NEWNES KAOLIN PTY LTD

Sand quarry & kaolin mine

Resource Assessments & Compliance
NSW Department of Planning & Environment
PO Box 5475
WOLLONGONG
NSW, 2520
email: Christopher.Schultz@planning.nsw.gov.au

23th October 2017
as amended

Attn: Chris Schultz

Re: Newnes Kaolin Sandmine – DA 329-7-2003
Newnes Junction – Sandham Road
Annual Environmental Management Report – June 2016 to March 2017

Dear Mr Schultz

Please see following the Newnes Kaolin P/L AEMR for 2017.

The report has been prepared with the assistance of the Newnes Kaolin Environmental Manager who is now on extended leave.

ALS Laboratory Group in Lithgow have been collecting on-site monitoring data dating from 1.6.16 and have provided 6 data files, two of which will be forwarded with this report as examples. Note that our previous monitoring plan included two dust monitoring locations within 100 metres of each other at the north east corner of the proposed quarry. The southern most of these two locations has been deleted due to the proximity to the northern most dust monitoring location. Refer to amended monitoring plan attached.

Should any additional information be required I can be contacted as follows:

Email: rongoldbery@optusnet.com.au
Address: 3 Karingal Court, Marsfield, NSW, 2122
Mobile: 0410-692404

Yours sincerely,

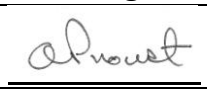
Ron Goldbery

General Manager

NEWNES KAOLIN P/L AEMR

Reporting period: June 2016 – March 2017

Title Block

Name of mine	**Newnes kaolin P/L**		
Titles/mining lease	**ML1654**		
MOP commencement date	**31 March 2016**	**MOP completion date**	**31 March 2019**
AEMR commencement date	**Starting in 2018 Commencement date: 1/1/2017**	**AEMR end date**	**31.12.2017**
Name of leaseholder	**Newnes kaolin P/L**		
Name of mine operator (if different)	**As above**		
Reporting officer	Tony Proust		
title	Environmental Manager		
signature			
date	23.10.2017		

1. Background

The project was approved in March 2006.

In late 2010 the draft Environmental Management Plan (EMP) was prepared and circulated to all stakeholders with final approval in 2013. The EMP can be accessed on the project website: www.sydneyconstructionmaterials.com

In March 2011 the Department of Planning gave approval for 'physical commencement works'. The work undertaken included the removal of approximately 2500m2 of vegetation and the construction of a small stormwater detention pond and appropriate erosion and sediment controls.

There have been no additional site works undertaken since then, except for the on-going on site environmental monitoring as required under the DA consent.

In early 2016 Newnes Kaolin P/L engaged Lithgow based ecologists (***Consulting and Engineering Services***) to undertake the annual flora and fauna monitoring. Refer to Appendix 2 for the 2017 monitoring results.

In mid 2016 Newnes Kaolin P/L engaged a Lithgow based laboratory (***ALS Laboratory Group***) to undertake the groundwater, surface water and air quality data collection and management. Refer to Appendix 1 for summary of the 2017 results.

In early 2017 Newnes Kaolin engaged a Sydney based hydrologist (***Pells Consulting***) to analyse and interpret the groundwater water and surface water monitoring data. Refer to Appendix 3.

2. Current situation

The project was 'physically commenced' in 2011.

Newnes Kaolin are negotiating a site at Glenlee near Camden for the processing of the raw material which will be transported from Newnes to Glenlee by rail. The mine is unlikely to be operation before 2020. It is anticipated that the construction phase will begin at both Newnes Junction and Glenlee in 2018/2019.

The main focus of Newnes Kaolin P/L in the last 12 months has been on the preparation and submission of an application for the Secretary's Environmental Assessment Requirements (SEARs) for Glenlee and negotiating access to the processing site at Glenlee in south west Sydney.

In August 2016 the Department of Planning issued the SEARs for the Newnes Kaolin Processing Plant at Glenlee: State Significant Development – SSD 7833.

3. Standards and performance measures

- Condition 15 of the consent specifies as follows:

  The Applicant shall prepare and implement an Air Quality Monitoring Program

- Condition 21 of the consent specifies as follows:
  The Surface Water Monitoring Program shall include detailed baseline data on surface water flows and quality in waterbodies that could potentially be impacted by the development

- Condition 22 of the consent specifies as follows:

The Groundwater Monitoring Plan shall include detailed baseline data on groundwater levels and quality based on statistical analysis to benchmark the pre-mining natural variation in groundwater levels

- Condition 23 of the consent specifies as follows:
  Each year from the date of the consent the Applicant shall report the results of the monitoring in the AEMR

- Condition 24 specifies as follows:
  The applicant shall establish and maintain a meteorological station in the vicinity of the development.

- Condition 30 of the consent specifies as follows:
  That the Flora and Fauna Monitoring Program shall include detailed baseline data on the flora and fauna of the site and adjacent the site including habitat present in the Greater Blue Mountains WHA and along the Wollangambe River and its tributaries

4. Monitoring results

a) Flora and Fauna

Newnes kaolin engaged Consulting & Environmental Services based in Lithgow to undertake the annual flora and fauna monitoring as was the case for the 2016 AEMR. Refer to Appendix 2 for the report.

The field work for the Annual Monitoring Summer 2017 report was undertaken in March 2017.

The report states as follows:

Our initial comparison indicates that ground cover value (GCV) increased for sites 2, 3, 4, 6, 7, 8, 9 and 10. Sites 1 and 5 GCV remained at the equivalent of the 2016 value.

The resultant increase in ground cover was noted with a corresponding increase in avian fauna with a variety of calls and their evidence of feeding, particularly the Banksia florets at site 9. Additional grass cover is also supporting the grazing by wallaby particularly at site 10.

b) Air quality

Newnes kaolin engaged ALS Laboratory Group in Lithgow to collect and manage the air quality data.

Raw weather station data – wind direction and wind speed - has been collected as required as well as PM10 and TSP. Please note that the air quality data for the last 12 months is limited due to significant vandalism to the monitoring equipment in the first half of 2016.

