to access, optimal camera angles, lighting and focus allowing positive species identification and counting were not always achieved. As such, where multiple animals were detected in boxes, an estimate of animal abundance was made. There is potential that there may have been more animals underneath those identified, including juveniles.

Using a GIS program on an Apple iPad, the locations of some boxes were moved slightly to more accurately represent their location on the ground. Original installation locations had been collected with a hand-held GPS, which during times of high cloud cover or dense canopy can lose accuracy, and typically only have an accuracy of 3-5 metres. The newly collected and identified points have been included in Appendix A of this report. Additionally, where previously points contained multiple nest boxes in trees, these points have now been duplicated, so that each point refers specifically to a nest box, allowing for more accurate comparison of results during future surveys.

Most arboreal mammal and glider species that may occur in the local area such as Common Ringtail Possum (*Pseudocheirus peregrinus*), Common Brushtail Possum, Yellow-bellied Glider (*Petaurus australis*), Greater Glider (*Petauroides volans*), Squirrel Glider (*Petaurus norfolcensis*), Sugar Glider (*Petaurus breviceps*), and microbats such as Southern Myotis (*Myotis macropus*), Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*) and Eastern Freetail-bat (*Mormopterus norfolkensis*) use multiple hollows within their home-range (Thomson and Owen 1964, Henry and Suckling 1984, Craig 1985, Cowan 1989, Lindenmeyer *et al.* 1991, Norton 1998) and so may not have been observed using species specific nest boxes during a single inspection of each nest box during the survey period. Furthermore, target species may not have been using the nest box habitat areas at the time of the surveys.

## 3 RESULTS AND DISCUSSION

### 3.1 SURVEY RESULTS

The survey periods were considered suitable for detecting the majority of species likely to be using the nest boxes for breeding purposes (winter and spring). Two survey periods in different seasons (winter and spring) ensured all fauna types likely to be using the nest boxes were surveyed. This included owls and antechinuses which breed in winter.

#### 3.1.1 Winter

Of the total 284 boxes mapped as occurring, a total of 273 nest boxes were inspected either through use of a remote camera or by observation during the 2017 Winter survey. 235 trees had one box installed, with twenty-three trees having two or more nest boxes installed (totalling 49 boxes). 263 of these nest boxes were found to be habitable. Weather conditions ranged between mild and sunny (maximum temperature 16°C) to cold (minimum temperature 3.6°C) over the survey period).

Nest boxes were located in trees situated outside the project boundary in a range of habitat types (generally close to areas where hollow-bearing trees had been cleared) (Table 3-1).

Table 3-1 Habitat types, abundance and type of fauna using the nest boxes installed.

Habitat type	Number of nest boxes surveyed	Number of used nest boxes	Fauna types using nest boxes
Isolated tree	19	7	Birds, arboreal mammals
Forest	148	67	Birds, arboreal mammals, antechinus, Diamond Python
Woodland	56	26	Arboreal mammals
Riparian forest	50	15	Birds, arboreal mammals
<b>Total</b>	<b>273</b>	<b>115</b>	<b>42%</b>

Nest boxes were installed in trees and habitat types that suited the nest box type. For example, microbat type nest boxes were mainly installed in trees within riparian habitat or forest patches, and glider type nest boxes were mainly installed in forest patches.

10 boxes were not found to be habitable. These boxes had typically fallen down to the base of trees, had lids open or were hanging from trees.

One hundred and fifteen (115) out of the 273 nest boxes inspected were observed either being used by fauna or showing signs of use, with 27 individuals from seven different species (not including eggs) being recorded in total (Table 3-2). Nest boxes containing fauna were taken to show signs of use.

Table 3-2 Nest box use by fauna type

Fauna Type	Number of Adults	Number of Juveniles, Chicks or Eggs	Number of Nest Boxes
Brown Antechinus	3	0	1
Common Ringtail Possum	4	0	2
Common Brushtail Possum	15	0	14
Crimson Rosella	1	0	1
Eastern Rosella	1	0	1
Sugar Glider	3	0	1
Diamond Python	1	0	1
Eggs (unidentified bird species)	0	11	6
		Total inhabited	27
Signs of use	-	-	115
<b>Total</b>	<b>28</b>	<b>11</b>	<b>115</b>

The Common Brushtail Possum was the most abundant species recorded using nest boxes (14 nest boxes, 15 individuals) followed by the Common Ringtail Possum (*Peregrinus pseudocheirus*) (two nest boxes, four individuals). Other species recorded included the Sugar Glider (*Petaurus breviceps*), Brown Antechinus (*Antechinus stuartii*), Crimson Rosella (*Platycercus elegans*), and Diamond Python (*Morelia spilota*). Six nest boxes with a total of 11 eggs were observed, however the species could not be identified. All of the eggs recorded were white and oval in shape, similar to that of the other bird species recorded (for example the Crimson Rosella and most parrot species all have white, rounded oval eggs).

It is presumed that all birds recorded using a nest box were doing so for breeding purposes. Although no juvenile Brown Antechinus were recorded, it is likely that they were mating during the survey, considering this usually solitary animal was recorded in groups. This species usually begins mating around July for an approximate two-week period, after which all males die from stress-induced immune system breakdown. The young are then born approximately one month later.

Apart from the Sugar Gliders, other species were recorded in nest box types which were not designed for that species. Being opportunistic, it was not surprising that species such as the Common Brushtail Possum and Common Ringtail Possum were recorded in several nest box types. The unidentified eggs and eggshells were recorded in nest boxes designed for owl, dollarbird, parrot, and Common Brushtail Possum.

Signs of use included scratches, whitewash, gnawing at the hole of the nest box (a behaviour often undertaken by parrots in hollows to keep the hole from growing inwards), vegetative material deposited inside the nest box for nesting, and feathers inside the nest box.

There was no evidence of nest box use by pests (e.g. bees and wasps) during winter.

### 3.1.2 Spring

Of the total 300 boxes mapped as occurring, a total of 286 nest boxes were inspected either through use of a remote camera or by observation during the 2017 Spring survey. 251 trees contained one box, while Twenty-three trees had two or more nest boxes installed (totalling 49 boxes). Weather conditions ranged between warm and sunny (maximum temperature 23.9°C) to cool with heavy rain (minimum temperature 13.2°C and 33.8 mm rainfall) over the survey period. Fifty-eight boxes were too high to be inspected with the camera, and 18 were uninhabitable.

Nest boxes were located in trees situated outside the project boundary in a range of habitat types (generally close to areas where hollow-bearing trees had been cleared) (Table 3-3).

Table 3-3 Habitat types, abundance and type of fauna using the nest boxes installed.

Habitat type	Number of nest boxes surveyed	Number of used nest boxes	Fauna types using nest boxes
Isolated tree	19	11	Birds, arboreal mammals
Forest	156	83	Birds, arboreal mammals, antechinus, gliders, rats, bats
Woodland	56	32	Birds, arboreal mammals, gliders
Riparian forest	55	24	Birds, arboreal mammals
<b>Total</b>	<b>286</b>	<b>150</b>	<b>55%</b>

Nest boxes were located in trees and habitat types that suited the nest box type. For example, microbat type nest boxes were mainly installed in trees within riparian habitat or forest patches, and glider type nest boxes were mainly installed in forest patches.

One-hundred and fifty (150) of the 286 nest boxes surveyed during Spring 2017 were observed either being used by fauna or showing signs of use, with 70 individuals from 13 different species (including one unidentified species, not including unidentifiable eggs) being recorded in total (Table 3-4).

Table 3-4 Nest box use by fauna type

Fauna Type	Number of Adults	Number of Juveniles, Chicks or Eggs	Number of Nest Boxes
Crimson Rosella	4	0	4
Bird (species unknown)	0	2	1
Eastern Rosella	1	0	1
Unidentified Duck	0	2	1
Brown Antechinus	3	0	1
Laughing Kookaburra	1	0	1
Dollarbird	1	0	1
Eggs (unidentified bird)	0	15	9

Fauna Type	Number of Adults	Number of Juveniles, Chicks or Eggs	Number of Nest Boxes
Common Brushtail Possum	24	0	22
Common Ringtail Possum	7	0	6
Sugar Glider	7	0	4
*Black Rat	5	0	2
<i>Nyctophilus</i> sp.	Approximately 15	0	2
Unknown Mammal	1		1
		Total inhabited	55
Signs of use	-	-	150
<b>Total</b>	<b>69</b>	<b>19</b>	<b>150</b>

\*Introduced species

The Common Ringtail Possum (five nest boxes, seven individuals) and the Common Brushtail Possum (22 nest boxes, 24 individuals) were the most abundant species to be recorded using the most nest boxes. Other common species recorded in numerous nest boxes included the Crimson Rosella (four nest boxes, four individuals) and the Sugar Glider (*Petaurus breviceps*) (four nest boxes, seven individuals). Nine nest boxes with a total of 15 eggs of an unidentified species were observed. One box was found to contain two duck eggs, and one box was found to contain two bird chicks. Most of the eggs recorded were white and oval in shape, similar to that of the other bird species recorded (for example the Crimson Rosella, Eastern Rosella, and Laughing Kookaburra all have white, oval eggs). A significant result was recorded in that two microbat boxes were found to contain a number of bats from the *Nyctophilus* genus. Approximately seven bats were recorded in one box, and eight in the other. This is the first recording of bats inhabiting boxes on the project.

