Holcim

Strength. Performance. Passion

Lynwood Quarry

2018 Annual Review

1 January 2018 – 31 December 2018

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Title Block

Name of operation	Lynwood Quarry
Name of operator	Holcim Australia Pty Ltd
Development consent#	DA 128-5-2005
Name of holder of development consent	George Agriogiannis
Name of holder of mining lease	N/A
Water licence #	WAL No. 25575
Name of holder of water licence	N/A
MOP/RMP end date	N/A
Annual review start date	1 January 2018
Annual review end date	31 December 2018
I, Richard Savage, certify that this audit report is a true and accurate record of the compliance status of Lynwood Quarry for the period 1 January to 31 December 2018 and that I am authorised to make this statement on behalf of Holcim. *Note.* *a) The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.* b) *The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement – maximum penalty 5 years imprisonment): sections 307A, 307B and 307C (False or misleading applications/information/documents – maximum penalty 2 years imprisonment or $22,000, or both).*	
Name of authorized reporting officer	Richard Savage
Title of authorized reporting officer	Lynwood Quarry Works Manager
Signature of authorised reporting officer	
Date	

1.0 Statement of compliance

This Annual Review has been prepared to provide a summary of the performance of the Lynwood Quarry operations over the period 1 January 2018 to 31 December 2018 (referred to hereafter as the report period). The compliance of the operation with relevant approvals is summarised in **Table 1.1**.

It is noted that an Independent Environmental Audit (IEA) was undertaken during the 2018 report period. The IEA report has been submitted to DPE as a draft on 8 April 2019. As the 2018 IEA Audit Report has not been approved by DPE, it is not discussed further in this report. The 2018 IEA Report and accompanying action plan will be published on the Holcim website following DPE approval of the report. The 2018 IEA report includes non-compliances which occurred outside of the 2018 Annual Review period. Non-compliances which occurred outside of the 2018 Annual Review period have not been included in this 2018 Annual Review.

The most recent approved IEA was undertaken in October 2014 which identified non-compliances across the approvals and licences for Lynwood Quarry. An action plan is included on the Lynwood Quarry website. An update on the progress against outstanding actions from the 2014 IEA is provided in **Section 10.0** and was also considered during the 2018 IEA.

Table 1.1 below provides a statement of compliance for the report period. The non-compliances have been ranked according to the risk matrix included in **Table 1.2**. A description of each non-compliance is provided in **Table 1.3.**

Table 1.1 Statement of Commitments

Relevant Approval	All Conditions Complied With?
Development Consent (DA) 128-5-2005 (Mod 5)	No
Environment Protection Licence (EPL) 12939	No
Water Access Licence (WAL) No. 25575	Yes
Controlled Activity Approval (CAA) No. 10 ERM 2011/0446	Yes
Aboriginal Heritage Impact Permit (AHIP) No. 1100264	Yes
S65 Approval under the *Heritage Act 1977* 2009/S65A/13	Yes

Table 1.2 Compliance status key for Table 1.3

Risk Level	Colour Code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless of likelihood of occurrence
Medium	Non-compliant	Non-compliance with: • Potential for serious environmental consequences, but is unlikely to occur; or • Potential for moderate environmental consequences, but is likely to occur
Low	Non-compliant	Non-compliance with: • Potential for moderate environmental consequences, but is unlikely to occur; or • Potential for low environmental consequences, but is likely to occur
Administrative Non-compliance	Non-compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval condition)

Source: Annual Review Guideline (NSW Government, 2015).

Table 1.3 Non-Compliances

Relevant approval	Condition #	Condition description (summary)	Compliance status	Comment	Where addressed in this Report
DA128-5-2005 (Mod 5)	Condition 9 of Schedule 3	Construction and occupation certificates are not available for the pre-coat plant constructed during the period 22 October 2014 to 9 January 2018.	Non-compliant	Construction and occupation certificates are not currently held for the pre-coat plant which has been constructed on site. These will be progressed by Holcim with the IEA action plan targeting receipt of these certificates by October 2019.	**Section 4.3**
DA128-5-2005 (Mod 5)	Condition 12 of Schedule 3	Within 12 weeks of commencing an IEA, or otherwise agreed by the Secretary, the applicant must submit a copy of the IEA together with its response to any recommendations contained within the audit report.	Non-compliant	The Independent Environmental Audit (IEA) commenced in January 2018. A draft IEA report was provided to Lynwood Quarry during 2018 however the draft report was not finalised and submitted to DPE until 8 April 2019.	**Section 10.0**
DA128-5-2005 (Mod 5) EPL 12939	Condition 15 of Schedule 3 Condition M2.2	Failure to monitor in accordance with Air Quality Monitoring Program Failure to Monitor at High Volume Air Sampler (HVAS) units HVAS 1 (EPL point 14) and HVAS 2 (EPL point 15)	Non-compliant	Lynwood Quarry has two HVAS units which measure PM_{10} on a six day cycle in accordance with the requirements of the Development Consent. There were instances during the 2018 report period where the HVAS units did not run on the required day and there were also instances where the units did not run for the required duration in accordance with the Australian Standards. This non-compliance details where the units failed to run. High Volume Air Sampling unit HVAS 1 (EPL point 14) failed to run on 28 November 2018 and 4 December 2018. The failure to monitor was	**Section 6.3**

Relevant approval	Condition #	Condition description (summary)	Compliance status	Comment	Where addressed in this Report
				attributed to an insufficient supply of power from the solar panels which power the unit. An inspection was completed on the unit and associated solar panels which identified that overcast weather conditions and cloud cover may have reduced the capacity of the batteries charging the unit resulting in no power supply. High Volume Air Sampling unit HVAS 2 (EPL point 15) failed to monitor from 15 November 2018 to 28 December 2018 (inclusive). Following an investigation, it was identified that: • 15 November 2018 to 28 December 2018 – outage occurred due to a lightning strike which cut power supply to the unit. Following the reported lightning strike on 28 December 2018, HVAS 2 was inspected by Lynwood Quarry personnel. Repairs were completed on the unit however HVAS 2 continued to experience technical difficulties. A hire unit has been installed at this location while the permanent unit is being sourced Refer to **Section 6.3** for further information.	

Relevant approval	Condition #	Condition description (summary)	Compliance status	Comment	Where addressed in this Report
DA128-5-2005 (Mod 5) EPL 12939	Condition 15 of Schedule 3 Condition M2.2	Failure to monitor in accordance with Air Quality Monitoring Program Failure to Monitor at High Volume Air Sampler (HVAS) units HVAS 1 (EPL point 14) and HVAS 2 (EPL point 15)	Non-compliant	The HVAS units are required to run for 24 hrs +- 1 hour for each HVAS run. Due to power supply issues during the report period, both HVAS units did not run for the required 24 hrs for a number of monitoring events. Holcim has undertaken a review of monitoring procedures and power supply at each HVAS unit and actions undertaken will be provided to DPE in separate correspondence. Further information is included in **Section 6.3** with raw monitoring data included in **Appendix 1A**.	**Section 6.3**
DA128-5-2005 (Mod 5)	Condition 23 of Schedule 3	Exceedance of surface water quality criteria identified in the Surface Water Monitoring Program	Non-compliant	Elevated surface water monitoring results exceeded site based trigger levels and no site based investigation was undertaken at the for the following locations and parameters during the report period: • pH at SW 5 – March-June, August and December 2018 • EC at SW5 – April – June, August and December 2018 • TSS at SW5 – April 2018 • Total N at SW 5 – April and December 2018 • Total Phosphorus at SW5 – April 2018 • pH at SW6 – January – September and November – December 2018 • EC at SW6 – February and November 2018 A range of these elevated results are believed to be attributable to the low rainfall recorded during the report period with further information included in **Section 6.4**. It is also noted that revised surface water trigger levels have been included in a revised	**Section 6.4**

Relevant approval	Condition #	Condition description (summary)	Compliance status	Comment	Where addressed in this Report
				WMP which will be submitted to DPE for review during 2019.	
DA128-5-2005 (Mod 5)	Condition 23 of Schedule 3	Failure to monitor surface water at the locations listed in the Lynwood Quarry Surface Water Management Plan.	Non-compliant	Surface water sampling was not undertaken at the following locations during the report period: • SW5 – July 2018 • SW6 – December 2018 There were a number of occasions during the report period where sampling was not required to be undertaken as there was no flow at the monitoring locations. However, for the two events detailed above the monitoring locations were observed to be flowing but no sample was undertaken.	**Section 6.4**
DA128-5-2005 (Mod 5)	Condition 24 of Schedule 3	Exceedance of groundwater quality criteria identified in the Groundwater Monitoring Program	Non-compliant	Elevated groundwater monitoring results exceeded site based trigger levels as defined in the WMP (Umwelt, 2011) over four consecutive monitoring rounds and no site based investigation was undertaken. Selected trace elements and metals discussed further in **Section 6.5**. Elevated results were recorded during the report period for: • pH at MP2 • Phosphate as P at GPZ1 • Nitrate at N at GPZ4 and GPZ6 • Total Petroleum Hydrocarbons at GPZ8 It is also noted that there have been revisions of the Lynwood WMP modified since the approved Umwelt 2011 document was originally approved. Whilst the management plan has been modified and submitted to DPE for approval, Holcim have not addressed the DPE comments on the draft documents and as such the plans have not yet been approved. Holcim will address DPE comments	**Section 6.5**

Relevant approval	Condition #	Condition description (summary)	Compliance status	Comment	Where addressed in this Report
				and update site specific trigger levels for the WMP during 2019.	
DA128-5-2005 (Mod 5)	Condition 13 of Schedule 5	Complaints register updated quarterly	Non-compliant	During the 2018 report period the complaints register was not updated quarterly. The complaints register has been updated in April 2019 and will be updated quarterly for future monitoring periods.	**Section 9.2**
DA128-5-2005 (Mod 5)	Condition 5 of Schedule 5	Revision of Strategies, Plans and Programs	Non-compliant	During the 2018 report period, management plans were not updated three months after the submission of the Annual Review. During 2019, management plans will be updated to address DPE comments on existing draft management plan revisions as well as addressing the outcomes of the 2018 IEA.	**Section 6.0**

2.0 Introduction

Holcim (Australia) Pty Ltd (Holcim) owns and operates Lynwood Quarry, a hard rock quarry located west of Marulan, approximately 160 km southwest of Sydney and 27 km northeast of Goulburn in New South Wales (NSW) (refer to **Figure 2.1**).