Summary of results to date are as follows:

Criterion	Date	Concentration Ug/m3	Wind speed m/sec	Wind direction degrees
PM10	1.9.16	0	0.3	0 to 2
30 Ug/m3 Microgram Per	7.9.16	0 to 11	0 to 1.6	23 to 204
Cubic metre				
	19.9.16	0 to 1	2.9 to 5.1	230 to 190
	25.9.16	0	1.2 to 4.2	230 to 250
	1.12.16	0 to 21	0.3	0 to 6
TSP	31.12.16	0 to 20	0.3	0 to 5
90 Ug/m3	6.1.17	0 to 16	0.3	4 to 78
maximum	11.2.17	0 to 3	0.3	0 to 12
	17.2.17	0 to 25	0.3	1 to 36
	23.2.17	0 to 31	0.3	2.to 25

c) Dust

Newnes kaolin engaged ALS Laboratory Group in Lithgow to collect and manage the dust data which may be summarised as follows:

DG#1 – Dust gauge adjacent to Meteorological Station on Sandham Road

DG#2 – Dust gauge adjacent to SW1 in the south east corner of the site

DG#3 – Dust gauge 100m north of SW2 in the north east corner of the site

(Note that it is intended to amend the dust monitoring plan to delete the fourth dust gauge located adjacent and just to the south of SW2)

Dust gauge	**Date**	**Days exposed**	**Combustible matter**	**ash**	**insects**	**Organic matter**	**Water in bottle mm**	**comments**
DG1	1.8.16	31	0.3	0.2	no	yes	1500	Clear fine grey dust & course brown/black/grey dust
DG1	1.9.16	29	0.2	<0.1	no	no	2000	Clear fine grey

								dust & coarse black dust
DG2	1.9.16	29	0.5	<0.1	yes	no	2200	As above
DG3	1.9.16	29	1.5	0.3	no	yes	2100	As above
DG1	30.9.16	31						Dust bottle stolen
DG2	30.9.16	31						Dust bottle stolen
DG3	30.9.16	31	1.4	0.4	yes	yes	1100	Clear fine dust & course brown/black dust
DG1	31.10.16	29	0.3	<0.1	yes	yes	1000	Clear fine brown dust & course brown dust
DG2	31.10.16	29	0.5	0.2	yes	no	1000	Clear fine brown & coarse black/brown dust
DG3	31.10.16	29	1.1	0.3	yes	yes	1000	Clear fine brown/black & coarse brown/black dust
DG1	29.11.16	31	0.3	0.3	yes	yes	1900	Clear fine brown dust & course brown dust
DG2	29.11.16	31	1	0.6	yes	no	2250	Clear fine brown & coarse black/brown dust
DG3	29.11.16	31	0.8	0.4	yes	yes	2100	Clear fine black & coarse black dust
DG1	30.12.16	28	0.3	0	yes	no	1200	Clear fine brown & coarse black dust
DG2	30.12.16	28	0.2	0	no	yes	1200	As above
DG3	30.12.16	28	0.9	0.2	yes	yes	1000	As above

d) Groundwater water

Newnes kaolin engaged ALS Laboratory Group in Lithgow to collect and manage the groundwater data and Pells Consulting to analyse the data and who advised as follows:

Groundwater levels have been plotted as metres below ground level for the 'shallow' and 'deep' bores respectively. Also shown are the daily rainfall figures from the Bureau of Meteorology.

The observed groundwater levels are relatively consistent with previous monitoring and remain constant over the monitoring period showing little observable response to rainfall events. The general trend is flow towards the northeast.

Groundwater quality data is summarised in the report and accords with previous recorded data. However, there are 3 instances noted where the recorded constituents are outside the baseline range indicated in the 2015 monitoring report. As no on-site works of significance which may impact on the groundwater quality have occurred to date, these exceedances will be noted when establishing revised baseline levels prior to commencement of mining/quarrying activities on site.

Refer to Ground and Surface Water Monitoring Report (Appendix 3).

e) Surface water

Newnes Kaolin engaged ALS Laboratory Group in Lithgow to collect and manage the surface water data. Pells Consulting have analysed the data and advised as follows:

The surface water quality data are summarised in the report – see Appendix 3 attached.

The surface water data accord with previous measurements made.

Refer to Groundwater and Surface Water monitoring report attached.

5. Analysis of Monitoring results

a) Flora and fauna

As noted previously the most notable result is that the site was severely burnt by a bushfire in 2013.

As stated in the Flora and Fauna monitoring report there has been some increase in ground cover for 8 of the 10 monitoring sites over the last 12 months.

b) Air quality

In accordance with the monitoring schedule dust and weather station data is sampled monthly and shared with Clarence Colliery. The E-sampler data is shared with Clarence Colliery.

The air quality data collected to date reflects the existing air quality at Newnes Junction and Clarence more generally. Given that Newnes Kaolin is yet to commence mining/quarrying activities it is reasonable to assume that the air quality data collected to date reflects the existing situation in the vicinity of the site.

c) Dust

The dust samples are collected monthly in accordance with the monitoring schedule.

The results are consistent and within expectations given the location of the nearby colliery and coal rail loading infrastructure and that the Newnes Kaolin operations are not yet underway.

d) Groundwater

In accordance with the monitoring schedule groundwater is sampled quarterly and bi-annually.

The observed groundwater levels are consistent with previous monitoring and remain constant over the monitoring period. There is little observable response to rainfall events.

The Groundwater report states as follows:

There has been relatively little observable response to rainfalls during the recent monitoring period. Groundwater levels in NE60 are more dynamic, and are considered to reflect flow through stress relief openings close to the edge of the valley, which were interpreted to be encountered by this bore.

Groundwater elevations are lowest at the NE site and highest at the S site, indicating flow toward the NE. At each monitoring site, groundwater levels in the shallow bores have a higher elevation than levels in the corresponding deep bores, indicating a vertical-downwards gradient – i.e. signifying downward flow. This is consistent with flows moving downwards toward the valley, enroute to the Wollangambe creek. The vertical downward gradient is more pronounced at the NE site (i.e. the difference between shallow and deep groundwater elevations is greater), which is consistent with increasing flow gradient through the steeper topography just downstream of the NE site.

e) Surface water

In accordance with the monitoring schedule surface waters are sampled bi-annually.