No species were positively identified as undertaking breeding within the boxes, as no juvenile animals could be distinctly identified compared to adult animals. Two chicks were identified in one box, however the parents of the chicks were not identified during the survey. Clearly many of the bird species are using the nest boxes for breeding purposes, given the presence of eggs and eggshells.

Crimson Rosellas were recorded in a range of nest boxes including those designed for cockatoo, large glider, rosella and possum. Microbats were recorded in two microbat boxes. Opportunistic species, such as the Black Rat, Common Brushtail Possum and Common Ringtail Possum were recorded in a variety of nest box types. Sugar gliders were generally recorded in glider nest boxes but also in a dollarbird and parrot nest box. The unidentified eggs were recorded in both bird and possum nest boxes.

Signs of use included gnawing at the hole of the nest box (a behaviour often undertaken by parrots in hollows to keep the hole from growing inwards), vegetative material deposited inside the nest box for nesting, feathers, whitewash, and scats.

18 boxes were found to be unsuitable for habitation during the Spring 2017 survey. Reasons for boxes not being habitable included boxes having fallen down, hanging loosely, being filled with rubbish or debris and one containing evidence of a bee hive.

There was evidence of nest box use by pests and non-target species. One nest box appeared to be occupied by European bees (see Section 4 for recommendations on pest removal).



### 3.1.3 2017 Combined Data

Between the two surveys undertaken over winter and spring, a total of 294 of the 300 mapped boxes were surveyed (Table 3-5). Of these, 163 individual boxes were found to contain either fauna actively using boxes, or evidence of use by fauna in the form of nesting material, debris, leaf litter or feathers.

Table 3-5 Habitat types, abundance and type of fauna using the nest boxes surveyed in 2017.

Habitat type	Number of nest boxes surveyed	Number of used nest boxes (signs of use or fauna present)	Percent used	Fauna types using nest boxes
<b>Isolated tree</b>	19	12	63%	Birds
<b>Forest</b>	160	91	57%	Birds, arboreal mammals, antechinus, gliders
<b>Woodland</b>	57	35	61%	Birds, arboreal mammals, gliders
<b>Riparian forest</b>	58	25	43%	Birds, arboreal mammals
<b>Total</b>	294	163	55%	

Eighteen in total were either in need of repair or had been displaced. 18 boxes were found to be unsuitable for habitation during the Spring 2017 survey. Reasons for boxes not being habitable included boxes having fallen down, hanging loosely, being filled with rubbish or debris and one containing evidence of a bee hive.

There was evidence of nest box use by pests and non-target species. One nest box appeared to be occupied by European bees (see Section 4 for recommendations on pest removal).

For the combined winter and spring monitoring sessions, 163 of the 294 nest boxes surveyed (55%) were observed either being used by fauna or showing signs of use, with 126 individuals from 15 different species (including unidentified species) being recorded in total (Table 3-6). Eleven boxes had the same species in them over two both survey periods, including Antechinus, Brushtail Possum, Ringtail Possum and Sugar Glider, while 42 boxes contained newly detected individuals. Where the same species was found in the same box over two seasons, the numbers of individuals detected were summed. The exception to this was box 65 which contained a dead Crimson Rosella during both surveys, thus this animal was counted only once. Additionally, if boxes showed signs of use in one season but not the other, the box was taken to show signs of use.

Table 3-6 Nest box use by fauna type

Fauna Type	Number of Adults	Number of Juveniles, Chicks or Eggs	Number of Nest Boxes	Box Types
<b>Brown Antechinus</b>	6	0	1	Galah (1)
<b>Common Brushtail Possum</b>	39	0	28	Galah (3) Brushtail Possum (2) Ringtail Possum (2) Large Glider (3) Small Glider (1) Cockatoo (2) Kookaburra (5) Rosella (1) Owl (2) King Parrot (3) Dollarbird (3) Possum (1)
<b>Crimson Rosella</b>	4	0	4	Rosella (1) Possum (1) Large Glider (1) Galah (1)
<b>Bird (species unknown)</b>	0	2	1	Possum (1)
<b>Diamond Python</b>	1	0	1	Rosella (1)
<b>Dollarbird</b>	1	0	1	Cockatoo (1)
<b>Unidentified Duck</b>	0	2	1	Owl (1)
<b>Eastern Rosella</b>	2	0	2	Cockatoo (1) Galah (1)
<b>Laughing Kookaburra</b>	1	0	1	Kookaburra (1)
<b>Rat</b>	5	0	2	Antechinus (1) Rosella (1)
<b>Common Ringtail Possum</b>	11	0	6	Dollarbird (1) Rosella (2) Ringtail Possum (2) Kookaburra (1)
<b>Sugar Glider</b>	10	0	5	Small Glider (3) Dollarbird (1) Lorikeet (1)
<b>Microbats (Nyctophilus sp.)</b>	15	0	2	Microbat (2)
<b>Eggs (unidentified bird species)</b>	0	26	12	Brushtail Possum (1) Owl (2)

Fauna Type	Number of Adults	Number of Juveniles, Chicks or Eggs	Number of Nest Boxes	Box Types
				Possum (2) Rosella (1) Dollarbird (1) Parrot (1) Glider (1) Ringtail Possum (2) Kookaburra (1)
<b>Unknown animal</b>	1	0	1	Glider (1)
<b>Signs of use</b>			163	
<b>Total</b>	<b>96</b>	<b>30</b>	<b>163</b>	

\*Introduced species

The Common Brushtail Possum (28 nest boxes, 39 individuals) and the Common Ringtail Possum (six nest boxes, 11 individuals) were the most abundant species to be recorded using the most nest boxes. Other common species recorded in numerous nest boxes included the Crimson Rosella (four nest boxes, four individuals) and the Sugar Glider (five nest boxes, ten individuals). 12 nest boxes with either eggs or eggshells were observed, however the species could not be identified. Most of the eggs recorded were white and oval in shape, similar to that of the other bird species recorded (for example the Crimson Rosella, Eastern Rosella, and Laughing Kookaburra all have white, oval eggs). This is evidence that bird species are breeding within the nest boxes. 163 boxes showed signs of use.

There was evidence of nest box use by pests and non-target species including the Black Rat and bees.

As was expected, a higher species diversity was recorded in the spring survey (13 species in spring, seven in winter) because most native nest box users breed during this period. However, six nest boxes containing eggs were recorded in winter.

### 3.1.4 Years 1 - 3

Across the three years there was an increase in the number of nest boxes available and an increase in used nest boxes (Table 3-7). The number of individuals recorded dropped from 2016 to 2017 (151 in 2016, 126 in 2017). Additionally, the number of species recorded breeding was significantly lower than in previous surveys. No juveniles were positively identified during surveys, and unidentified eggs not being counted as evidence of specific breeding. Chicks were present within one box in spring but their species is unknown. It is considered highly likely that the number of species utilising the boxes for breeding would be higher than this number indicates, with species such as Crimson Rosella and Dollarbird investigating hollows, presumably for breeding purposes.

One-hundred and sixty-three (163) of the 294 nest boxes surveyed were observed either being used by fauna or showing signs of use, with 126 individuals from 14 different species (including unidentified species) being recorded in total during 2017 (Table 3-7).

Table 3-7 Results of Year 1 to Year 3

	Year 1	Year 2	Year 3
<b>Number of nest boxes surveyed</b>	161	269	294
<b>Number of used nest boxes</b>	29 (18%)	130 (48%)	163 (55%)
<b>Number of species recorded</b>	6	13	14
<b>Number of species recorded breeding</b>	5	9	1 (unidentified)

### 3.2 DISCUSSION

As discussed within the limitations section, it may take local fauna a longer period of time to start using nest boxes for refuge and nesting purposes, and the 2016 monitoring report predicted that a greater abundance of local fauna would be using the nest boxes in year three (2017) of the monitoring period (Lindenmeyer *et al.* 2009). As predicted within the 2016 report, the rate of fauna utilisation of nest boxes is higher than in previous studies. It is noted that a higher percentage of nest boxes were recorded as having been used during the current surveys (55% of total boxes) compared to the first year’s survey (18%), and last year’s survey (48%), as shown in the Figure 1-1Figure 2 below.