Holcim is the trading name for Holcim (Australia) Pty Ltd which as a member of the LafargeHolcim group is one of the leading suppliers of heavy construction material products in Australia, operating over 80 quarries, over 200 fixed concrete plants and a fleet of over 900 concrete delivery trucks. Holcim began quarry operations at Lynwood Quarry in 2010 and since this time has provided high quality sand and aggregates for use in construction and landscaping across the local, regional and Sydney markets.

Holcim was granted development consent in December 2005 (DA 128-5-2005) (Development Consent) by the then NSW Minister for Planning for the construction and operation of Lynwood Quarry. There have been 5 modifications approved to the Development Consent under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act) since 2005.

On 18 May 2016, Lynwood Quarry was granted modification to commence quarrying and associated activities in an alternative resource known as the Granite Pit located to the west of the Approved Pit area (refer to **Figure 2.2**). The approval also allowed for the reduction in the extent of the approved pit to reflect limitations within the ignimbrite resource.

2.1 Quarry contacts

The Lynwood Quarry Works Manager is responsible to the regulatory authorities for all aspects of environmental compliance at the site. The Lynwood Quarry Works Manager's contact details are presented in **Table 2.1**.

Table 2.1 Key personnel responsible for environmental management

Name	Role	Company	Contact Details
Richard Savage	Lynwood Quarry Works Manager	Holcim	02 48207007 0419476397

2.2 Annual Review requirements

Condition 10 of Schedule 5 of the Lynwood Quarry Development Consent requires an Annual Review (AR) to be prepared and submitted to the Department of Planning and Environment (DPE). This report has been prepared in accordance with the *NSW Government Annual Review Guideline* (NSW Government, 2015) and details the operational and environmental management activities of Lynwood Quarry during the report period 1 January 2018 to 31 December 2018. Development Consent requirements along with an explanation of where each requirement is addressed within this document are provided in **Table 2.2**.

Table 2.2 Development Consent 128-5-2005 (MOD 5) conditions for the annual review

Conditions		Addressed in Section
Schedule 2 – General Administrative Conditions **Production Data**		
13.	The Applicant must (a) Provide annual quarry production data to DRG using the standard form for that purpose; and (b) Include a copy of this data in the Annual Review.	**Section 4.2**
Schedule 3 – Specific Environmental Conditions **Monitoring of Quarry Product Transport**		
33A.	The Applicant must keep accurate records of all laden truck movements from the site (weekly, monthly and annually) and publish a summary of records in its Annual Review.	**Section 4.2.2**
Schedule 3 – Specific Environmental Conditions **Retirement of Biodiversity Credits**		
48A.	Each Annual Review required under condition 10 of Schedule 5 must record the number of credits retired in the reporting year (or previously) and the area of vegetation expected to be cleared in the forthcoming five years.	**Section 6.7**
Schedule 3 – Specific Environmental Conditions **Waste Management**		
53	The Applicant must: (d) Report on waste management and minimisation on the Annual Review. to the satisfaction of the Secretary.	**Section 6.10**
Schedule 5 – Environmental Management, Reporting and Auditing **Annual Review**		
10	By the end of September each year, or other timing as may be agreed by the Secretary, the Applicant must review the environmental performance of the development to the satisfaction of the Secretary. This review must:	**This document**
	(a) Describe the development (including rehabilitation) that was carried out in the previous financial year, and the development that is proposed to be carried out over the current financial year;	**Section 4.0, Section 6.0** and **Section 8.0**
	(b) Include a comprehensive review of the monitoring results and complaints records of the development over the previous financial year, which includes a comparison of these results against: • The relevant statutory requirements, limits or performance measures/criteria; • The requirements of any plan or program required under this consent; • The monitoring results of previous years; and • The relevant predictions in the documents listed in condition 2(a) of Schedule 2;	**Section 6.0** and **Section 9.2**
	(c) Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;	**Section 1.0** and **Section 11.0**
	(d) Identify any trends in the monitoring data over the life of the development;	**Section 6.0**
	(e) Identify any discrepancies between the predicted and actual impacts of the	**Section 6.1**

Conditions		Addressed in Section
	development, and analyse the potential cause of significant discrepancies;	
	(f) Describe what measures will be implemented over the current financial year to improve the environmental performance of the development;	**Section 6.0**
	(g) Describe the area of vegetation cleared as part of the development and identify the area proposed to be cleared over the next 5 years;	**Section 6.7**
	(h) Calculate the number of additional BioBanking (or equivalent) credits that will need to be purchased, before that clearing can be done; and	**Section 6.7**
	(i) Report on the number of BioBanking (or equivalent) credits that have been purchased to allow ongoing clearing and completion of stages.	**Section 6.7**

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FIGURE 2.1

Locality Plan

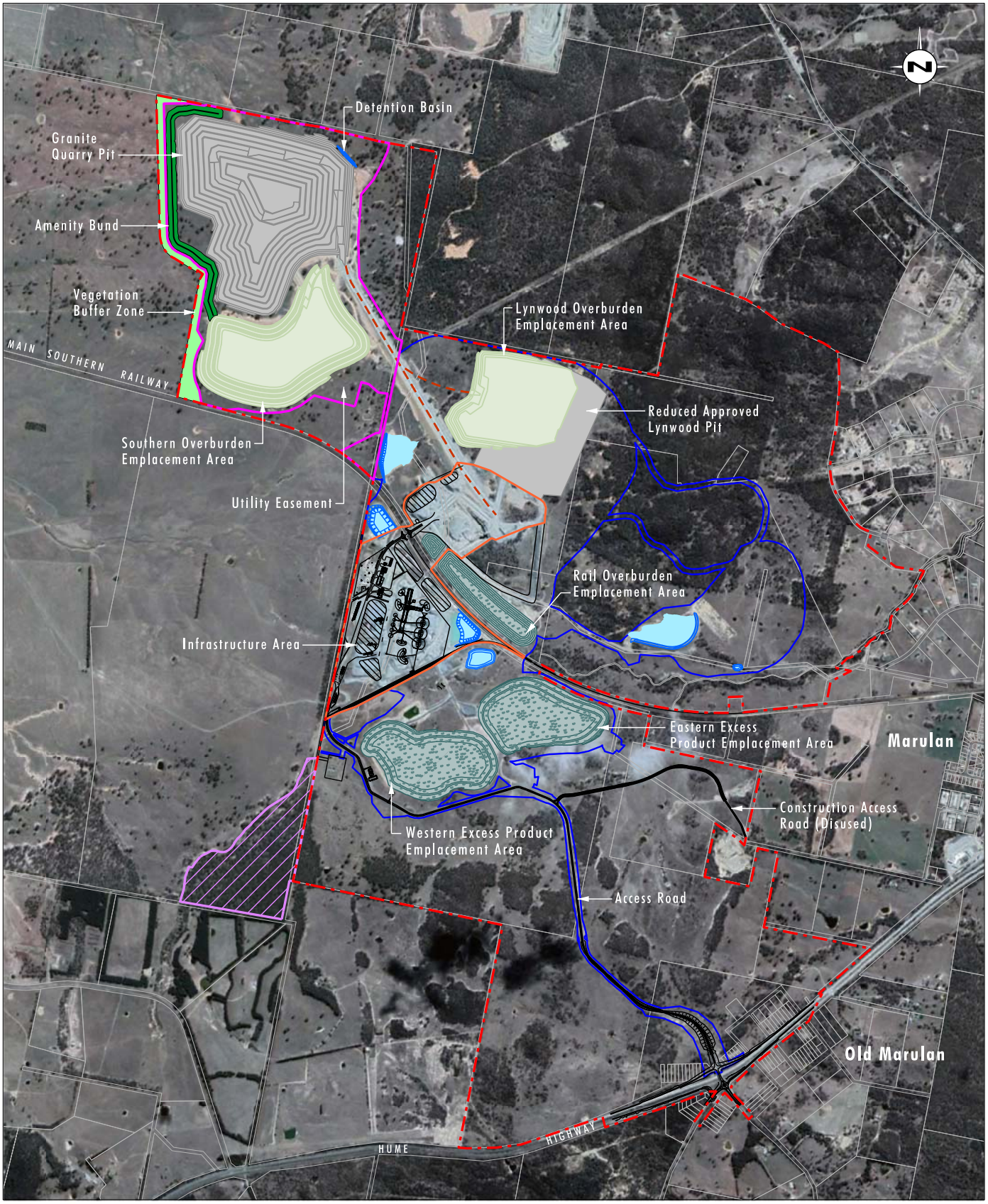

Image Source: Google Earth (2012), Holcim (2012, 2014)
Data Source: LPI (2014), Holcim Australia (2015)

0 0.5 1.0 1.5km
1:30 000

Legend

- Approved Project Area
- Lynwood Infrastructure Area
- Approved Disturbance Footprint
- Granite Pit Disturbance Footprint
- Lynwood Infrastructure Layout
- Habitat Management Area
- Quarry Pit
- Emplacement Area
- Dam
- Overburden Emplacement Area
- Vegetation Buffer Zone
- Amenity Bund
- Haul Road

FIGURE 2.2

Overview of Operations

File Name (A4): R01/4541_002.dgn
20190321 13.46

3.0 Approvals

Approvals currently held by Lynwood Quarry are listed in **Table 3.1**.