There are two sampling locations: SW1 (South Creek) and SW2 (North Creek). When sampled in September 2016 both creeks were running however when sampled in March 2017 site SW1 was dry.

6. Monitoring result trends

As this is only the second AEMR it is unlikely that any discernible trends will be apparent at this stage. However, it is important to note that there, can, and often will be, significant natural variability from year to year particularly in air quality, groundwater and surface water.

Newnes Kaolin will need another year of data, at least, before any meaningful trends can be identified.

a) Air quality

It is interesting to note that the PM10 results in September 2015 are comparable to those in September 2016, i.e.

PM10 – September 2015 – ranging between 0 and 4

PM10 – September 2016 – ranging between 0 and 11

Similarly the TSP results for February 2015 are comparable to the equivalent results in February 2017.

TSP – February 2015 – ranging between 1 and 36
TSP – February 2017 – ranging between 0 and 31

b) Dust

The dust sample data are consistent. More data is required before any comment can be made about trends.

c) Groundwater

The observed groundwater levels are consistent with previous monitoring and remain relatively constant over the monitoring period. There is little observable response to rainfall events.

d) Surface water

The surface water data accord with previous measurements made.

e) Flora and fauna

It is important to note that the site vegetation was devastated by a severe bushfire in October 2013 the impact of which is still very apparent physically in the ground.

7. Incidents and Compliance

There have been no incidents or matters of non-compliance to date

8. Pollution Incident Response Management Plan

As reported to the May 2016 CCC meeting the PIRMP was subjected to a desktop test for the first time. The 2 key issues identified were:

a) threat of bushfire to the workers on site. Note that the site was devastated by a wild fire in October 2013 and the vegetation will take years to recover.
b) detention basin over flow

9. Community Consultative Committee

The Newnes kaolin CCC has met twice during the last year as required under the DA consent:

12th meeting of the CCC was held on 11th May 2016
13th meeting of the CCC was held on 3rd November 2016

Minutes of the CCC meeting will be on the project website as required.

APPENDICES

1) Summary of monitoring data from ALS Laboratory Group - Lithgow

2) Annual Flora & Fauna Monitoring Summer 2017 – Consulting & Environmental Services

3) Groundwater & Surface Water monitoring report – Pells Consulting

4) Monitoring Plan as amended

5) ALS Laboratory Group monitoring data reports - extracts

Appendix 1 - Summary of monitoring data from ALS Laboratory Group - Lithgow

	Sept 2016 report	Nov 2016 report	Dec 2016 report	Jan 2017 report	Feb 2017 report	March 2017 Report (prelim report only)
Groundwater	1.6.16 to 31.8.16 June, July, August	NA	1.9.16 to 30.11.16 Sept, Oct, Nov	NA	NA	1.12.16 to 28.2.17 Dec, Jan, Feb
Surface water	1.9.16 & 5.9.16	NA	NA	NA	NA	14.3.17
Weather - Wind speed & direction	20.9.16 to 30.9.16	1.10.16 To 10.10.16	1.11.16 To 28.11.16	1.1.17 To 27.1.17	1.2.17 To 28.2.17	Still to come – due early April 2017
Dust	1.8.16 exposure 1.9.16 collection	30.9.16 Exposure 21.10.16 collection	31.10.16 Exposure 29.11.16 collection	29.11.16 Exposure 30.12.16 Collection 30.12.16 Exposure 27.1.17 collection	27.1.17 Exposure 1.3.17 collection	Still to come – due early April 2017
TSP	NA	NA	31.12.16 Dec	To Jan	24.2.17 Feb	As indicated
PM10	1.9.16 Sept	To Oct/Nov	2.12.16 Dec	NA	NA	As indicated

Note: ALS Laboratory Group have provided monthly data sets as follows in accordance with the sampling program:

Sept 2016

Groundwater – 1.6.16 to 31.8.16 – June 2016, July, August
Surface water data – 1 Sept 2016
Groundwater depths – 5 Sept 2016
Weather station data – wind speed and wind direction - 20.9.16 to 30.9.16
Dust – exposure on 1.8.16 – collected – 1.9.16

Nov 2016

No water data
Weather station data – wind speed and wind direction - 1.10.16 to 10.10.16

Dust – exposure on 30.9.16 – collected – 31.9.16

Dec 2016

Groundwater – 1.9.16 to 30.11.16 – September, October , November 2016
No surface water data
Groundwater depths – 14th – 19th Dec2016
Weather station data – wind speed and wind direction -1.11.16 to 28.11.16
Dust – exposure on 31.10.16 – collected – 29.11.16

Jan 2017

No water data
Weather station data – wind speed and wind direction -1.1.17 to 27.1.17
Dust – exposure on 29.11.16 – collected – 3.12.16
And again – exposure on 30.12.16 – collection on 21.1.17

Feb 2017

No water data
Weather station data – wind speed and wind direction - 1.2.17 to 28.2.17
Dust – exposure on 27.1.17 – collected – 1.3.17

March 2017

PM10 Esampler – 1.9.16 to 2.12.16 – September 2016 to December 2016
TSP Esampler – 31.12.16 to 24.2.17 – December 2016 to February 2017
Groundwater – 3.12.16 to 28.2.17 – December, January 2017, February
Surface water data – 14.3.17
Groundwater depths – 14.3.17
Weather data – still to come – due April 2017
Dust – still to come - due April 2017

Appendix 2

FLORA AND FAUNA MANAGEMENT PLAN

ANNUAL MONITORING SUMMER 2017

CONSULTING & ENVIRONMENTAL SERVICES

NEWNES KAOLIN & SAND MINE, NEWNES JUNCTION

ENVIRONMENTAL SCIENCE AND SOIL SCIENCE SERVICES FOR THE BLUE MOUNTAINS/ CENTRAL WEST DISTRICTS

Inspiration is a journey with the land

Understanding soils in our landscape

Achieve sustainable, capable review

Document C&ES-005-1702_170320: Version 01.