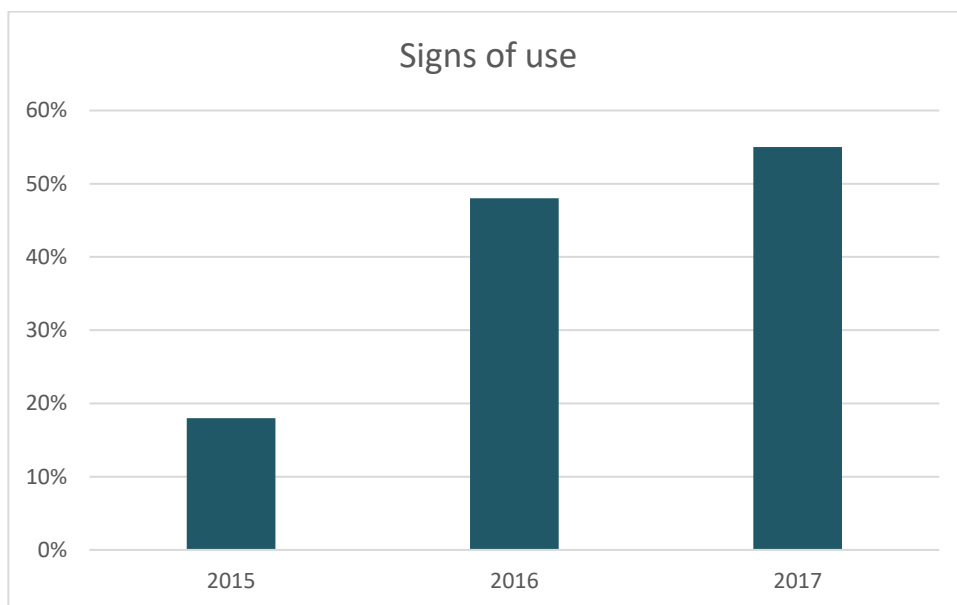


Figure 2 – Percentage of surveyed nest boxes showing signs of use

Proportionally, nest boxes installed in areas of forest and woodland habitats showed the greatest increase in occupancy or signs of use over time, with forest boxes going from 21% showing signs of use in 2016 to 57% showing signs of use in 2017, and woodland boxes going from 15.5% of boxes showing signs of use in 2016 to 61% in 2017. Isolated paddock trees showed a far higher degree of use with a change from 32% showing signs of use in 2016 to 63% showing signs of use in 2017. Riparian nest boxes rose from 30% showing signs of use in 2016 to 43% in 2017. Nest box use has increased over time in all habitat types. These results are shown in Figure 3 below.

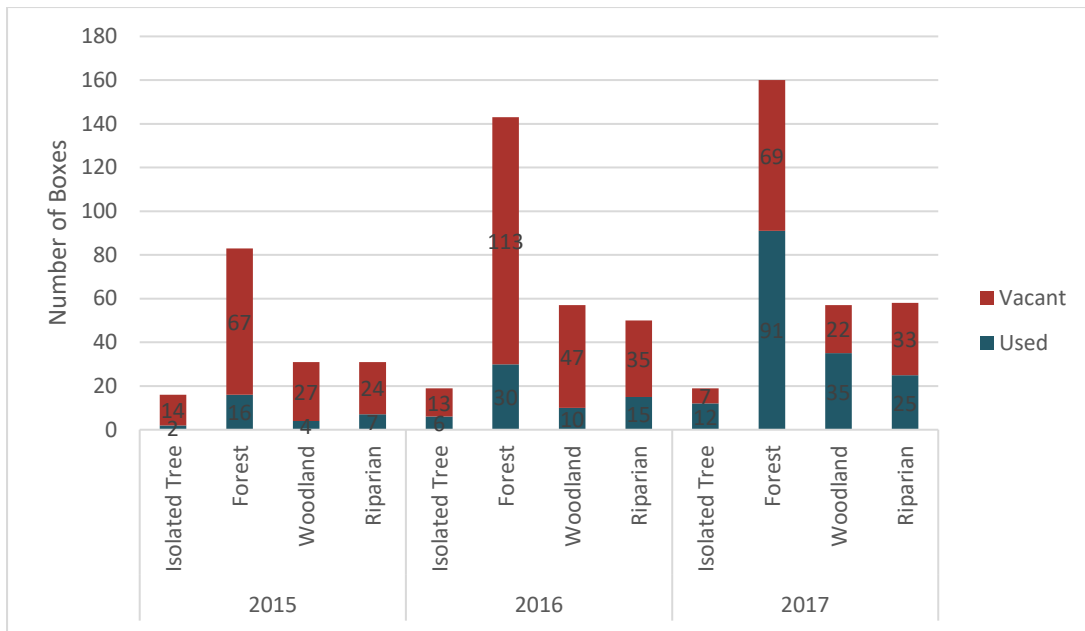


Figure 3 – Proportion of boxes showing signs of use in habitat types over time

Species diversity rose slightly in 2017 to 14 species, however the additional species was not identifiable, whilst the percentage of nest boxes with fauna occupying them increased. Detections of birds utilising nest boxes declined, and the number of boxes containing mammals increased. Two new faunal groups were identified during the 2017 survey utilising boxes, with a Diamond Python found utilising a nest box, and two microbat boxes found to contain microbats. Both of these microbat boxes were located within forest habitat. The number of boxes showing signs of use also increased significantly, as would be anticipated as fauna discover and utilise the boxes over time. Figure 4 below shows this data graphically.

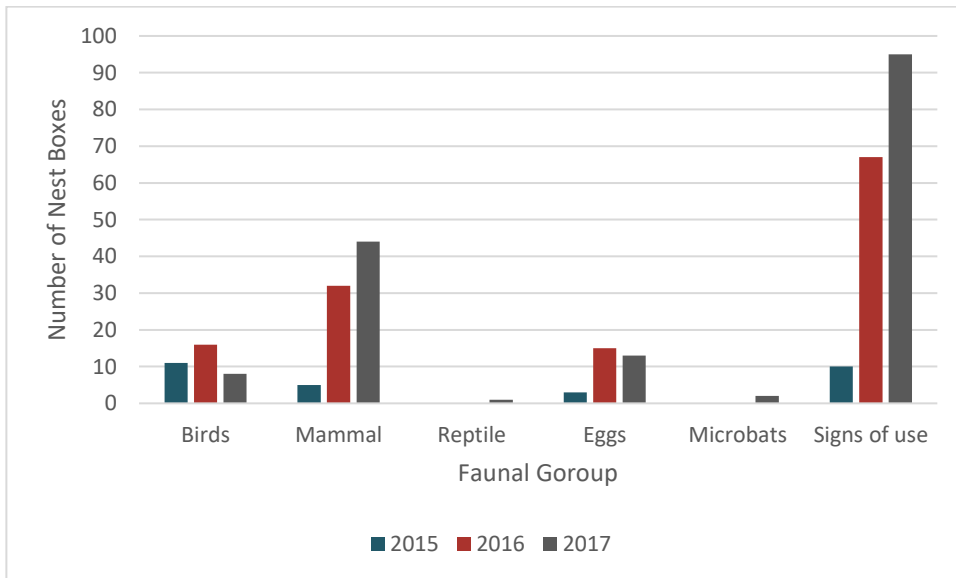


Figure 4 – Nest Box occupation by fauna groups over time – note that those shown as showing signs of use exclude those containing fauna

The proportion of boxes not located or broken increased during the 2017 survey, as additional boxes were detected, surveyed and mapped during the survey, however a number were found to be uninhabitable during the spring survey. As of spring 2017, a total of 18 boxes have fallen or contain debris and are

currently unsuitable for habitation. Figure 5 below illustrates the proportion of nest boxes able to be inspected.