3.1 Development consent history

The original Lynwood Quarry Development Consent 128-5-2005 (Development Consent) was granted on 21 December 2005. Subsequent modifications to the Development Consent were approved in 2009, 2011, 2016 and 2017. The Development Consent permits carrying out quarrying operations until 1 January 2038.

On 18 May 2016, Lynwood Quarry was granted modification (MOD 4) to commence quarrying and associated activities in an alternative resource known as the Granite Pit immediately northwest of the existing operations.

MOD 4 of the Development Consent included:

- Development of a new Granite Pit to the west of the existing Approved Pit;
- Construction of an additional haul road, to connect the new Granite Pit to the existing infrastructure, water management structures and other minor additions;
- Emplacement of overburden from the Granite Pit in the Approved Pit;
- Construction of an amenity bund to the west and northwest of the Granite Pit; and
- A reduction in total disturbance area due to a decrease in the Approved Pit disturbance footprint and associated overburden storage and haul roads.

In May 2018, Lynwood Quarry was granted approval (MOD 5) to modify condition 48A of Schedule 3 of the Development Consent. This condition related to the retirement of biodiversity credits for the site. All references to Development Consent conditions within this document refer to the MOD 5 unless stated otherwise. Approvals and licences held by Holcim are provided in **Table 3.1**.

Table 3.1 Current approvals, licences and leases

Approval and Relevant Legislation	Details
Development Consent (DA) 128-5-2005 (Mod 5) *NSW Environmental Planning and Assessment Act 1979*	The MOD 5 Development Consent applied through the report period. Mining operations permitted to 1 January 2038 in accordance with the MOD 5 Development Consent.
Part 3A permit *Water Management Act 2000*	Obtained for works within 40 m of stream
Part 2 Licence *Water Act 1912 Part 2*	Obtained for surface water capture and use
Part 5 Licence *Water Act 1912 Part 5*	Obtained for groundwater monitoring
Controlled Activity Approval (CAA) No. 10 ERM 2011/0446*Rivers and Foreshores Improvement Act 1948*	Works within the riparian zones on site
Environment Protection Licence (EPL) 12939 *Protection of the Environment Operations Act 1997*	Held by Holcim over the Lynwood Quarry premises.
Water Access Licence (WAL) No. 25575	Obtained under the water sharing plan for the Upper Nepean and Upstream Warragamba Water source (refer to **Section 7.2**)
Aboriginal Heritage Impact Permit (AHIP) No. 1100264 *National Parks and Wildlife Act 1974*	Discussed further in **Section 6.11**.

4.0 Operations summary

A summary of the operations undertaken at Lynwood Quarry during the report period are included in the following sections.

4.1 Quarrying operations

Quarrying operations were completed within the Lynwood Pit on 15 March 2018. The cessation of quarrying in this area reflected the limitations of the quarry resource. Quarrying operations commenced in the Granite Pit in 2017 and during the report period extraction of resource within the Granite Pit at the western end of the Quarry (refer to **Figure 2.2**) was undertaken.

The quarrying process on site consists of the following four stages:

- Clearing and topsoil stripping – typically undertaken using a dozer and/or excavator in accordance with Lynwood Quarry's clearing procedure, with selected material stockpiled for later use in rehabilitation;
- Overburden removal and emplacement – overlain material is typically removed without the need for blasting and hauled to emplacement areas;
- Blasting, loading and haulage of primary raw feed (PRF) material – target resource removed via drill and blast then loaded by front-end loaders into haul trucks for transportation to the primary crusher; and
- Crushing and screening – resources are processed by the primary crusher are then transported via conveyor to the infrastructure area for tertiary processing and screening. Products are stockpiled awaiting transport to local, regional and Sydney markets via road and rail transportation methods.

During the report period, operations focused on quarrying within the Granite Pit, with the commencement of construction of the amenity bund also occurring.

4.2 Production limits

During the report period, a total of 2,242,443 tonnes of quarry product was transported from the Quarry via road and rail. During the report, 768,022 tonnes of material was transported from the site via road which is well below the approved limit of 1.5 million tonnes. In accordance with Condition 13 of Schedule 2 of the Development Consent, Lynwood Quarry production data for the 2017 – 2018 financial year was reported to DPE – Division of Resources and Geosciences (DRG) during 2018. The data has not been included in this report as this report has been prepared for the calendar year with the data provided to DRG being prepared for the financial year.

Table 4.1 provides the annual production and transportation volumes for the 2018 report period and also provides a forecast for the 2019 report period.

Table 4.1 Production summary

Material	Approved limit DA 128-5-2005	2018 report period (actual) (t)	2019 report period (forecast) (t)	Compliance with criterion
Product - total	5 million tonnes from the site in a year	2,242,443	2,454,941	Yes
Product Transported - Rail	5 million tonnes from the site in a year	1,474,422	1,560,896	Yes
Product Transported - Road	1.5 million tonnes from the site in a year by road	768,022	894,045	Yes

4.2.1 Hours of operation

Lynwood Quarry operates in accordance with the operating hours specified in **Table 4.2** below.

Table 4.2 Operating hours at Lynwood Quarry

Activity	Day	Time	Compliance with Operating Hours during this report period
Construction works	Monday – Friday	7am to 6pm	Yes
	Saturday	8am to 1pm	Yes
	Sunday and Public Holidays	None	Yes
Topsoil/overburden removal/emplacement; drilling	Any day	7am to 6pm	Yes
Blasting	Monday – Saturday	9am to 5pm	Yes
	Sunday and Public Holidays	None	Yes
Extraction	Any day	7am to 10pm	Yes
Processing (crushing, screening, stockpiling); loading, delivery and distribution; maintenance	Any day	Anytime	Yes

4.2.2 Vehicle movements

In accordance with Condition 33A of Schedule 3 of the Development Consent, the number of laden truck movements from Lynwood Quarry are summarised in **Table 4.3** below. Product transported by road from Lynwood Quarry is restricted to less than 1.5 million tonnes per annum, with the 2018 report period road transport tonnages being within the approved limits.

Table 4.3 Summary of laden trucks movements 2018

Month	Laden Truck Movements	Product by Road Transport (tonnes)
January	815	28,748
February	1,251	43,414

Month	Laden Truck Movements	Product by Road Transport (tonnes)
March	1,592	55,010
April	1,771	62,485
May	2,164	75,684
June	1,393	49,823
July	835	27,987
August	614	20,165
September	979	34,910
October	660	23,416
November	1,557	56,247
December	1,016	36,795
Total	**14,647**	**514,691**

4.3 Construction activities

During the report period the construction of the Granite Pit haul road was completed along with the construction of a storage shed and temporary dome shed for heavy vehicle maintenance. Construction associated with the pre-coat plant was also completed during January 2018. Construction of the amenity bund commenced in late 2018 and is expected to be completed during the 2019 report period.

5.0 Actions required from previous Annual Review

Following the submission of the 2017 Annual Review, DPE acknowledged their satisfaction of the report in correspondence received on 17 April 2018. DPE noted that that Holcim was granted an extension to the retirement of biodiversity credits and that the credits were to be retired in June 2018 and reported in the next report period Annual Review. DPE also requested that additional information be included in the 2018 Annual Review including:

- A comparison of the environmental impacts and performance of the project against the environmental impacts and performance predicted in the Environmental Assessment;
- Identification of trends in monitoring data over the life of the project to date; and
- Graphical representation of trends and comparisons for the year and with previous years.

DPE also stipulated that up to date copies of relevant documents and information are made available on the Lynwood Quarry website. Works undertaken to address comments provided by DPE are detailed in **Table 5.1**.