Cover Letter

Office@Hillcrest 2A Eskbank Street, Lithgow NSW 2790,
E: info@cessoils.com.au
T: 0407 990 613
www.cessoils.com.au

CONSULTING & ENVIRONMENTAL SERVICES

19th March 2017

Ron Goldbery,
3 Karingal Court,
Marsfield NSW 2122
E: rongoldbery@optusnet.com.au

Dear Dr Goldbery,

Newnes Kaolin & Sand Mine Annual Flora and Fauna Monitoring Study

Introduction

Consulting and Environmental Services Pty Ltd in collaboration with Woodlands & Wetlands Pty Ltd report the results of field assessment for flora and fauna undertaken within an annual monitoring program. The field assessment was conducted 25th and 26th February 2017. The study reports the annual monitoring review for Flora and Fauna 2017.

This letter is referenced as Consulting & Environmental Services C&ES-005-1702_Dated: 170320). It specifically addresses the development of impact assessment criteria as noted by condition 30b of the project conditions of consent as outlined within the Flora and Fauna Management Plan RPR103669 (September 2012).

Methodology

An annual survey was undertaken as part of the project management strategy to undertake a series of 'easily repeatable surveys that will gather a comprehensive set of data each time" (RPS, 2012, PR103669, Revised Final p 34). Data collection was undertaken using the standard set of environmental management proformas to record flora and fauna. Each of the ten sites was inspected as 400 m^2 plots.

An evaluation of species presence was undertaken using the modified Braun-Blanquet methodology, closely inspected using the original survey (RPS Australia, 2012) as a guide to likely species. In addition to recording presence/ absence as per the original survey (RPA Australia, 2012), each species identified as being present in the original, pre-bush fire survey was 'scored' on abundance in March 2017 using the following criteria. NE-not evident, R- rare: one or two specimens, O-occasional: a few isolated specimens, C- common: occurs throughout the plot, A-Abundant:

numerous individuals throughout the plot, and D-The major species present at the time of the survey.

At each site, a photograph was taken viewing N, S, E, and W from the plot geo-reference location. Additional photographs record ground cover and canopy cover. Fauna habitat was recorded by topographic position, plot quality, ecological resources, species diversity, ground-cover by trees and shrubs, canopy, geology and soils. The presence of birds, invertebrates, and vertebrate species was noted.

Ground cover at each site was recorded using a toe-point transect, which traversed diagonally from corner to corner of the 20 m x 20 m monitoring quadrat. Data collected included the type of ground cover and its proportion about a 50 cm x 50 cm quadrat. Through this process, a model was developed to quantify the ground cover for all the monitoring sites over time, and the baseline 2016 data was included together with the 2017 data.

The method is called the Ground Cover Value (GCV) and was developed for this project. GCV provides a computation that accounts for the assessment of bare soil, the ground with exposed rock of < 100 mm size and bedrock; organic matter comprising charcoal, leaf litter and timber and bark and an emergent layer; being a series of eleven different types of emergent vegetation observed along the transect.

The model computes a Ground Cover Value. The premise of the calculation is based on the fact that vegetation is layered and therefore percent cover values can add up to more than 100 percent. When the GCV is 1 or greater, then the site has a full cover.

Site data also includes

- Evaluation of Canopy Tree Health for 2017. Stand health was assessed using the methodology of Grimes, (1978) and
- A record of avifauna presence during the assessment time at each of the ten plots.

Result Summary

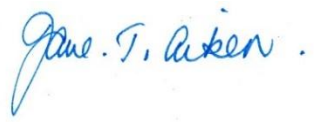
Our initial comparison indicates that ground cover value (GCV) increased for sites 2, 3, 4, 6, 7, 8, 9 and 10. Sites 1 and 5 GCV remained at the equivalent of the 2016 value.

The resultant increase in ground cover was noted with a corresponding increase in avian fauna with a variety of calls and their evidence of feeding, particularly the Banksia florets at site 9. Additional grass cover is also supporting the grazing by wallaby particularly at site 10.

Close

Annual monitoring for the flora and fauna management plan is to provide for the ongoing assessment of impacts from future mine operations. However, due to the significant fire damage to the project area, impact assessment has to include aspects of re-establishment and the subsequent succession of structural diversity within the vegetation community.

Yours faithfully,



Dr. Jane T. Aiken PhD, BSc(Hons), BSc, MSusAgr$_{(in\ prog,}$ CPSS.

19th March, 2017.

Appendix 3 – Groundwater and Surface Water Monitoring Report

Pells Consulting

ABN 74 978 620 434
Phone: 02 4381 2125
Fax: 02 4381 2126
The Old Post Office
49 Lakeside Drive
MacMasters Beach NSW 2251
www.pellsconsulting.com.au

Our Ref: S024.L1

31 March 2017

Tony Proust

c/- Sydney Construction Materials

PO Box 266

ST LEONARDS NSW 1590

Dear Tony

SUMMARY OF GROUNDWATER AND SURFACE WATER MONITORING DATA AT THE NEWNES KAOLIN SITE FOR THE PERIOD JUNE 2016 TO MARCH 2017

Ongoing groundwater monitoring has been undertaken at the proposed Newnes-Kaolin Project, an open-pit operation at Newnes Junction (The Site) (see Figure 1). A total of six groundwater bores were installed at three locations at The Site in November 2004. Groundwater levels and water quality were measured subsequent to bore installation. Monitoring of surface water quality at two locations has also been undertaken. The groundwater and surface water monitoring locations are shown in Figure 2.

Note that at each of the groundwater monitoring locations, two bores were drilled, one being designated as “shallow” (at 17.5 m below ground level (BGL)) and the other as “deep” (at 60 m BGL for NE and NW sites, and 54 m BGL at S site).

A water monitoring program was established in September 2010. The guidelines set out for monitoring, prior to operation of the quarry, included the following:

- Routine collection of surface water samples at locations SW1 and SW2, testing for: physical properties (pH, EC and TSS); BOD; selected metals, and; Oil and Grease.
- Daily measurement of groundwater levels in all six bores
- Quarterly collection of groundwater samples from all bores, testing for physical properties (pH, EC and TDS);

- Biannual collection of groundwater samples from all bores, testing for:
    - Physical properties (pH, EC and TDS);
    - Major ions (Ca, Mg, K, Cl, SO_4, HCO_3 and CO_3);
    - Nutrients, and;
    - Dissolved metals.