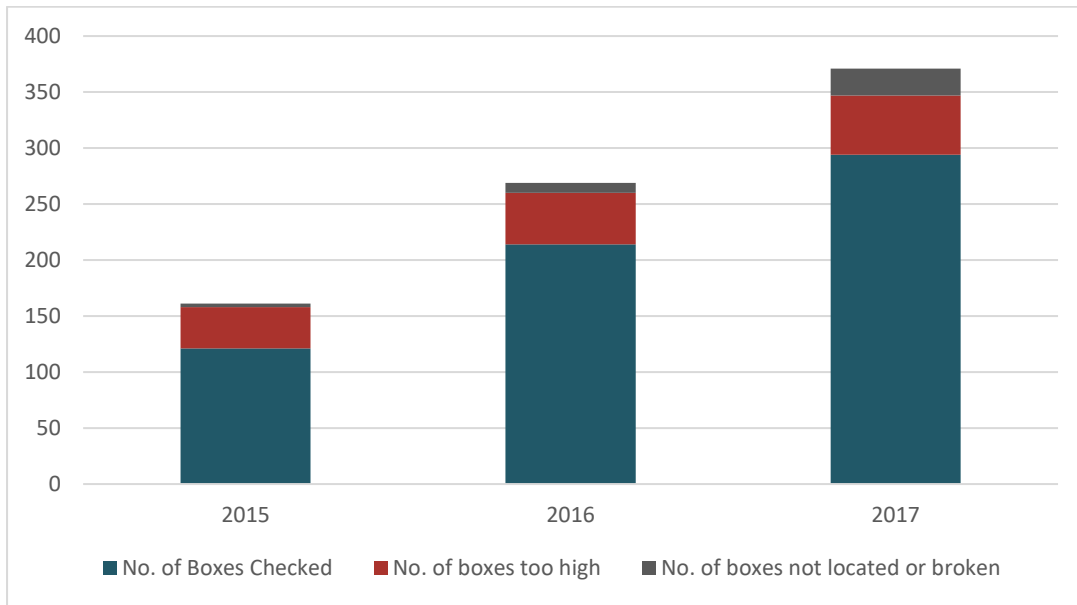


Figure 5 - Box condition over time

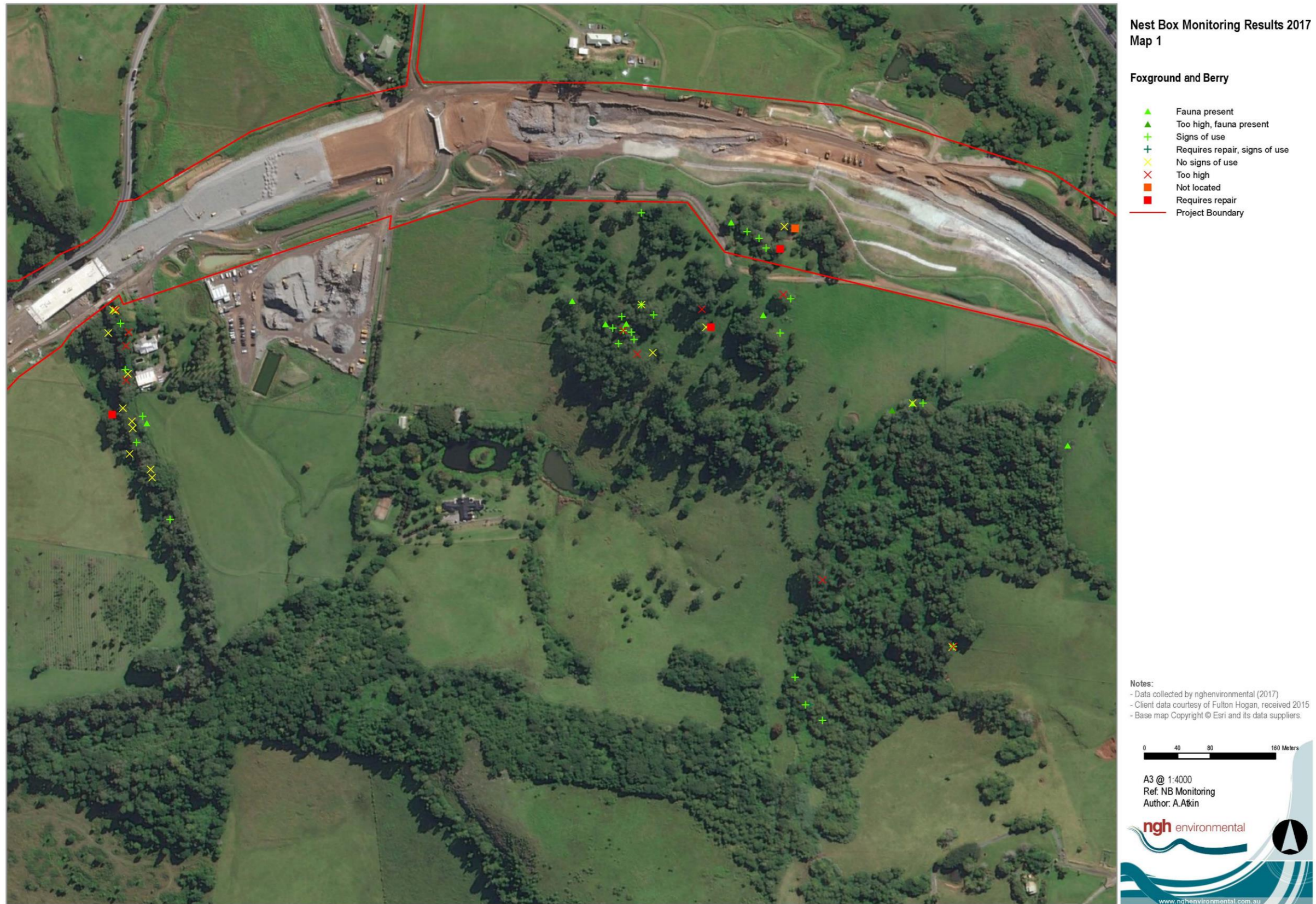


Figure 3-6 Nest box usage and locations winter and spring monitoring combined Map 1.

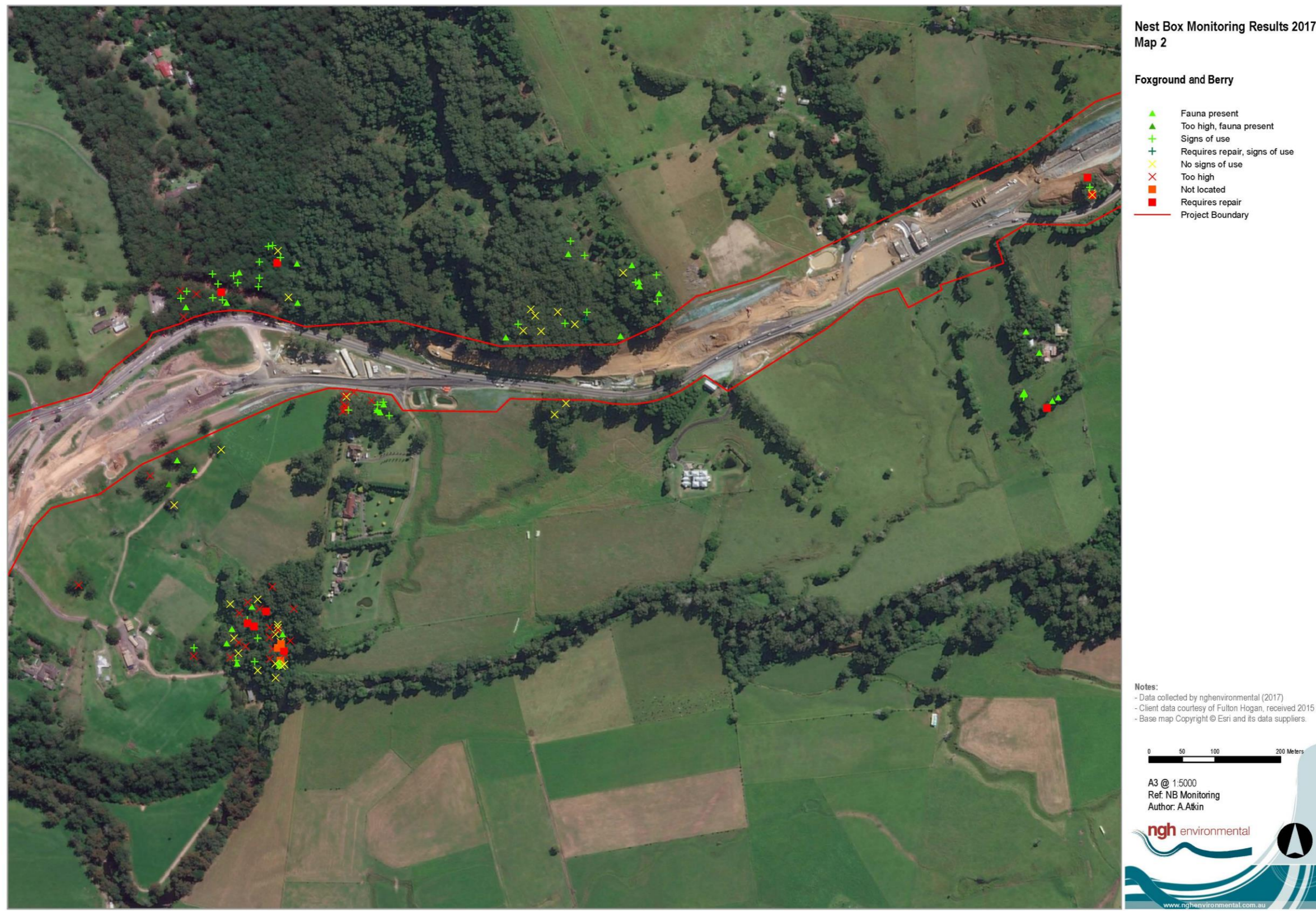


Figure 3-7 Nest box usage and locations winter and spring monitoring combined Map 2