Table 5.1 Actions Required for 2018 Annual review

DPE Requirements	Works Undertaken	Where addressed in this Document
Holcim was granted an extension to the retirement of biodiversity credits and that the credits were to be retired in June 2018 and reported in the next report period.	Biodiversity credits are retired progressively as operational disturbance and land clearing activities progress. Lynwood Quarry retired a total of 3,369 Biodiversity Credits during the 2018 report period. A summary of the retired credits is provided in **Section 6.7.3**.	**Section 6.7.2** and **Section 6.7.3**
Include a comparison of the environmental impacts and performance of the project against the environmental impacts and performance predicted in the Environmental Assessment.	The environmental performance during 2018 has been compared to the predictions made in the EA (as modified) and is provided in **Section 6.1**.	**Section 6.1**
Include an identification of trends in monitoring data over the life of the project to date.	A discussion of trends in is provided in **Section 6.0**. Monitoring data from the report period is compared to the previous years data in **Section 6**. Surface water and groundwater graphs detailing trends in monitoring data will be included in a revised Water Management Plan to be submitted to DPE during Qtr 2 2019.	**Section 6.0**
Include graphical representation of trends and comparisons for the year and with previous years.	The 2018 Annual Review includes graphical representation of trend for the year and compares these against previous years in **Appendix 1**.	**Appendix 1**

DPE Requirements	Works Undertaken	Where addressed in this Document
Include up to date copies of relevant documents and information on the Lynwood Quarry website.	In accordance with Condition 13 (a) of Schedule 5, Lynwood Quarry has made copies of the following publically available on its website: - the EIS and relevant modifications - current statutory approvals for the development; - approved strategies, plans or programs; - a summary of the monitoring results of the development, which have been reported in - accordance with the various plans and programs approved under the conditions of the consent; - a complaints register, which is to be updated on a quarterly basis; - the Annual Reviews (over the last 5 years); - any independent environmental audit, and the Applicant's response to the recommendations in any audit; In accordance with Condition 13 (b) of Schedule 5, Lynwood Quarry has ensured that these copies are up-to-date.	N/A – documents included on the Lynwood Quarry website.

6.0 Environmental performance

The following sections provide a summary of environmental monitoring and management undertaken during the report period. In accordance with the Development Consent, Lynwood Quarry has prepared a number of management plans in consultation with relevant stakeholders.

Environmental management plans

The management plans have been prepared for a number of environmental management aspects and include:

- Environmental management strategy (Umwelt, 2016);
- Rehabilitation and Landscape management plan (Umwelt, 2018);
- Water management plan (Umwelt, 2011- see **Section 6.4**);
- Environment monitoring program (Umwelt, 2010);
- Aboriginal heritage management plan (Umwelt, 2011);
- Construction traffic management plan (Umwelt, 2011);
- Box gum woodland management plan (Umwelt, 2013);
- Air quality management plan (Umwelt, 2016);
- Noise management plan (Umwelt, 2016); and
- Blast management plan (Umwelt, 2016).

Environmental monitoring data and a copy of the current Lynwood Quarry management plans are published on the Holcim website (https://www.holcim.com.au/lynwood). In accordance with Schedule 5, Condition 5 of the Development Consent, Holcim will provide DPE with a summary of changes required to be undertaken to address outcomes of the 2018 Independent Environmental Audit (IEA) and also to include any updates required to the management plans following the submission of the Annual Review by 30 June 2019.

An overview of environmental performance at Lynwood Quarry is provided in the following sections. A summary of the environmental performance during the report period is presented in **Table 6.1**.

6.1 Summary of performance against EA predictions

The Lynwood Quarry has been subject to three environmental assessments (EA) and five modifications since the original environmental impact statement and development application was approved in 2005. MOD 4 involved expanding quarrying operations to the west of the existing operations. This was assessed by the most recent EA dated November 2015 (Umwelt, 2015). The results of environmental monitoring data obtained during the report period have been compared to the predictions in the EA dated November 2015 within this Annual Review. During the report period, monitoring was undertaken at Lynwood Quarry for noise, air quality, water quality and biodiversity.

6.1.1 Air quality predictions against the EA

An Air Quality Impact Assessment (PEL, 2015) was completed as part of the Lynwood Quarry Extraction Area Modification EA (Umwelt, 2015). The assessment predicted that as operations move in a westerly direction, there would be no predicted exceedances of the assessment criteria for all PM_{10} and Depositional Dust at private residences during the operational phase of the quarry. In summary, the EA concluded that:

- EPA air quality impact assessment criteria were not predicted to the exceeded at nearby residences; and
- The modification is not anticipated to cause adverse impacts offsite.

The EA (Umwelt, 2015) further outlined the implementation of the existing air quality management and monitoring system was suitable to comply with relevant air quality assessment criteria. All depositional dust results recorded during the report period were below impact assessment criteria and consistent with EA predictions. One PM_{10} monitoring event on 15 December 2018 recorded an exceedance of short term impact assessment criteria at HVAS 1, however it is likely that this elevated readings were due to a regional dust storm. A discussion of air quality monitoring results recorded during the report period is provided in **Section 6.3**.

6.1.2 Water quality predictions against the EA

The outcomes of the surface water assessment (Umwelt 2005 & 2015) indicated that Lynwood Quarry would not significantly alter the flow regimes or annual flow volumes in the surrounding creek network in terms of peak discharges, flood levels or peak in-stream velocities either upstream or downstream of Lynwood. No adverse impacts are predicted in terms of channel stability, in-stream habitat of either Joarimin Creek or Lockyersleigh Creek systems. No adverse impacts are predicted in terms of water quality in Joarimin Creek, Lockyersleigh Creek or the downstream drainage systems.

A discussion of the surface water quality results recorded during report period is provided in **Section 6.4**.

6.1.3 Groundwater predictions against the EA

Drawdown impacts are expected within the immediate vicinity of the quarry pit. As the expansion of the granite pit continues a progressively deepening and slightly expanding cone of depression surrounding the pit is expected (Umwelt, 2015). Groundwater inflow rates are predicted to be negligible given the early stage of operations in the extension area.

Groundwater levels recorded during the report period were generally consistent with historical levels. A discussion of groundwater level and water quality results is provided in **Section 6.5**.

6.1.4 Noise predictions against the EA

The results of the noise impact assessment identified that noise impacts from the operations will meet the existing development consent criteria at all locations and time of day periods except receiver location 11 (Monitoring Location - N3) where a minor 1 dB exceedance is predicted at night (Umwelt, 2015).

No noise monitoring exceedances were recorded during the report period and all results remained below impact assessment criteria. A discussion of noise monitoring results recorded during the report period is provided in **Section 6.6**.

Table 6.1 Summary of the environmental performance during the report period

Aspect	Approval Criteria/ EIS Prediction	Performance during the report period	Trend / key management implications	Implemented / proposed management actions
Air Quality (Refer to Section 6.3)	Refer to **Section 6.1.1**/ Refer to **Section 6.3.2**	Non-compliant (due to monitoring equipment failure)	Depositional dust monitoring results continued to trend below impact assessment criteria limits during the report period and remained within historical range. Non-compliance occurred due to monitoring equipment failure (see **Section 6.3**).	Actions to be undertaken are detailed in **Section 6.3**.
Surface Water Quality (Refer to Section 6.4)	Refer to **Section 6.1.2**/ Refer to **Section 6.4.2**	Non-compliant	Non-compliant due to sampling events which were not undertaken (refer to **Section 6.4.1**) and the receipt of monitoring results above trigger levels in the approved WMP (Umwelt, 2011) which were not investigated.	A revised water management plan will be submitted to DPE during Qtr 2 2019 which will include graphs of historical water quality and a review of surface water trigger levels for the operation. It is noted that there was no discharge from Lynwood Quarry during the report period.
Groundwater (Refer to Section 6.5)	Refer to **Section 6.1.3**/ Refer to **Section 6.5.2**	Non-compliant	Non-compliant due to sampling events which were not undertaken and the receipt of monitoring results for MP bores above trigger levels in the approved WMP which were not investigated.	A revised water management plan will be submitted to DPE during Qtr 2 2019 which will include graphs of historical water quality and a review of surface water trigger levels for the operation.
Noise (Refer to Section 6.6)	Refer to **Section 6.1.4**/ Refer to **Section 6.6.2**	Compliant	Attended noise monitoring results continued to trend below impact assessment criteria during the report period and remained within historical range.	No additional management or mitigation measures are proposed to be implemented which are outside of the existing approved NMP.
Biodiversity (Refer to Section 6.7)	Refer to **Section 6.7.2**/ Refer to **Section 8.3**	Compliant	A summary of biodiversity management measures and credits retired during the report period is included in **Section 6.7**.	No additional management measures other than those identified in the Rehabilitation and Landscape Management Plan.

Aspect	Approval Criteria/ EIS Prediction	Performance during the report period	Trend / key management implications	Implemented / proposed management actions
Blasting (Refer to Section 6.9)	Refer to **Section 6.9**.	Compliant	Blast monitoring undertaken during the report period complied with Development Consent and EPL criteria.	Continued implementation of the Blast Management Plan during the report period.

6.2 Meteorological monitoring

The Lynwood Quarry weather station (M1) is located in the vicinity of Lynwood Quarry as shown in **Figure 6.1**. A summary of the monthly meteorological monitoring results is presented in **Table 6.2**.