It is understood that monitoring in respect to this program was undertaken from 17 June 2010 through to late 2014.

This letter report has been provided to compile and summarise monitoring data that has been obtained for the period June 2016 to March 2017. During this time, the following monitoring of water was undertaken:

- Continuous (6 hourly) monitoring of water levels in all bores
- Quarterly sampling of groundwater from all bores and surface water sites:
    - September 2016 – "biannual testing" of groundwater sources and 'routine' testing of surface water sources
    - December 2016 – "quarterly testing" of groundwater sources
    - March 2017 – "quarterly testing" of groundwater sources

Groundwater levels

Groundwater levels have been plotted as metres below ground level (m BGL) in Figures 3 and 4 for the "deep" and "shallow" bores, respectively. Groundwater level data are also plotted as reduced levels (m AHD) in Figure 5[1]. Also shown on these plots are daily rainfall records from Bureau of Meteorology Station 63057 Mount Wilson (location shown on Figure 1)[2].

The observed groundwater levels are consistent with previous monitoring, as demonstrated in Table 1 below.

Table 1 – General groundwater levels, previous and current monitoring

	Observed groundwater levels (m BGL)	
	July 2010 to Dec 2014	June 2016 to March 2017
GW1A (NW60)	7 to 12	9 to 10
GW1B (NW17.5)	5 to 9	7 to 8
GW2A (NE60)	30 to 40	32 to 37
GW2B (NE17.5)	11 to 14	12 to 13
GW3A (S54)	5 to 12	10
GW3B (S17.5)	5 to 11	9 to 10

There has been relatively little observable response to rainfalls during the recent monitoring period. Groundwater levels in NE60 are more dynamic, and are considered to reflect flow through stress

[1] Note that these reduced levels are based on approximate elevation data of the ground surface at each site as presented in WRL 2010/40.
[2] Daily rainfall data from Bureau of Meteorology Station 63057 Mount Wilson were obtained from the Silo database (http://www.longpaddock.qld.gov.au/silo) as a patched point data set.

relief openings close to the edge of the valley, which were interpreted to be encountered by this bore.

On Figure 5, groundwater data are plotted as reduced levels (i.e. groundwater elevation in metres AHD). Groundwater elevations are lowest at the NE site and highest at the S site, indicating flow toward the NE. At each monitoring site, groundwater levels in the shallow bores (dashed lines) have a higher elevation than levels in the corresponding deep bores (solid lines), indicating a vertical-downwards gradient – i.e. signifying downward flow. This is consistent with flows moving downwards toward the valley, enroute to the Wollangambe creek. The vertical downward gradient is more pronounced at the NE site (i.e. the difference between shallow and deep groundwater elevations is greater), which is consistent with increasing flow gradient through the steeper topography just downstream of the NE site.

Groundwater quality

The groundwater quality data are summarised in Table 2 below. The data accord with previous measurements made. However, there are three instances noted (in boldface in Table 1) where the recorded constituents are outside of the baseline range indicated in Tables 4.1 and 4.2 of the 2015 Newnes Kaolin Groundwater Monitoring Report (Aquaterra, 2015). As not works of significance to groundwater quality have yet been undertaken, these exceedances should be noted when establishing revised baseline levels prior to commencement of larger scale works.

Surface water quality

The surface water quality data are summarised in Table 3 below. The data accord with previous measurements made.