Figure 3-8 Nest box usage and locations winter and spring monitoring combined Map 3



Figure 3-9 Nest box usage and locations winter and spring monitoring combined Map 4

### 3.3 COMPARISON WITH PERFORMANCE CRITERIA

The following performance criteria relevant to the nest boxes are taken from the EcMP (PB 2014). It should be noted that these do not relate specifically to the construction period monitoring but for the lifetime of the monitoring program, including post-construction.

Table 3-8 Performance criteria

Performance criteria	Performance target	Meeting Target	Comment
High use of bat roost boxes by targeted species	>60% of installed bat boxes used by bats during the life of the monitoring program.	No	<p>Two bat boxes were found to contain bats of the <i>Nyctophilus</i> genus. Both boxes were located within forest habitat, in areas containing a high abundance of natural hollows and of large patch size. Although only two of the 32 bat boxes installed contained bats, this result indicates that the boxes are suitable and are losing their “newness”. It is anticipated that the uptake of these boxes will be higher in following monitoring sessions.</p> <p>Irvine and Bender (1995) found that bat boxes were not occupied within 30 months of installation in regenerating woodland. Goldingay and Stevens (2009) found that bat box occupancy at the same site (Organ Pipes National Park) increased from 15% occupancy in 1994-1995 to &gt;100% occupancy in 2004-2005. Similarly, Boyd and Stebbings (1989) reported a doubling over a 10-year period in a population of brown long-eared bats (<i>Plecotus auritus</i>) supported by roost boxes in managed forest in Great Britain.</p>
High durability of bat roost boxes, with low maintenance requirements.	>90% of installed bat nest boxes persist during the life of the monitoring program.	Yes	None of the bat roost boxes monitored showed any signs of damage. All boxes are serviceable and available for use by microchiropteran bats.
High species diversity and abundance of hollow dependant native fauna	>80% of installed nest boxes occupied by target species or other	No, but on track to meet target in following years	Of the 294 nest boxes monitored, 163 (55%) were either used or showed signs of use by native fauna with 96 adult individuals from 14 different species being recorded.

occupying nest boxes	native fauna within 3 years.		This is an improvement from Year 1 where 42 individuals (from six species) from 29 (18%) nest boxes had either signs of use or species recorded and Year 2 where 151 individuals from 13 species were identified in 130 (48%) of nest boxes. Additionally, this calculation is a worst case scenario, as a significant portion of the nest boxes were too high to positively confirm species utilisation.
High durability of nest boxes	>90% of next boxes installed persist through monitoring program life	Yes	By the end of Year 3, 18 (6%) of the nest boxes installed and monitored were either missing or showed signs of damage.

## 4 RECOMMENDATIONS

The following provides recommendations in relation to nest boxes based on the results.

- Several nest boxes for a range of species (53 out of the 300 or 18%) were installed above 6 metres (the upper limit recommended in the NBMP to allow monitoring using a camera on a pole). It is recommended that those already installed be left in place to avoid further disturbance. An 8m extended camera pole was used during the 2017 surveys, however the majority of boxes were still found to be too high to monitor using the camera.
- One nest box was recorded being used or previously used by bees. Nest boxes have been installed with carpet attached to the underside of the nest box lid to deter bees from nesting as per the NBMP (Section 2.1), but it does have varying degrees of success. Advice should be sought from the nest box designer and manufacturer regarding the best methods of feral bee deterrence, however this is such a low number compared to the number of boxes installed that it is unlikely to significantly impact fauna occupancy rates.
- Nest boxes installed on the excluded vector. NBMP states boxes should be installed on north west to east vector. This is to avoid sun and storm impacts. The project has installed boxes on the vector which is not recommended in the plan, but they contain animals. The recommendation is to leave the boxes in place and continue to observe.
- It is recommended that monitoring continue to be undertaken utilising the same methodology as detailed above at regular intervals by RMS to ensure that the compensatory habitat provided by the installed nest boxes is maintained into the future, and the data gained from the long-term study of these boxes should be utilised to inform nest box strategies on future similar projects.

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# APPENDIX A SPREADSHEET OF MONITORING RESULTS

Combined Monitoring Session Data

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
1	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Microbat									56	294955	6152564
5	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Owlet-nightjar		1					Leaves		56	294916	6152753
6	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Owl									56	294926	6152742
7	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Owl									56	294923	6152725
8	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Kookaburra		1					Casuarina nest		56	294922	6152696
9	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Microbat									56	294925	6152691
10	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Owlet-nightjar							Too high		56	294923	6152683
11	BC1	Riparian	Ringtail Possum		1					Bird Excrements on the side of the wall		56	294977	6152513
12	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Microbat									56	294927	6152593
13	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Microbat									56	294901	6152741
14	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Ringtail Possum		1	Ringtail Possum	3					56	294948.4	6152630
15	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Microbat									56	294919	6152649
16	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Microbat									56	294930	6152633
17	BC1	Riparian	Ringtail Possum	Loosened with lid open. Off tree						Loosened with lid open		56	294906	6152641

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
18	BC1	Riparian	Small Glider		1					Leaves inside		56	294943.3	6152639
19	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Microbat									56	294931	6152624
20	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Ringtail Possum		1					Nest		56	294936	6152607
21	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Microbat									56	294953	6152574
22	Bundewallah Ck	Riparian	Dollarbird		1	Egg	4			Two eggs		56	289807	6149830
23	Bundewallah Ck	Riparian	King Parrot									56	289813	6149842
25	Bundewallah Ck	Riparian	Dollarbird	Box type updated	1	Brushtail Possum	1					56	289556	6149928
26	Bundewallah Ck	Riparian	Kookaburra		1	Ringtail Possum	2					56	289500	6149988
28	Bundewallah Ck	Riparian	Kookaburra							Too high		56	289494	6149996
29	Bundewallah Ck	Riparian	Microbat									56	289837	6149820
30	Bundewallah Ck	Riparian	Microbat									56	289793	6149818
31	Bundewallah Ck	Riparian	Small Glider	loose	1					Nest		56	289785	6149820
32	Bundewallah Ck	Riparian	Parrot			Egg	3			Little White eggs x3		56	289762	6149827
33	Bundewallah Ck	Riparian	Kingfisher		1					Feathers		56	289717	6149859
34	Bundewallah Ck	Riparian	Microbat									56	289702	6149865



Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
35	Bundewallah Ck	Riparian	Cockatoo		1					Leaves		56	289695	6149867
36	Bundewallah Ck	Riparian	Owl		1					Old nest		56	289847	6149798
37	Bundewallah Ck	Riparian	Ringtail		1	Egg	2			Nest		56	289818	6149800
38	Cut 2	Forest	Rosella		1	Diamond Python	1					56	296076	6152603
41	Cut 2	Forest	Kookaburra		1	Brushtail Possum	1			Second box. Too high to reach		56	295861	6152646
42	Cut 2	Forest	Rosella		1					Leaves		56	295742	6152320
43	Cut 2	Forest	Small Glider	Needs repair. Hanging off tree	1							56	295760	6152286
44	Cut 2	Forest	Small Glider		1					Leaves		56	295755	6152286
45	Cut 2	Forest	Small Glider		1					Leaves		56	295776	6152267
46	Cut 2	Woodland	Galah		1					Nest		56	295737	6152783
47	Cut 2	Woodland	Galah							Too high		56	295728	6152788
48	Cut 2	Woodland	Galah		1	Brushtail Possum	2			Brushtail possum		56	295703	6152763
51	Cut 2	Woodland	King Parrot									56	295633	6152748
53	Cut 2	Woodland	Galah		1					Leaves		56	295554	6152888
55	Cut 2	Woodland	Rosella		1					Leaves		56	295569	6152763