Table 6.2 Lynwood Quarry weather station data - 2018

Month	Rainfall (mm)	Cumulative Rainfall (mm)	No of rain days/month	Air Temperature (°C)		Humidity (%)	
				Minimum	Maximum	Minimum	Maximum
January	37.8	37.8	17	10.7	25.5	26.4	94.7
February	151.2	189	12	11.4	24.8	11.4	95.6
March	11.4	200.4	10	8.5	22.8	29.2	95.4
April	18.2	218.6	10	7.8	21.3	37.6	98.2
May	15.2	233.8	7	3.1	17	41.6	98.3
June	33	266.8	22	-0.4	9.4	57.9	96.9
July	6	272.8	5	-1.8	12.4	21.5	96.8
August	20.4	293.2	9	0.4	12.6	32.3	89.1
September	20	313.2	7	2.4	14.4	45.8	99.3
October	49.8	363	15	4.6	17.3	35.4	100
November	81.6	444.6	12	6.9	22.8	39.2	97.4
December	116	560.6	11	9.7	24.5	31.7	100
Total	**560.6**	-	**137**	-	-	-	-

6.2.1 Rainfall

Lynwood Quarry received approximately 560.6 mm of rain over 137 rain days during the report period. The highest mean monthly rainfall occurred during February 2018 (151.2 mm) while July had the lowest monthly rainfall recording 6 mm.

6.2.2 Temperature

The mean maximum temperature recorded during the report period occurred during January (25.5 °C) and the lowest mean temperature occurred in July (-1.8 °C).

6.2.3 Humidity

The highest humidity recorded during the report period at Lynwood Quarry occurred during both October and December (100 %) and the lowest was during February (11.4 %).

6.3 Air quality

6.3.1 Environmental management measures

Air quality monitoring is undertaken in accordance with the approved Air Quality Management Plan (AQMP) (Umwelt, 2016) which sets out the procedures and management requirements for the management of dust at the Quarry.

The air quality monitoring network consists of five dust deposition gauges (DD5, DD8, DD11, D12, DD13) and two High Volume Air Samplers (HVAS1 and HVAS2), which are used to measure depositional dust and particulate matter <10µm (PM_{10}), respectively. Dust monitoring locations are provided in **Figure 6.1**.

6.3.2 Performance criteria

Holcim is required to ensure that dust and particulate emissions do not cause exceedances of the criteria specified in the Development Consent. The air quality assessment criteria specified in the Development Consent are provided in **Table 6.3**.

Table 6.3 Air quality impact assessment criteria

Pollutant	Averaging Period	Criterion
Total suspended particulate (TSP) matter	Annual average	90 µg/ m^3
Particulate matter <10µm (PM10)	Annual average	30 µg/ m^3
	24 hour average	50 µg/m^3
Deposited dust	Annual average (maximum total)	4 g/m^2/month
	Annual average (maximum increase)	2 g/m^2/month

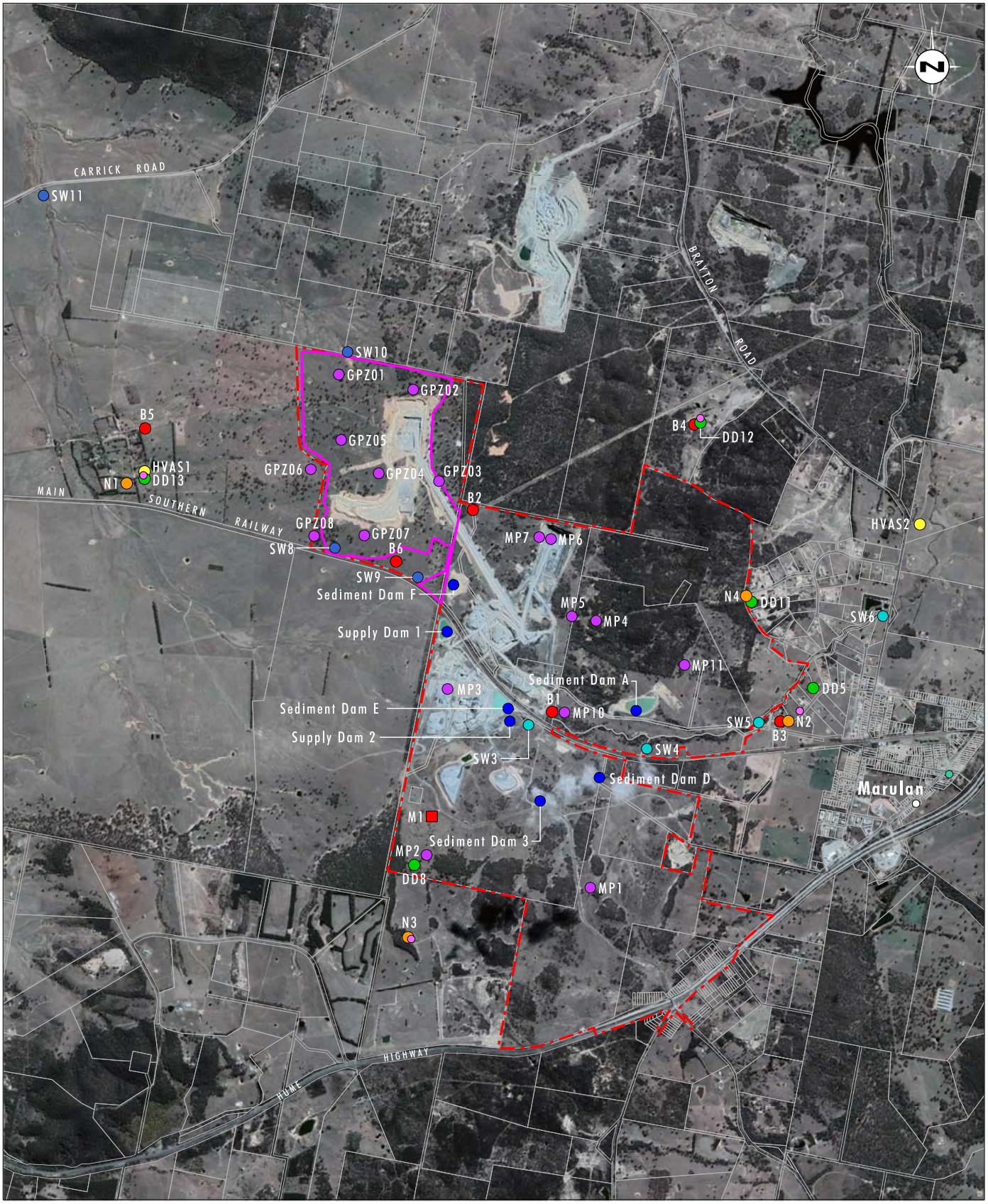

Image Source: Google Earth (2018)
Data Source: LPI (2014), Holcim Australia (2015)

0 0.5 1.0 2.0km
1:45 000

Legend

- Approved Project Area
- Granite Pit Disturbance Footprint
- Meteorological Station
- Depositional Dust Monitoring Location
- HVAS Location
- Blasting Monitoring Location
- Noise Monitoring Location
- Groundwater Piezometer
- Surface Water Monitoring Location
- Site Water Management Dams
- Granite Pit Surface Water Monitoring Location SW8 to SW11
- Residence Location
- Marulan Public School
- Marulan Childrens Centre

FIGURE 6.1

Environmental Monitoring Network

File Name (A4): R01/4541_003.dgn
20190319 14.26

6.3.3 Environmental outcomes

6.3.3.1 Depositional Dust

As noted in **Table 6.4**, depositional dust monitoring during the report period on a monthly basis. All sites were compliant with Development Consent criteria for annual average total deposited dust and ranged between 0.8 – 1.8 g/m^2/month.

Table 6.4 2018 Depositional Dust Monitoring Results

Month	Total Insoluble Solids (g/m2/month)				
	DD5	DD8	DD11	DD12	DD13
January	1.4	3.7	1.6	1	1.8
February	1.1	1.6	0.8	0.7	1.6
March	1.8	2.2	0.5	0.9	2.1
April	1.2	2.1	1.5	1.2	1.7
May	1.7	0.8	0.9	0.5	0.9
June	1.4	0.4	0.8	0.6	0.5
July	0.8	0.3	0.8	0.4	0.3
August	2.5	0.5	1.6	0.9	0.8
September	3.4	0.4	1	0.4	1.7
October	1.4	0.5	1.4	0.4	1.4
November	3.1	1.5	2.2	1.3	2.6
December	2.1	2.3	2	1.8	0.8
Annual Average	**1.8**	**1.4**	**1.3**	**0.8**	**1.4**

6.3.3.2 PM_{10} / TSP

PM_{10} monitoring via HVAS units 1 and 2 was undertaken during the report period. During the review of PM_{10} data in developing the Annual Review, it was identified that a number of PM_{10} monitoring events at HVAS units 1 and 2 did not record for the entire 24 hour period as required by relevant Australian Standards during 2018. Holcim notes that HVAS 1 is sited in a remote location and is operated on solar power as it is unable to be connected to the mains power supply. During the report period there were a number of occasions where the battery supply challenges resulted in HVAS 1 not running for the entire 24 hour run time. A compliance summary of PM_{10} monitoring data is provided in **Table 6.5** with raw monitoring data and monitoring run times detailed in **Appendix 1A**. Holcim will investigate alternate power supply options or re-locate HVAS 1 during April 2019 in consultation with DPE.

A review of HVAS 2 results and consultation with the monitoring contractor identified that the HVAS unit was affected by a lightning storm in late 2018 and this was reported to Lynwood quarry staff on 28 December 2018. Power was returned to the unit following the outage however, a hire unit has been installed at this location while the permanent unit is being sourced. Lynwood Quarry is currently in the process of sourcing a new unit for installation in Q2 2019.