Yours sincerely,

DR STEVEN PELLS

BE(Eng) MEngSc PhD

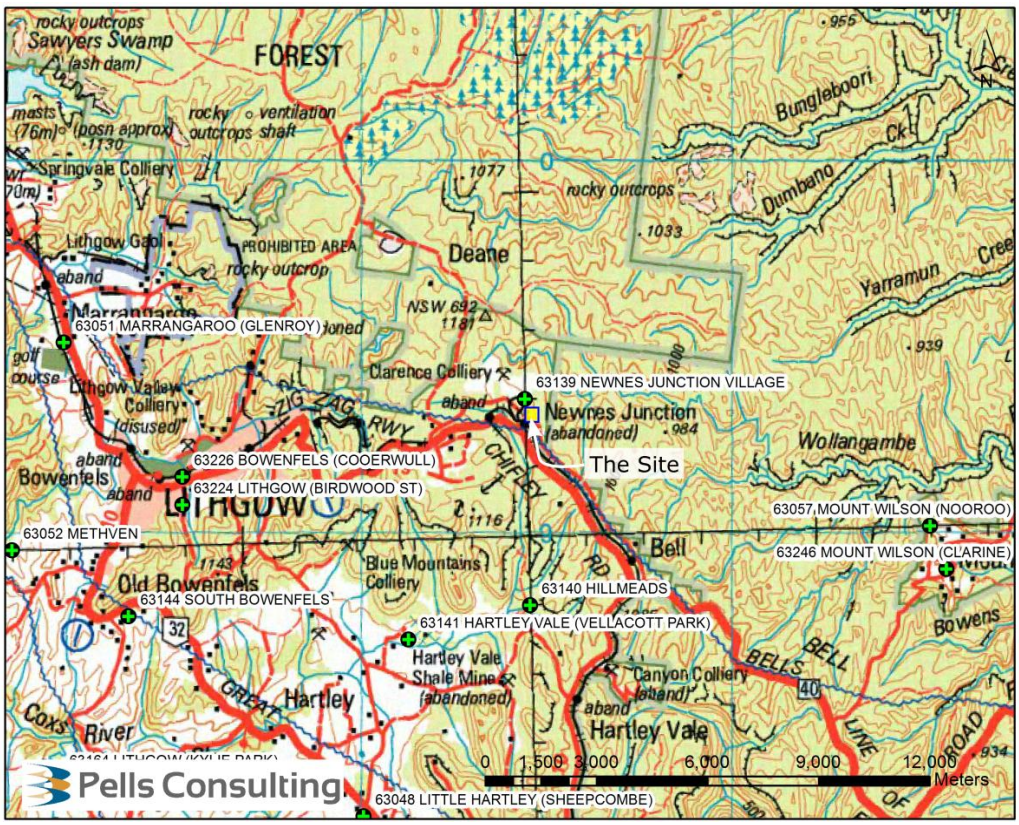


Figure 1 – Site location, showing locations of regional meteorological stations