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
58	Cut 2	Woodland	Kookaburra		1					Leaves		56	295545	6152733
59	Cut 2	Woodland	Large Glider		1					Leaves		56	295526	6152728
60	Cut 2	Woodland	Rosella		1	Egg	1			Leaves		56	295535.4	6152752
62	Cut 2	Woodland	Large Glider		1							56	295542	6152742
63	Cut 2	Woodland	Galah		1							56	295530	6152761
64	Cut 2	Woodland	Large Glider		1					Nest with eucalyptus leaves		56	295519	6152747
65	Cut 2	Woodland	Large Glider		1	Crimson Rosella	1			Nest with crimson rosella feathers		56	295510	6152752
67	Cut 2	Woodland	Galah	Loose								56	293056	6151167
68	Cut 2	Woodland	Brush-tailed Possum		1	Egg	1			Small White Egg		56	295664	6152876
69	Cut 2	Woodland	Kingfisher		1					Leaves		56	295698	6152857
70	Cut 2	Woodland	Rosella		1					Leaves		56	295707	6152845
71	Cut 2	Woodland	Owl	Lid closed, filled with debris						Lid now closed		56	295724	6152844
72	Cut 2	Woodland	Owl									56	295729	6152871
76	Cut 2	Forest	Microbat	Location updated						Next to others, point moved		56	295934.7	6152357
78	Downe's	Isolated tree	Owl	Too high						Too high		56	291685	6150461

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
79	Downe's	Forest	Brushial Possum		1	Brushtail Possum	1					56	291736	6150480
80	Downe's	Forest	Ringtail Possum		1	Brushtail Possum	2					56	291752	6150449
81	Downe's	Forest	Owl	Nest with cracked egg shells	1	Egg	4			Nest with cracked egg shells		56	291749.9	6150454
82	Downe's	Forest	King Parrot		1							56	291767.8	6150516
83	Downe's	Forest	Owl									56	291786	6150533
84	Downe's	Forest	Rosella									56	291814	6150504
85	Downe's	Forest	King Parrot							Too high		56	291801	6150489
86	Downe's	Forest	Owl	Fallen down								56	291777.9	6150506
87	Downe's	Forest	Small Glider	Too high						Too high		56	291806	6150472
88	Downe's	Forest	Owl	Not found						Could not be located		56	291814	6150473
89	Downe's	Forest	Microbat		1	Nyctophilus	7					56	291744	6150502
90	Downe's	Forest	Owl									56	291747	6150488
91	Downe's	Forest	Dollarbird		1					Nest		56	291783.3	6150488
92	Downe's	Forest	Owl	Fallen down, no lid						Fallen down, no lid		56	291768	6150511
93	Downe's	Forest	Owl							Too high		56	291755	6150526

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
94	Downe's	Forest	Small Glider		1	Sugar Glider	2					56	291774	6150536
95	Downe's	Forest	Owl									56	291783	6150547
96	Downe's	Forest	Ringtail Possum	Too high -17						Too high -17		56	291768	6150543
99	Downe's	Forest	Kookaburra	Too high	1	Kookaburra	1			Too high		56	291764.9	6150475
101	Downe's	Forest	Owl									56	291783	6150439
102	Downe's	Forest	King Parrot	Not found					Dead	Could not be located		56	291818	6150454
103	Downe's	Forest	Large Glider		1	Brushtail Possum	1					56	291816	6150452
104	Downe's	Forest	Large Glider		1	Brushtail Possum	2					56	291816	6150446
105	Downe's	Forest	Microbat									56	291810.4	6150427
106	Downe's	Forest	Microbat									56	291823.8	6150448
107	Downe's	Forest	Large Glider	Lid missing								56	291823.5	6150468
108	Downe's	Forest	Large Glider	Too high						Too high		56	291833	6150484
109	Downe's	Forest	Brushtail Possum									56	291818	6150482
110	Downe's	Forest	Cockatoo	Not found						Could not be located		56	291819	6150479
111	Downe's	Forest	Galah									56	291810.6	6150494

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
112	Downe's	Forest	Brush-tail Possum							Empty		56	291813.3	6150509
113	Downe's	Forest	King Parrot	Too high						Too high		56	291814	6150500
114	Downe's	Forest	Ringtail Possum	Too high						Both too high		56	291801	6150504
114	Downe's	Forest	Ringtail Possum	Too high						Both too high		56	291801	6150504
115	Downe's	Forest	Owl	Too high -17						Too high -17		56	291838	6150533
116	Downe's	Forest	Owl	Fallen down						Fallen off		56	291796	6150529
117	Downe's	Forest	Large Glider		1	Brush-tail Possum	4					56	291821	6150494
118	Downe's	Isolated tree	Microbat									56	291727	6150775
119	Downe's	Isolated tree	Cockatoo		1	Dollarbird	1					56	291687	6150744
120	Downe's	Isolated tree	Galah		1	Eastern Rosella	1					56	291660	6150759
121	Downe's	Isolated tree	Kookaburra	Too high						Too high		56	291619	6150735
122	Downe's	Isolated tree	Cockatoo	Too high	1	Eastern Rosella	1			Too high		56	291648	6150723
123	Downe's	Isolated tree	King Parrot	Too high						Too high		56	291510	6150569
124	Downe's	Isolated tree	Microbat									56	291656	6150691
125	Downe's	Forest	Microbat									56	291741	6150540

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
126	Gate 8	Isolated tree	Owl	No lid	1					No lid. Leaf litter		56	293050	6151191
127	Gate 8	Isolated tree	Owl							Leaves		56	293053	6151176
128	Gate 8	Isolated tree	Owl	Beehive	1					Leave debris and whitewash. Beehive.		56	293057	6151164
129	Gate 8	Isolated tree	Galah									56	293057	6151164
130	Gembrooke Lane	Forest	Large Glider	Too high	1	Crimson Rosella	1			Too high		56	291919	6150860
131	Gembrooke Lane	Forest	Owl									56	291919	6150856
132	Gembrooke Lane	Forest	Owl	Box type updated						Owl box. Too high		56	291930	6150863
133	Gembrooke Lane	Forest	Cockatoo	Box type updated, too high						Too high. Not an owl box. King parrot/ cockatoo box		56	291915	6150845
134	Gembrooke Lane	Forest	Owl	Too high						Too high		56	291917	6150841
135	Gembrooke Lane	Forest	Brush-tail Possum	Too high						Too high		56	291916	6150837
136	Gembrooke Lane	Forest	Ringtail Possum	Too high						Too high		56	291918	6150837
137	Gembrooke Lane	Forest	Owlet-nightjar		1					Leaves		56	291922	6150836
138	Gembrooke Lane	Forest	King Possum	Too high						Too high		56	291913	6150834
139	Gembrooke Lane	Forest	Owl	Loose	1	Brush-tail Possum	2			Twigs inside		56	291975.7	6150844
140	Gembrooke Lane	Forest	Small Glider		1					Nest		56	291966	6150844

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
141	Gembrooke Lane	Forest	Rosella	Nest inside with 3x antechinus (?)	1	Brown Antechinus	6			Nest inside with 3x antechinus (?)		56	291965	6150836
142	Gembrooke Lane	Forest	Antechinus		1	Black Rat	3					56	291970	6150832
143	Gembrooke Lane	Forest	Ringtail Possum	Nest inside	1					Nest inside		56	291984	6150827
144	Gembrooke Lane	Forest	Galah	Material	1					Material		56	291975	6150848
145	Gembrooke Lane	Forest	Ringtail Possum	Too high						Too high		56	291957	6150850
146	Gembrooke Lane	Forest	Ringtail Possum	Too high						Too high		56	291915	6150857
147	Lot 11	Woodland	Galah		1	Brushtail Possum	1					56	291071	6151018
148	Lot 11	Woodland	Possum	Not found						Could not be located		56	291153	6150993
149	Lot 11	Woodland	Kookaburra							Too high		56	291025	6150906
151	Lot 11	Woodland	Kookaburra		1					Nest with feathers		56	291140	6150988
152	Lot 177	Riparian	Cockatoo		1	Brushtail Possum	1					56	290920	6150552
153	Lot 177	Riparian	Galah	No access. Too high						No access. Too high		56	290932	6150485
154	Lot 177	Riparian	Kookaburra	Too high						No access. Too high		56	290916	6150490
156	Lot 81	Forest	Owl	Hanging	1	Egg	2			Broken eggs		56	292411	6150987
157	Lot 81	Forest	King Parrot		1							56	292393	6151002