Table 6.5 2018 PM_{10} Compliance Summary

Category	HVAS 1	HVAS 2
Total number of HVAS monitoring rounds required in 2018	62	62
Number of completed (24 hours +/- 1 hour) monitoring rounds	14	46
Number of incomplete monitoring rounds or not undertaken	48	16

A summary of PM_{10} monitoring results from completed monitoring rounds is provided in **Table 6.6** below.

Table 6.6 Summary of completed PM_{10} monitoring results

	HVAS 1	HVAS 2
Count	14	46
Minimum (µg/m^3)	3.2	< 1*
Average (µg/m^3)	12.7	11.8
Maximum (µg/m^3)	22.1	37.8

* Limit of Measurement

Of the available and completed PM_{10} monitoring data provided in **Table 6.45,** results indicate an average of 12.7 µg/m at HVAS 1 and 11.8 µg/m^3 at HVAS 2 and a maximum of 22.1 at HVAS 1 and 37.8 µg/m^3 at HVAS HVAS 2. One monitoring event recorded a PM_{10} value of 57.2 µg/m^3 on Saturday 15 December 2018 at HVAS 1. A comparison of results against the EPA Air Quality monitoring network noted that the regional locality experienced increased levels of dust on 15 December 2018 as a result of a regional dust event.

6.3.4 Trends in data

6.3.4.1 Depositional Dust

A summary of annual average monitoring results from 2014 to 2018 is provided in **Figure 6.2**. Gauges DD11, DD12 and DD13 were installed in December 2016 following a revision to the depositional dust monitoring network and the approval of the Development Consent (Mod 4). As a result, limited data is available to compare against historical operations. Gauges DD5 and DD8 provide a longer term comparison of monitoring results.

As shown in **Figure 6.2**, a comparison of depositional dust monitoring results indicates all sites were compliant with the Development Consent against maximum allowable annual increase criteria. DD11 and DD13 recorded an annual average increase of approximately 0.2 g/m^2/month during the report period, whilst DD5, DD8 and DD12 recorded decreases in annual averages between 0.7 and 0.8 g/m^2/month. Depositional dust results were also below the impact assessment criteria of 4g/m^2/month.

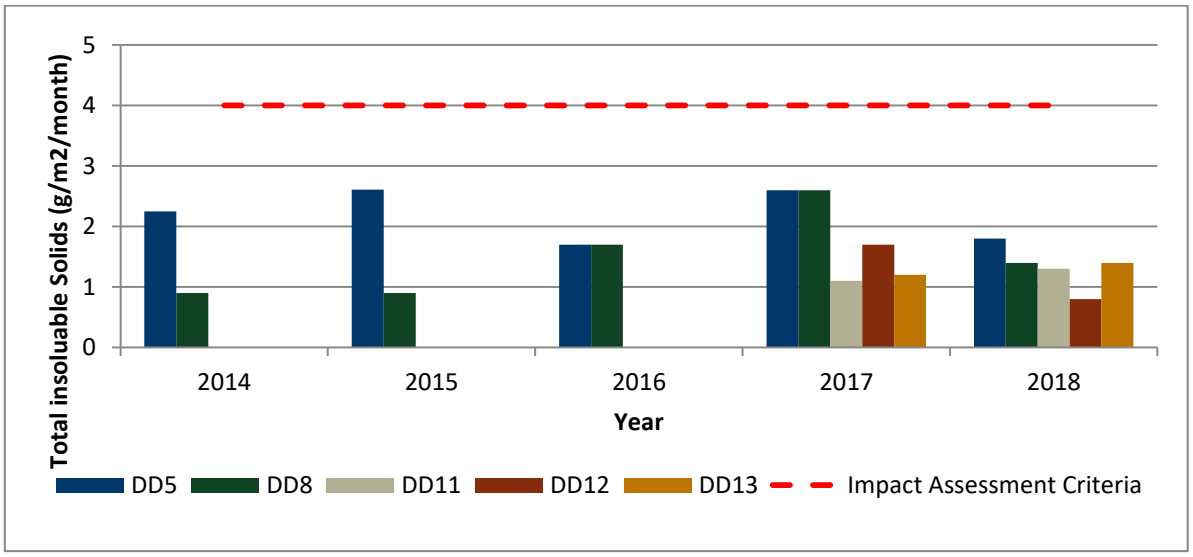

Figure 6.2 Historical Depositional Dust Monitoring

6.3.4.2 PM_{10}

Annual average PM_{10} monitoring results are provided in **Figure 6.3**. As noted in **Section 6.3.3**, an incomplete dataset was recorded at HVAS 1 and HVAS 2 during the report period. The 2018 average has been populated using data set which was obtained in accordance with the requirements of the Development Consent. Data which did not run for the required 24 hour sample period was excluded from the data set. As shown in **Figure 6.3** below and noted in previous annual review documents, a data gap is shown during 2013 at HVAS 2 as a result of the unit not recording the required number of readings due to power supply issues. Further information is provided in the 2013/2014 Annual Review document. Based on the available and completed 2018 dataset, monitoring results recorded during the report period are generally within the historical range. A year on year comparison of monitoring results noted a small increase of 3.2 µg/m^3 at HVAS 1 at and 0.8µg/m^3 at HVAS 2. These minor increases are relatively consistent with data obtained during the 2017 report period and are generally attributable to the dry conditions experienced throughout the locality during the report period.

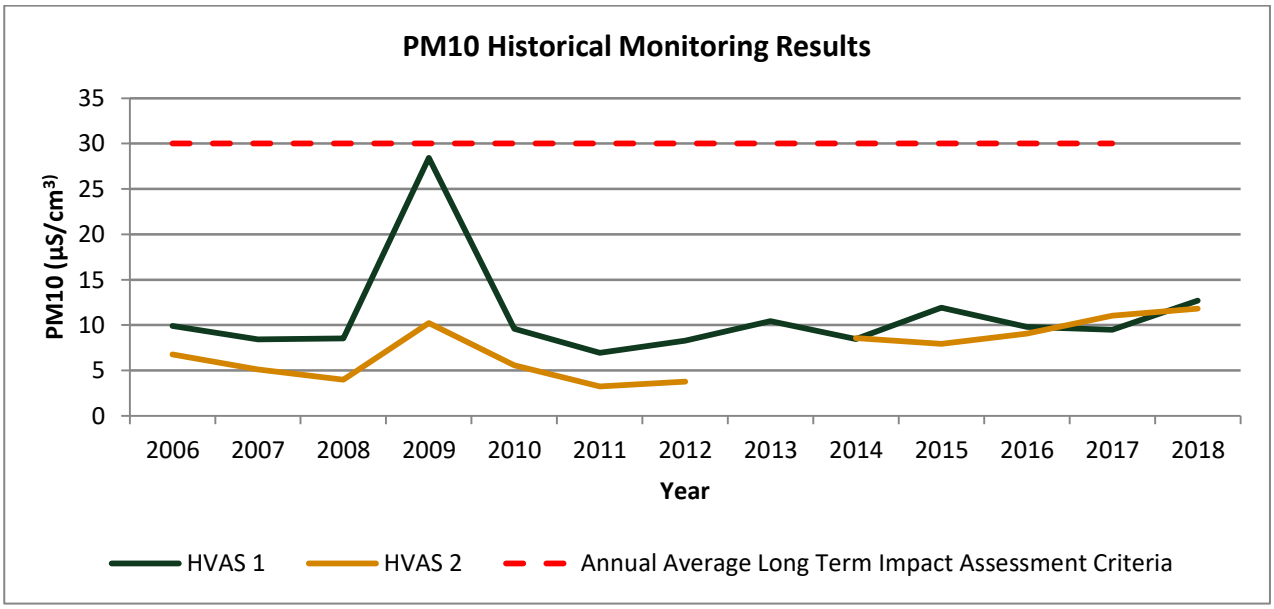

Figure 6.3 Historical PM10 Monitoring Results

6.3.5 Proposed improvements or actions next report period

During the 2019 report period, Lynwood Quarry will undertake a review of the HVAS units to confirm the power supply to the units is appropriate for the operation of the units. If suitable and reliable power supply to the units cannot be provided by Holcim, the units will be relocated following a discussion with DPE and approval of a revised Air Quality Management Plan.

No additional management or mitigation measures are proposed to be implemented which are outside of the existing approved AQMP.

6.4 Surface water

6.4.1 Environmental management measures

Lynwood has developed and implemented a Surface Water Monitoring Program (SWMP) (Umwelt, 2011) in accordance with the requirements of the Development Consent. A revised version of the Lynwood Quarry WMP (Umwelt, 2016, Umwelt 2017 and Umwelt 2018) has been submitted to DPE who have provided comment on the draft plan. These DPE comments will be addressed and a revised WMP will be submitted to DPE during Qtr 2 2019. The approved version of the WMP is dated 2011, refer to **Section 6.0**.

The SWMP provides details on:

- Baseline water quality data;
- Surface water impact criteria;
- Monitoring surface water flow and quality;
- Surface water impact trigger levels and management actions; and
- Erosion and sediment controls implemented onsite.