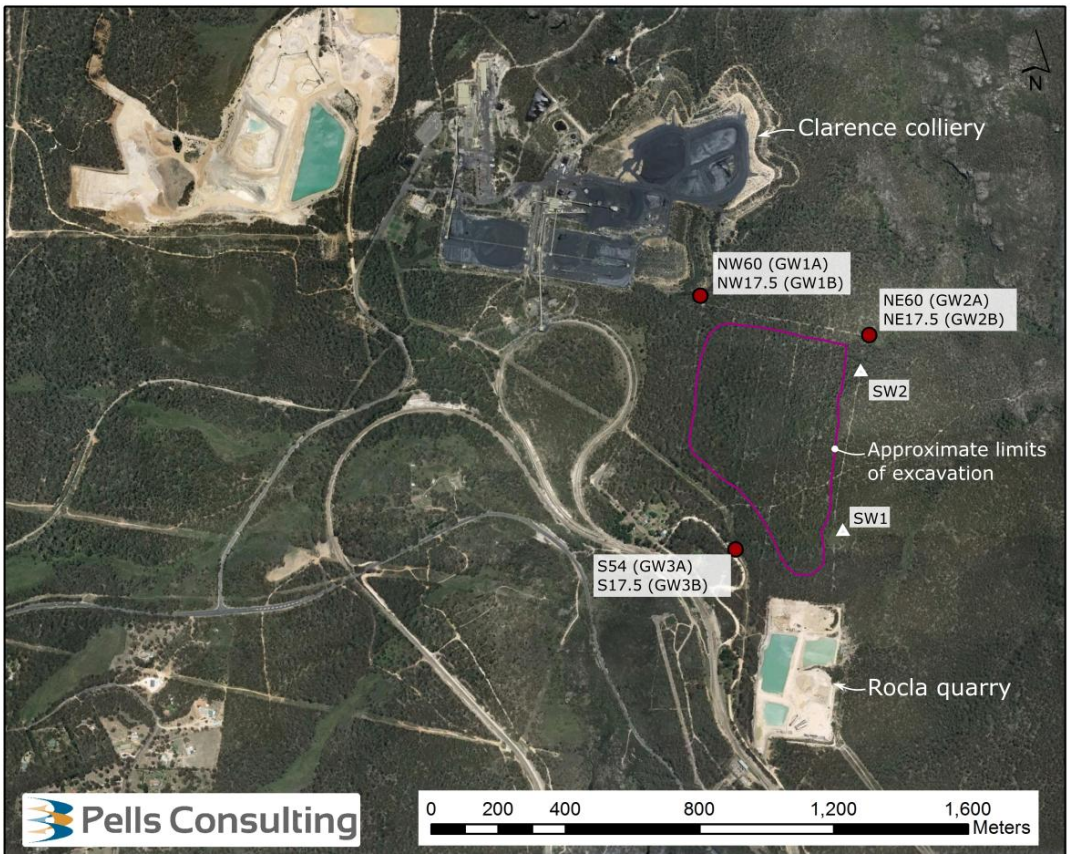


Figure 3 – Standing water levels as metres below ground, deep bores

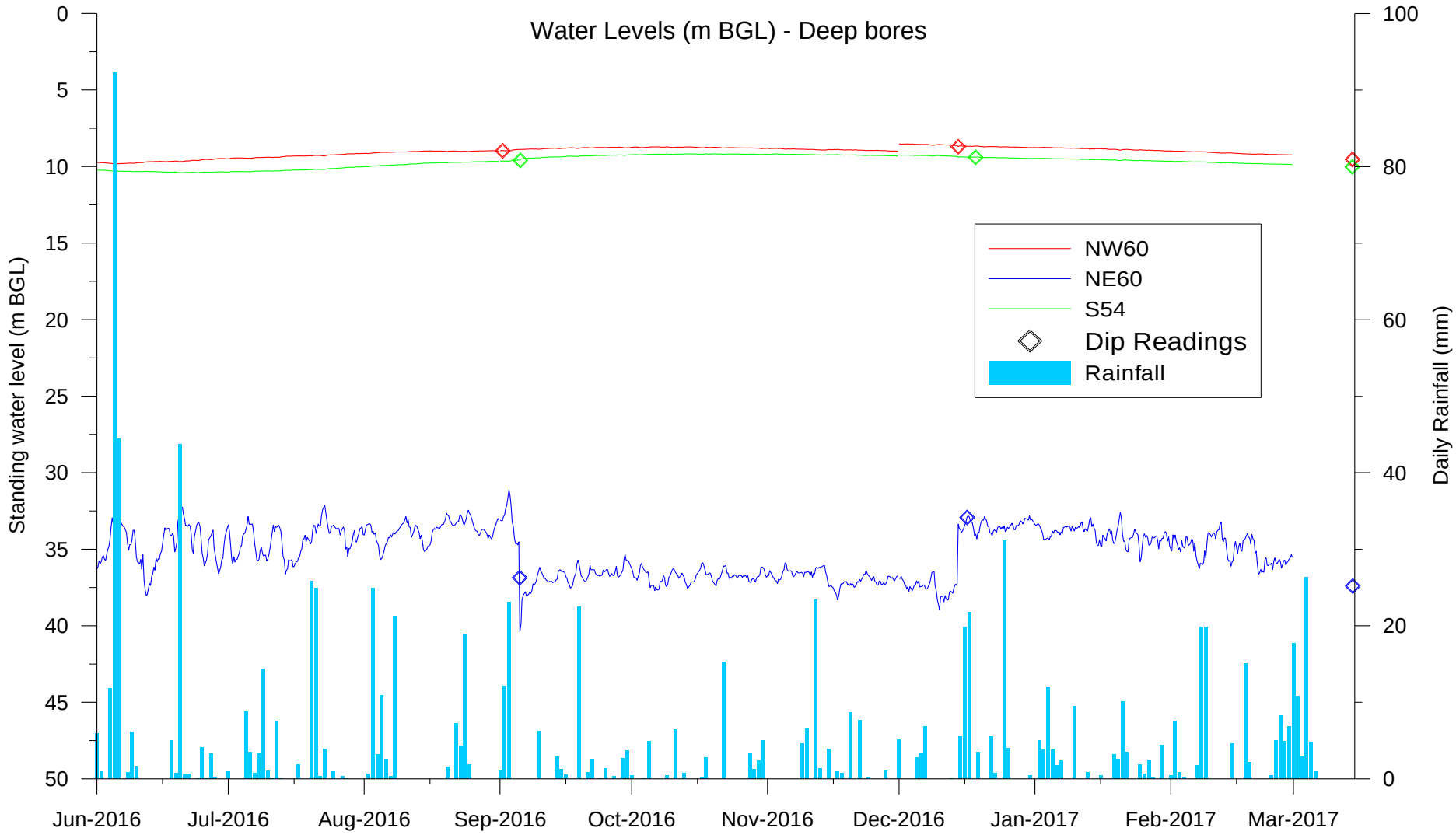
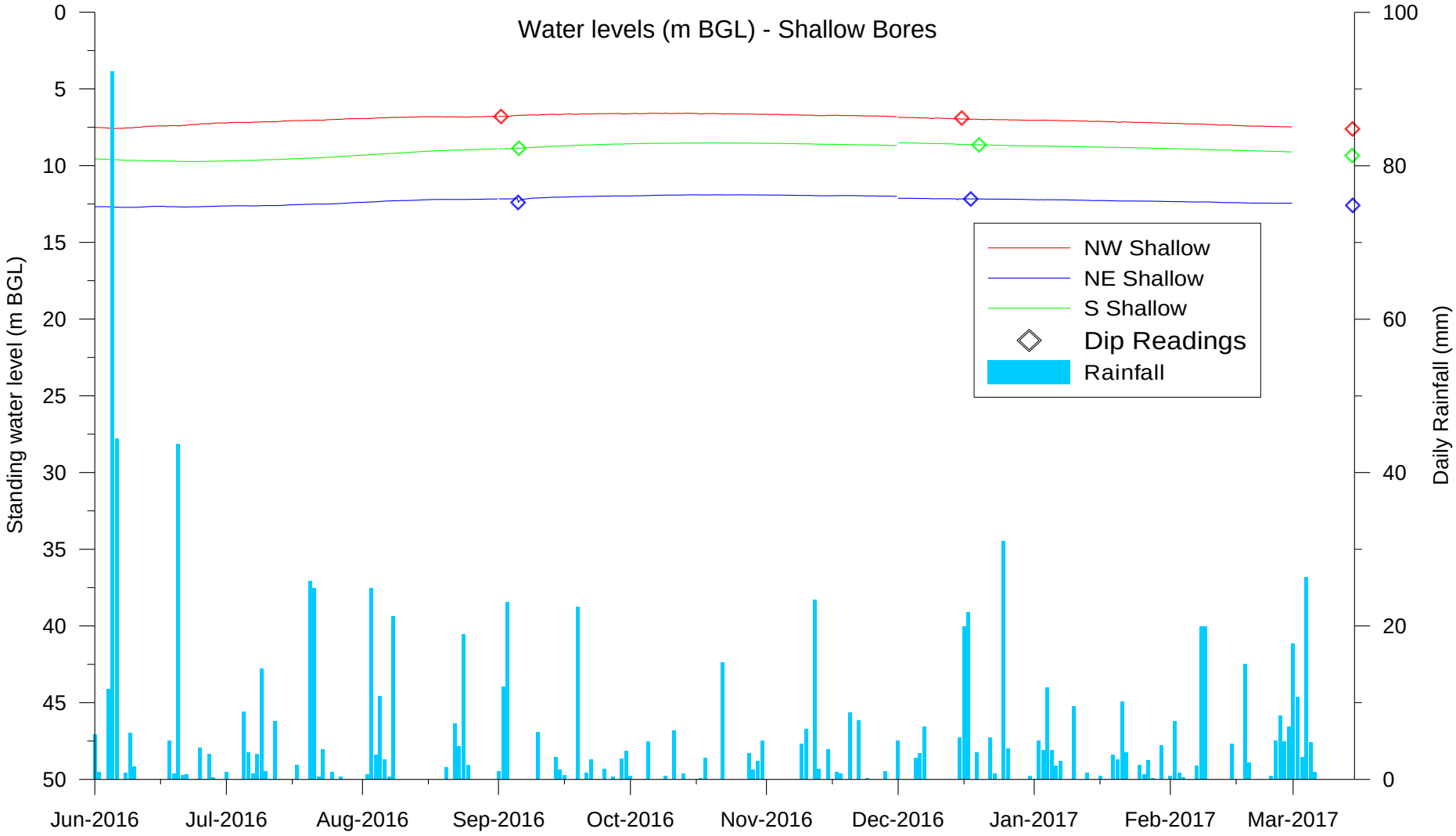