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
158	Lot 81	Forest	King Parrot		1	Brushtail Possum	1					56	292396	6151014
159	Lot 81	Forest	King Parrot		1	Brushtail Possum	1					56	292366	6151025
160	Lot 81	Forest	Ringtail Possum		1					Fresh nest		56	292360	6151031
161	Lot 81	Forest	Dollarbird	Nest with unidentified Possum (black/grey)	1	Brushtail Possum	1			Nest with unidentified Possum (black/grey)		56	292365	6151032
162	Lot 81	Forest	Owl		1							56	292392	6151042
163	Lot 81	Forest	Ringtail Possum		1	Ringtail Possum	3					56	292354	6151057
164	Lot 81	Forest	Owl									56	292341	6151045
165	Lot 81	Forest	Owl		1					Leaf litter/nest		56	292282	6151072
166	Lot 81	Forest	King Parrot	Nest	1	Brushtail Possum	1			Nest		56	292337	6150949
167	Lot 81	Forest	Microbat									56	292241	6150986
168	Lot 81	Forest	Dollarbird		1	Brushtail Possum	1			Brushtail Possum		56	292257	6151074
169	Lot 81	Forest	Kookaburra	Loose, hanging off the tree	1							56	292284	6150974
170	Lot 81	Forest	Owl		1							56	292286	6150985
171	Lot 81	Forest	King Parrot	Leaf debris inside	1					Leaf debris inside		56	292252	6150968
172	Lot 81	Forest	Owl	Loose								56	292215.8	6150956



Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
173	Lot 81	Forest	Owl		1					Nest		56	292181	6150967
174	Lot 81	Forest	Microbat									56	292188	6150957
175	Lot 81	Forest	Dollarbird	Leaves	1	Sugar Glider	1			Leaves		56	292162	6150947
176	Lot 81	Forest	Microbat									56	292207	6150980
177	Lot 81	Forest	Owl	Location updated								56	292200	6150990
178	Lot 81	Forest	King Parrot		1					Leaves and nest		56	292261	6151094
179	Lot 81	Forest	Owl									56	292267	6150967
180	Mark Radium Park	Isolated tree	Kookaburra		1	Brushtail Possum	2					56	288217	6149460
181	Mark Radium Park	Isolated tree	Possum	Scratches on outside of box. Debris inside	1					Scratches on outside of box. Debris inside		56	288212	6149427
182	Mark Radium Park	Isolated tree	Possum		1	Brushtail Possum	1					56	288180	6149393
183	Mark Radium Park	Isolated tree	Kookaburra		1	Brushtail Possum	2					56	288174	6149381
184	Mark Radium Park	Isolated tree	Rosella		1	Brushtail Possum, Crimson Rosella	1,1					56	288203	6149386
185	Paninis	Forest	Microbat									56	288020	6149136
186	Paninis	Forest	Small Glider									56	288006	6149135
187	Paninis	Forest	Rosella		1					Nest		56	288013	6149133

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
188	Paninis	Forest	Possum		1							56	287999	6149144
189	Paninis	Forest	Small Glider		1							56	288013	6149152
190	Paninis	Forest	Antechinus		1							56	288018	6149156
191	Paninis	Forest	Owl	X	1					No access		56	288018	6149162
192	Paninis	Forest	Kookaburra	Nest inside	1					Nest inside		56	287974	6149118
193	Paninis	Forest	Brush-tail Possum		1					Nest		56	288000	6149147
195	Paninis	Forest	Rosella	Bite marks around hole. Nest	1					Bite marks around hole. Nest		56	287968	6149118
196	Simons	Woodland	Possum		1	Bird Chick	2			Chicks		56	287578	6148535
197	Simons	Woodland	Owl		1					Litter		56	287778	6148564
198	Simons	Woodland	Owl									56	287767	6148562
199	Simons	Woodland	Rosella		1							56	287734	6148562
200	Simons	Woodland	Owl									56	287729	6148527
201	Simons	Woodland	Owl		1							56	287734	6148491
202	Simons	Woodland	Rosella		1					Nest and whitewash		56	287665	6148489
203	Simons	Woodland	Large Glider		1							56	287654	6148495

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
204	Simons	Woodland	Possum	Rubbish	1					Rubbish		56	287636	6148501
205	Simons	Woodland	Kookaburra		1	Egg	1			Scattered droppings on floor		56	287647	6148512
206	Simons	Woodland	Owl	Missing lid						Missing lid		56	287674	6148562
207	Simons	Woodland	Kingfisher									56	287615	6148530
208	Simons	Woodland	Small Glider									56	287738	6148499
209	Smarts	Forest	Small Glider		1	Brushtail Possum	1			Brushtail Possum		56	292976	6150923
210	Smarts	Forest	Kookaburra		1	Brushtail Possum	2					56	292956	6150956
211	Smarts	Forest	Kingfisher		1					Leaves and nest		56	292952	6150856
212	Smarts	Forest	Shrike-thrush		1							56	292953	6150858
213	Smarts	Riparian	Rosella	Ringtail possum	1	Ringtail Possum	1			Ringtail possum		56	292996	6150850
214	Smarts	Riparian	Galah		1	Brushtail Possum	2					56	293005	6150855
215	Smarts	Riparian	Owl	Fallen, no lid						Nearly on the floor. No lid.		56	292988	6150839
216	Tindals Lane	Forest	Galah	No access. Too high						No access. Too high		56	291670	6150978
217	Tindals Lane	Forest	Brushtail Possum		1	Brushtail Possum	1					56	291673.6	6150993
218	Tindals Lane	Forest	Lorikeet		1					Leaves present		56	291666	6151006

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
219	Tindals Lane	Forest	Owl	Too high						Too high		56	291665	6151018
220	Tindals Lane	Forest	Brushtail Possum	Too high						Too high		56	291690	6151013
221	Tindals Lane	Forest	Cockatoo		1							56	291714.5	6151044
222	Tindals Lane	Forest	Ringtail Possum		1							56	291723	6151028
223	Tindals Lane	Forest	Antechinus	Fallen down, box type updated	1					Leaf litter		56	291728	6151016
224	Tindals Lane	Forest	Rosella	Box type updated	1	Rat	2					56	291736	6151000
225	Tindals Lane	Forest	Small Glider		1					Leaf litter to the top of the box		56	291729.5	6151004
226	Tindals Lane	Forest	Cockatoo	Nest	1					Nest		56	291753	6151030
227	Tindals Lane	Forest	Rosella	Box type updated	1					Nest		56	291746.7	6151041
228	Tindals Lane	Forest	Antechinus	Unsuitable for habitation. Filled with debris								56	291813	6151061
229	Tindals Lane	Forest	King Parrot									56	291814	6151079
230	Tindals Lane	Forest	Antechinus		1					Leaves		56	291818	6151069
231	Tindals Lane	Forest	Antechinus		1					Leaves		56	291800	6151086
232	Tindals Lane	Forest	Lorikeet	Box type updated	1					Leaf litter		56	291805.7	6151087
233	Tindals Lane	Forest	Ringtail Possum		1	Brushtail Possum	1					56	291843	6151059

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
234	Tindals Lane	Forest	Small Glider		1					Leaves		56	291786	6151062
235	Tindals Lane	Forest	Kingfisher		1					Feathers and leaves		56	291785.8	6151037
236	Tindals Lane	Forest	Antechinus		1					Leaves		56	291784.5	6151025
237	Tindals Lane	Forest	Rosella		1					Scratching around entrance		56	291715	6151007
238	Tindals Lane	Forest	Cockatoo		1					Leaves		56	291675	6151017
239	Tindals Lane	Forest	King Parrot									56	291830	6151008
240	Tindals Lane	Forest	cockatoo		1	Brushtail Possum	2			Brushtail Possum family present		56	291844	6151000
241	Culvert (DP801512/4)	Riparian	Microbat									56	292254	6150846
242	Culvert (DP801512/4)	Riparian	Microbat									56	292236	6150829
243	Cut 7 East DP1029979/33	Forest	Glider		1	Egg	2			Leaves and possible eggshell. See picture		56	290808	6150240
244	Cut 7 East DP1029979/33	Forest	Glider	Fallen down								56	290817	6150240
245	Cut 7 East DP1029979/33	Forest	Glider		1					Leaves		56	290926	6150320
246	Cut 7 East DP1029979/33	Forest	Ringtail Possum		1	Egg	2			Leaves inside		56	290936	6150327
247	Cut 7 East DP1029979/33	Forest	Glider	Loose	1					Leaves and visible scratches		56	290972	6150352
248	Cut 7 East DP1029979/33	Forest	Glider		1	Unknown	1			Leaves inside		56	290992	6150363