Surface water management infrastructure at the Quarry was constructed during the initial construction and operational phase of the Quarry. The water management system includes a series of clean water diversion drains, catch drains and sedimentation dams. These structures have been constructed to minimise the interaction between clean and dirty water and to provide controls to treat captured dirty water to a standard acceptable for discharge off-site.

6.4.2 Performance criteria

6.4.2.1 Surface Water Monitoring Criteria

As noted in Section 4 of the SMWP (Umwelt, 2011) and consistent with ANZECC Guidelines (ANZECC, 2000), locally appropriate trigger values have been calculated based off the 80th percentile of historical monitoring results collected between 2004 and 2010. Where sufficient baseline data has not been collected (i.e. less than two years of contiguous data), the default trigger values for lowland rivers in NSW have been selected.

Trigger values have been selected for surface water monitoring locations downstream of the site (i.e. SW5 and SW6). Temporary trigger levels for surface water monitoring locations SW8 - SW11 have been adopted as a management measure whilst the WMP (2017-2018) is finalised. Trigger levels as shown in **Table 6.7** below for SW8 – SW11 are those as contained in the Draft WMP submitted to DPE by Holcim in 2018, as there were no trigger levels for SW8 – SW11 in the 2011 WMP.

Trigger values are not listed for SW3 and SW4 as these sites are upstream of site impacts. It is noted that during the report period, there were no discharges from the Lynwood Quarry water management system.

Table 6.7 Surface Water Criteria

Parameter	Unit of Measure	Trigger Value			
		SW5	SW6	SW8-SW11* (Granite Pit)	Site Water Management Dams (various)
Source	N/A	Table 2.1 WMP (2011)	Table 2.1 WMP (2011)	Indicative trigger level values provided from Draft WMP (2018)	Development Consent / EPL
pH	pH	5.8 (min)[2] 6.8 (max)	6.2 (min)[2] 7.2 (max)	6.5 (min) 7.55 (max)	6.5 (min)[1] 8.5 (max)[1]
Electrical Conductivity (EC)	µS/cm	732	1,197	2,200	2,200
Oil and Grease[1]	mg/L	10 or none visible	10 or none visible	10 or none visible	10 or none visible
Total Suspended Solids[1]	mg/L	50	50	50	50
Total Nitrogen	mg/L	2	1	2.1	2.1
Total Phosphorus	mg/L	0.17	0.06	0.21	0.21

[1]As specified within Schedule 3 Condition 17 of the Development Consent

[2] As specified in Table 2.1 of WMP (2011)

*Indicative trigger level values provided from Draft WMP (2018)

6.4.3 Environmental outcomes

As noted in **Section 6.4.1** above, there were no discharges from Lynwood Quarry during the report period.

Surface Water Monitoring Program

Lynwood conducts surface water monitoring across the site on a monthly basis at monitoring locations consistent with those shown in **Figure 6.1**. Surface water monitoring records captured during the report period are provided in **Appendix 1B**. Surface water monitoring is undertaken when an appropriate volume of water is available to enable a representative sample to be obtained. During the report period , SW 8 – 11 were dry or water volume was too low to obtain a representative sample and as such these locations were not sampled. Limited discussion regarding SW 8 – 11 is included below, with monitoring results obtained during the report period included in **Appendix 1B**.

SW5

Monitoring was undertaken on 11 occasions during the report period, no monitoring occurred during July 2018. Low flow conditions were observed during July 2018 however no sample was undertaken. SW5 was dry during 3 monitoring events and no flow was observed on 2 occasions. There were 6 samples collected during low flow conditions. A summary of SW5 monitoring results is provided in **Table 6.8**. In regard to **Table 6.8** results identified in bold are above trigger levels and there was no sampling undertaken in July 2018.

Table 6.8 SW5 Summary of Results

Date	pH	EC (us/cm)	TSS (mg/L)	N (mg/L)	P (mg/L)	Oil & Grease (mg/L)	Flow
19-Jan-18	ND	ND	ND	ND	ND	ND	No flow
14-Feb-18	ND	ND	ND	ND	ND	ND	No flow
15-Mar-18	**7.54**	707	5	1.33	0.05	<1	Low
20-Apr-18	**6.98**	**818**	**95**	**4.34**	**0.51**	<1	Low
18-May-18	**7.63**	**871**	3	1.4	0.03	<1	Low
14-Jun-18	**7.66**	**846**	3	1.36	0.03	<1	Low
16-Jul-18	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	Low
13-Aug-18	**7.73**	**1110**	13	1.74	0.07	<1	Low
17-Sep-18	ND	ND	ND	ND	ND	ND	Dry
23-Oct-18	ND	ND	ND	ND	ND	ND	Dry
15-Nov-18	ND	ND	ND	ND	ND	ND	Dry
17-Dec-18	**7.05**	**892**	13	**3.18**	0.03	**NS**	Low
Trigger Level	5.8 to 6.8	732	50	2	0.17	10 or none visible	N/A

Six pH and five EC results were noted above the site specific trigger level during the report period however the results remained within range of the ANZECC Guidelines Lowland Rivers parameters and remained within general range of results recorded during the previous report period.

Two nitrogen, one elevated phosphorous and one elevated TSS result were also recorded during the report period. Measurements of Nitrogen, TSS and Phosporous recorded during April 2018 were higher than the historical maximum however the results for the following May 2018 sample reduced to levels consistent with ranges recorded during the remainder of the report period. All results for oil and grease were below the limit of detection. The elevated results recorded during the report period are believed to be attributable to dry conditions in the locality and it is noted that Lynwood Quarry did not discharge water from the water management system during the report period. The pH and EC triggers for SW5 will be reviewed as part of the revision to the Lynwood Quarry WMP during Qtr 2 2019.

SW6

Monitoring was undertaken on 11 occasions during the report period, no monitoring occurred in December 2018. Low flow conditions were observed during December 2018 but no sample was undertaken. 11 samples were collected during low flow conditions during the report period. A summary of SW6 monitoring results is provided in **Table 6.9**. Results identified in bold are above trigger levels and there was no sampling undertaken in December 2018.

Table 6.9 SW6 Summary of Results

Date	pH	EC (us/cm)	TSS (mg/L)	N (mg/L)	P (mg/L)	Oil & Grease (mg/L)	Flow
19-Jan-18	**7.38**	1060	4	0.94	0.02	<1	Low
14-Feb-18	**7.60**	**1200**	5	0.88	0.02	<1	Low
15-Mar-18	**7.35**	637	5	0.94	0.04	<1	Low
20-Apr-18	**7.34**	1030	4	0.71	0.02	<1	Low
18-May-18	**7.78**	1060	<2	0.72	0.01	<1	Low
14-Jun-18	**7.86**	1020	4	0.7	0.01	<1	Low

Date	pH	EC (us/cm)	TSS (mg/L)	N (mg/L)	P (mg/L)	Oil & Grease (mg/L)	Flow
16-Jul-18	**8.00**	1020	<2	0.68	0.01	<1	Low
13-Aug-18	**7.90**	987	<2	0.55	0.02	<1	Low
17-Sep-18	**7.83**	1040	<2	0.7	0.01	<1	Low
23-Oct-18	6.82	1100	6	0.79	0.03	<1	Low
15-Nov-18	**7.66**	**1230**	7	0.8	0.03	<1	Low
17-Dec-18	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	Low
Trigger Level	6.2 to 7.2	1197	50	1	0.06	10 or none visible	N/A

10 pH and two EC results were noted above the site specific trigger level during the report period however, results remained within the range of the ANZECC Guidelines Lowland Rivers parameters of 6.5 – 8.5. The pH triggers for SW6 will be reviewed as part of the revision to the Lynwood Quarry WMP during Qtr 2 2019.

Elevated Total Nitrogen and Phosphorous results were recorded during the report period, however all results remained within historical range of monitoring results. All TSS results remained below trigger levels and within historical range and oil and grease results were below the limit of detection during the report period. Surface water monitoring results recorded at SW6 during the report period were generally consistent with results recorded during the 2017 report period.

SW8

Monitoring was undertaken on 11 occasions during the report period, no monitoring occurred in December 2018. Dry conditions were observed during December 2018 resulting in no sample being collected. Of the 11 monitoring events, SW8 was dry during 10 events and no flow was occurring on one occasion during the report period. As a result, no SW8 samples were collected during the report period. Surface water monitoring did not occur at SW8 during December 2018.

SW9

Monitoring was undertaken on 11 occasions during the report period, no monitoring occurred in December 2018. Dry conditions were observed during December 2018 resulting in no sample being collected. Of the 11 monitoring events, SW9 was dry during 10 events and no flow was occurring on one occasion during the report period. As a result no SW9 samples were collected during the report period. Surface water monitoring did not occur at SW9 during December 2018.

SW10

Monitoring was undertaken on 10 occasions during the report period, no monitoring occurred in July and December 2018. Dry conditions were observed during July and December 2018 resulting in no sample being collected. Of the 10 monitoring events, SW10 was dry during 9 events and no flow was occurring on one occasion during the report period. As a result no SW10 samples were collected during the report period. Surface water monitoring did not occur at SW10 during July and December 2018.

SW11

Monitoring was undertaken on 10 occasions during the report period, no monitoring occurred in July and December 2018. Dry conditions were observed during July and December 2018 resulting in no sample being collected. Of the 10 monitoring events, SW11 was dry during 9 events and no flow was occurring on one occasion during the report period. As a result, no SW11 samples were collected during the report period. Surface water monitoring did not occur at SW11 during July and December 2018.