Figure 4 – Standing water levels as metres below ground, shallow bores



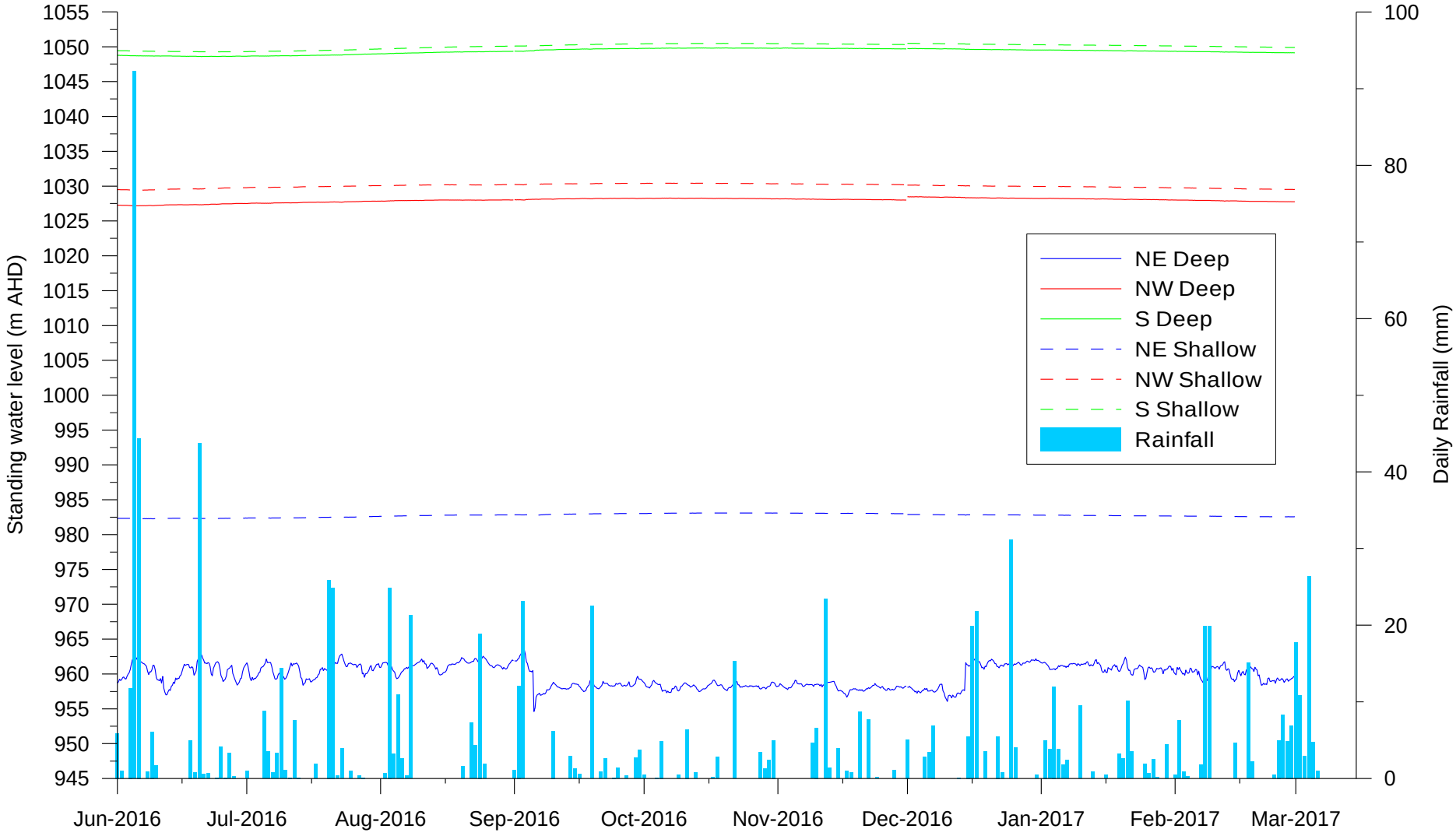


Figure 5 – Standing water levels as metres AHD, all bores

Table 2 – Summary of groundwater quality measurements

	Date and time	Location	Temp	pH	EC	TDS	Ca	Mg	Na	K	SO4	Cl	Fe	Mn	$CaCO_3$[1.]	Total P	Nitrate as N
			°C	--	*µS/cm*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*	*mg/L*
Sept-16	01-09-16 13:15	GW1A (NW60)	13.9	4.86	32	60	<1	<1	2	<1	<1	4	<0.05	0.009	2	<0.01	0.12
	01-09-16 12:50	GW1B (NW17.5)	14.6	4.91	33	58	<1	<1	2	<1	<1	4	<0.05	0.011	4	0.02	0.18
	05-09-16 10:45	GW2A (NE60)	14.6	4.80	32	46	<1	<1	5	<1	<1	5	<0.05	0.024	2	<0.01	0.07
	05-09-16 9:30	GW2B (NE17.5)	13.5	4.72	49	110	<1	<1	5	<1	<1	**8**	<0.05	0.081	3	1.09	0.12
	05-09-16 14:00	GW3A (S54)	13.5	4.75	67	62	1	1	7	<1	<1	6	<0.05	0.013	<1	0.02	**3.08**
	05-09-16 14:00	GW3B (S17.5)	13.9	5.06	38	24	<1	<1	4	<1	<1	4	<0.05	0.018	4	0.04	**0.42**
Dec-16	14-12-16 11:45	GW1A (NW60)	15.5	4.77	30	16											
	15-12-16 11:25	GW1B (NW17.5)	14.9	4.8	30	<10											
	16-12-16 12:40	GW2A (NE60)	15.7	4.52	36	32											
	17-12-16 12:15	GW2B (NE17.5)	15.6	4.5	44	42											
	18-12-16 10:40	GW3A (S54)	14.5	4.9	61	28											
	19-12-16 10:00	GW3B (S17.5)	14.2	5.27	34	6											
Mar-17	14-03-17 11:00	GW1A (NW60)	14.1	4.39	25												
	14-03-17 11:20	GW1B (NW17.5)	14.5	4.48	24												
	14-03-17 12:10	GW2A (NE60)	13.5	4.39	33												
	14-03-17 12:35	GW2B (NE17.5)	13.7	4.25	35												
	14-03-17 10:00	GW3A (S54)	13.8	4.35	51												
	14-03-17 10:15	GW3B (S17.5)	14.3	4.72	26												

1. Bicarbonate alkalinity at $CaCO_3$

Table 3 – Summary of surface water quality measurements

	Date	Location	Temp *°C*	pH --	EC *µS/cm*	TSS *mg/L*	Fe *mg/L*	Mn *mg/L*	Oil and Grease *mg/L*	BOD *mg/L*
Sep-16	01-09-16 12:10	SW1 (South Creek)	13.7	4.47	57	16	<0.05	0.006	<5	<2
	01-09-16 11:25	SW2 (North Creek)	9.3	5.28	45	<5	<0.05	0.006	<5	<2
Dec-16	-	SW1 (South Creek)								
	-	SW2 (North Creek)								
Mar-17	14-03-17 13:35	SW1 (South Creek)	(DRY)							
	14-03-17 13:00	SW2 (North Creek)	15.2	5.44	25					