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
249	Cut 7 East DP1029979/33	Forest	Glider		1					Leaves inside		56	291006	6150371
250	Cut 7 East DP1029979/33	Forest	Microbat									56	291051	6150391
251	Cut 7 East DP1029979/33	Forest	Glider		1					Leaves inside		56	291059	6150397
252	Cut 7 East DP1029979/33	Forest	Glider		1					Leaves		56	291052	6150397
253	Panini's DP596879/4	Forest	Microbat	Newly identified						Extra box not mapped		56	287920.6	6149046
254	Cut 2 Lot 421/Lot A/Lots 419 and 420 DP224377/2, DP255171/1, DP377518/A, DP255171/2	Woodland	Ringtail Possum	Newly identified	1							56	295683.6	6152865
255	Smarts DP628132/1	Forest	Microbat	Newly identified	1	Nyctophilus	8			New location		56	292952.8	6150863
256	Simons DP615284/4	Woodland	Glider	Newly identified	1					Curled litter		56	287734.3	6148588
257	Simons DP615284/4	Woodland	Glider	Newly identified	1							56	287639.9	6148517
258	Bundewallah Creek (Lots 51 and 52 DP1108069/46 and DP815023/7)	Riparian	Microbat	Newly identified								56	289816.2	6149805
259	Bundewallah Creek (Lots 51 and 52 DP1108069/46 and DP815023/7)	Riparian	Owl	Newly identified	1	Duck Egg	2					56	289786.4	6149815
260	Bundewallah Creek (Lots 51 and 52 DP1108069/46 and DP815023/7)	Riparian	Possum	Newly identified	1	Egg	2					56	289781.9	6149826
261	Bundewallah Creek (Lots 51 and 52 DP1108069/46 and DP815023/7)	Riparian	Possum	Newly identified	1	Crimson Rosella	1					56	289787.7	6149836
262	Bundewallah Creek (Lots 51 and 52 DP1108069/46 and DP815023/7)	Riparian	Rosella	Newly identified	1	Egg	2					56	289815.7	6149838
263	Bundewallah Creek (Lots 51 and 52 DP1108069/46 and DP815023/7)	Riparian	Dollarbird	Newly identified						Too high		56	289816.3	6149842

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
265	Downes DP1098617/13	Forest	Ringtail Possum	Newly identified						Too high		56	291805.4	6150567
266	Downes DP1098617/13	Forest	Microbat	Newly identified								56	291820.2	6150445
267	Downes DP1098617/13	Forest	Large Glider	Newly identified								56	291824.6	6150463
268	Downes DP1098617/13	Forest	Large Glider	Newly identified								56	291810.2	6150449
269	Downes DP1098617/13	Forest	Brushtail Possum	Newly identified						Too high		56	291801.6	6150457
270	Downes DP1098617/13	Forest	Ringtail Possum	Newly identified								56	291741.5	6150458
271	Tindals Lane DP1098617/12	Forest	Lorikeet	Newly identified	1	Sugar Glider	1			Sugar glider		56	291754.9	6151046
272	Gembrooke Lane DP801512/4	Forest	Antechinus	Newly identified	1							56	291966.3	6150836
100A	Downe's	Forest	Ringtail Possum	Small glider- used bite marks around hole Possum - same as above	1					Small glider- used bite marks around hole Possum - same as above		56	291778.8	6150452
100B	Downe's	Forest	Small Glider		1							56	291778.8	6150452
150A	Lot 11	Woodland	Cockatoo	Too high						Only one box. Too high		56	291077	6150968
150B	Lot 11	Woodland	Cockatoo	Not found								56	291077	6150968
155A	Lot 177	Riparian	Shrike-thrush		1							56	290891	6150594
155B	Lot 177	Riparian	Kookaburra		1							56	290891	6150594
194A	Paninis	Forest	Possum		1							56	287996	6149151

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
19 4B	Paninis	Forest	Kingfisher									5 6	287 996	614 915 1
24 A	Bundewallah Ck	Riparian	King Parrot									5 6	289 788	614 982 9
24 B	Bundewallah Ck	Riparian	Dollarbird									5 6	289 788	614 982 9
27 A	Bundewallah Ck	Riparian	Owl		1	Brushtail Possum	1			Too high		5 6	289 490	614 998 9
27 B	Bundewallah Ck	Riparian	Kingfisher									5 6	289 490	614 998 9
2A	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Microbat									5 6	294 910	615 276 8
2B	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Microbat									5 6	294 910	615 276 8
39 A	Cut 2	Forest	Rosella		1					Leaves		5 6	295 899	615 265 5
39 B	Cut 2	Forest	Shrike Thrush		1							5 6	295 899	615 265 5
3A	BC1	Riparian	Dollarbird		1	Ringtail Possum	1			Too high		5 6	294 907	615 276 9
3B	Broughton Creek BC1 (Lots 415 and 416 DP882532/1 and DP3344/9)	Riparian	Dollarbird									5 6	294 907	615 276 9
40 A	Cut 2	Forest	Kookaburra		1	Brushtail Possum	1					5 6	295 886	615 265 5
40 B	Cut 2	Forest	Shrike-thrush									5 6	295 886	615 265 5
49 A	Cut 2	Woodland	Shrike Thrush		1					All three with nests		5 6	295 724	615 274 1
49 B	Cut 2	Woodland	Rosella		1	Ringtail Possum	1					5 6	295 724	615 274 1



Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
49C	Cut 2	Woodland	Kookaburra		1							56	295724	6152741
4A	BC1	Riparian	Owl							Possum too high. Owl- empty		56	294910	6152769
4B	BC1	Riparian	Ringtail Possum									56	294910	6152769
50A	Cut 2	Woodland	Galah		1					Leaves. Other box too high		56	295639	6152748
50B	Cut 2	Woodland	Large Glider									56	295639	6152748
52A	Cut 2	Woodland	King Parrot							Shrike box too high		56	295628	6152770
52B	Cut 2	Woodland	Shrike Thrush									56	295628	6152770
54A	Cut 2	Woodland	Galah		1					Galah box with leaves, Shrike box empty		56	295554	6152776
54B	Cut 2	Woodland	Shrike Thrush									56	295554	6152776
56A	Cut 2	Woodland	Small Glider							Too high		56	295568	6152717
56B	Cut 2	Woodland	Large Glider									56	295568	6152717
57A	Cut 2	Woodland	Large Glider							Both too high		56	295549	6152715
57B	Cut 2	Woodland	Large Glider									56	295549	6152715
61A	Cut 2	Woodland	Large Glider		1					Leaves other box too high		56	295531.7	6152744
61B	Cut 2	Woodland	Small Glider									56	295531.7	6152744

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
66 A	Cut 2	Woodland	Small Glider	Lid open	1	Sugar Glider	3			Too high		56	295469	6152780
66 B	Cut 2	Woodland	Small Glider		1	Sugar Glider	3					56	295469	6152780
73 A	Cut 2	Woodland	Kookaburra							Owl box not located		56	295742	6152869
73 B	Cut 2	Woodland	Owl	Not found								56	295742	6152869
74 A	Cut 2	Forest	Small Glider		1					Glider only accessible, others too high, changed GPS location as it was inaccurate Leaves inside glider box		56	295936.1	6152358
74 B	Cut 2	Forest	King Parrot									56	295936.1	6152358
74 C	Cut 2	Forest	Large Glider									56	295936.1	6152358
74 D	Cut 2	Forest	Rosella									56	295936.1	6152358
75 A	Cut 2	Forest	Owl							Both too high		56	295776	6152439
75 B	Cut 2	Forest	Owl							Both too high		56	295776	6152439
77 A	Downe's	Isolated tree	Small Glider		1							56	291686	6150473
77 B	Downe's	Isolated tree	Brushtail Possum		1							56	291686	6150473
97 A	Downe's	Forest	Owl	Owl too high, ringtail empty						Owl too high, ringtail empty		56	291753.8	6150465
97 B	Downe's	Forest	Ringtail Possum									56	291753.8	6150465
98 A	Downe's	Forest	Ringtail Possum							King parrot too high Possum empty		56	291754	6150481

Nest Box Number	Location	Habitat	Box Type	Nest box condition	Signs of use	Species in nest box	Number	Sex	Age	Comments	GPS Number	Zone	Easting	Northing
98 B	Downe's	Forest	King parrot									56	291754	6150481