6.4.4 Trends in data

During the report period, a range of the surface water monitoring locations had limited surface water sampling undertaken as the locations did not have an appropriate volume of water available to enable a representative sample to be obtained due to the low rainfall recorded during the report period. This resulted in surface water sample results not being obtained for locations SW8, SW9, SW10 and SW11 during the report period. Sample results obtained for SW5 and SW6 were generally consistent with the results obtained for the 2017 report period.

6.4.5 Proposed improvements

Holcim will continue to liaise with DPE and relevant regulatory agencies to finalise the revised WMP during Qtr 2 2019. As part of the finalisation of the WMP, Holcim will refine trigger levels and reporting, notification and investigation requirements associated with elevated results obtained during surface water sampling.

6.5 Groundwater

6.5.1 Environmental management measures

Lynwood has developed and implemented a Groundwater Monitoring Program (GMP) (Umwelt, 2011) in accordance with the requirements of the Development Consent. The GMP provides details on:

- Baseline water quality;
- Groundwater Impact Criteria;
- Monitoring regional groundwater level and quality; and
- Groundwater impact trigger levels and management actions.

The groundwater water management system includes a series of piezometers and groundwater monitoring bores. The location of groundwater monitoring network is provided in **Figure 6.1.**

6.5.2 Performance criteria

6.5.2.1 Groundwater Inflow and Level Monitoring

As noted in Section 3.0 of the GMP (Umwelt, 2011), groundwater level monitoring will be reviewed against long term monitoring trends and further compared against drawdowns predicted within the Lynwood Quarry EIS (Umwelt, 2005) and Modification Project EA (Umwelt, 2015).

6.5.2.2 Groundwater Quality Monitoring Criteria

As noted in Section 3.0 of the GMP (Umwelt, 2011), where sufficient baseline data has been collected, locally appropriate trigger values have been calculated as the 10^{th} or 90^{th} percentile of the background values in accordance with the ANZECC Guidelines (ANZECC, 2000) and are provided in **Table 6.10**. Monitoring bores, MP 1, 2, 4, 5, 7, 10 and 11 utilise locally appropriate trigger levels developed based on background water quality monitoring. No MP series monitoring bores were mined out during the report period.

Table 6.10 Groundwater Monitoring Criteria for MP Series Bores (WMP, Umwelt 2011)

Parameter	Unit of Measure	10th Percentile	90th Percentile
Electrical Conductivity			
EC	µS/cm	-	10,488
pH			
pH	pH	6.1	7.3
Nutrients			
Sulphate	mg/L	-	49.7
Nitrate	mg/L	-	0.2
Phosphate	mg/L	-	0.2
Total Petroleum Hydrocarbons			
C6-9	µg/L	-	25
C10-14	µg/L	-	52.5
C15-28	µg/L	-	300
C29-36	µg/L	-	100
Benzene	µg/L	-	1
Toluene	µg/L	-	1
Ethyl Benzene	µg/L	-	1
Xylene	µg/L	-	2

Where sufficient baseline data has not been collected (i.e. less than two years of contiguous data), the default trigger values for lowland rivers in NSW have been temporarily selected (ANZECC, 2000).

No GPZ series monitoring bores were removed during the 2018 report period. GPZ series bores have not collected 2 years of contiguous monitoring data, as a result temporary trigger levels based on ANZECC criteria are provided in **Table 6.11**. The criteria as detailed in **Table 6.11** are consistent with criteria included in the Draft Lynwood Quarry (Umwelt, 2018) Water Management Plan as submitted to DPE.

Table 6.11 Groundwater Monitoring Criteria for GPZ Series Bores (Umwelt, 2018)

Parameter	Unit of Measure	Minimum	Maximum
Electrical Conductivity			
EC	µS/cm	-	2,200
pH			
pH	pH	6.5	8.0
Nutrients			
Sulphate	mg/L	-	NA*
Nitrate	mg/L	-	0.7
Phosphate	mg/L	-	0.05
Total Petroleum Hydrocarbons			
C6-9	µg/L	-	NA**

Parameter	Unit of Measure	Minimum	Maximum
C10-14	µg/L	-	NA**
C15-28	µg/L	-	NA**
C29-36	µg/L	-	NA**
Benzene	µg/L	-	950
Toluene	µg/L	-	NA*
Ethyl Benzene	µg/L	-	NA*
Xylene	µg/L	-	NA*

NA* Insufficient data to derive a reliable trigger value

NA** Parameter not considered in ANZECC Guideline (2000)

6.5.3 Environmental trends and outcomes

Lynwood conducts groundwater monitoring via a network of monitoring bores across site on a quarterly basis. Groundwater monitoring results are provided in full within **Appendix 1**.

6.5.3.1 Depth to groundwater

Groundwater levels at MP series bores fluctuated between 0.2-1.3 m during the report period and generally remained within historical range. Groundwater levels at GPZ series bores fluctuated between 0.2-1.2 m during the report period. Results were generally within range of results recorded in the 2017 report period.

6.5.3.2 pH

All pH monitoring results recorded at MP series bores were within investigation trigger level ranges and frequencies during the report period except for MP2, which recorded 4 consecutive measurements below pH criteria list in **Table 6.10**. pH results for MP2 ranged from 5.1 – 5.7. Lynwood will investigate these results as part of the revision of the WMP review to be submitted to DPE by end Qtr 2 2019.

All pH monitoring results recorded at GPZ series bores were within investigation trigger level ranges identified in **Table 6.11** and remained within general range of results recorded during the previous report period.

6.5.3.3 Electrical Conductivity

All EC monitoring results recorded at MP series bores were within investigation trigger level ranges and frequencies during the report period and are within the historical range. The MP7 Qtr 4 2018 result of 681-730 µS/cm will be reviewed against the Qtr 1 2019 result when it is received to determine whether the result reverts back to the range recorded during the report period.

EC monitoring results recorded at GPZ series monitoring bores fluctuated between 681-8020 µS/cm during the report period. Results within each bore were relatively consistent with the exception of the 8020 µS/cm result recorded at GPZ07 during Qtr 4 2018. The Qtr 1 2019 result will be reviewed to determine whether the Qtr 4 2018 groundwater result was an anomaly. As noted in **Section 6.5.2,** baseline monitoring is currently being undertaken at GPZ series monitoring bores to enable the development of site specific trigger levels.

6.5.3.4 Nutrients

Sulfate

All sulfate monitoring results recorded at MP series bores were within investigation trigger level ranges and frequencies during the report period. One elevated sulfate measurement was recorded at MP7 during the report period however no trend was identified and results returned to below the trigger level during the next monitoring round.

Sulfate monitoring results recorded at GPZ series bores ranged from non-detectable to 27.6 mg/L. As noted in **Table 6.11,** there are no ANZECC criteria applicable to sulfate.

Nitrate

All nitrate monitoring results recorded at MP series bores were within investigation trigger level ranges and within historical ranges during the report period. One elevated nitrate measurement was recorded at MP7 during the report period however this was within the ANZECC guidelines criteria and returned to below the trigger level during the next monitoring round.

All nitrate monitoring results recorded at GPZ series bores were within investigation trigger level ranges and frequencies during the report period except for GPZ 4 and 6, which both recorded 4 consecutive measurements above ANZECC Guidelines criteria trigger levels. Trigger levels based on groundwater monitoring data obtained from GPZ monitoring bores will be included in the revised WMP to be submitted to DPE during Qtr 2 2018.

Phosphate

All phosphate monitoring results recorded at MP series bores were below detectable limits during the report period.

All phosphate monitoring results recorded at GPZ series bores were within investigation trigger level ranges and frequencies during the report period except for GPZ 1, which recorded 4 consecutive measurements above ANZECC guidelines criteria trigger levels with results of 0.7 mg/L -0.8 mg/L recorded at the location. Trigger levels based on groundwater monitoring data obtained from GPZ monitoring bores will be included in the revised WMP to be submitted to DPE during Qtr 2 2019.

Total Petroleum Hydrocarbons

All Total Petroleum Hydrocarbon monitoring results recorded at MP series bores were below detectable limits during the report period.

All Total Petroleum Hydrocarbon results recorded at GPZ series monitoring bores during the report period were within the historical range of monitoring results shown in Table 2.7 of the GMP (Umwelt, 2018). Trigger levels based on groundwater monitoring data obtained from GPZ monitoring bores will be included in the revised WMP to be submitted to DPE during Qtr 2 2019.

6.5.4 Proposed improvements

As noted in **Section 6.4.5**, Lynwood will continue to liaise with DPE and relevant regulatory agencies to finalise the revised WMP during Qtr 2 of the 2019 report period. As part of the finalisation of the WMP, Lynwood will refine trigger levels to be implemented for Lynwood Quarry for surface water and groundwater monitoring undertaken at the site.

6.6 Noise

6.6.1 Environmental management measures

A Noise Monitoring Program (NMP) (Umwelt, 2016) has been prepared in accordance with the requirements of the Development Consent which describes measures for monitoring and managing noise emissions at Lynwood. Management measures undertaken onsite to ensure compliance against the requirements of the Development Consent include a range of design controls, ongoing operational controls and a program of compliance monitoring.

6.6.2 Performance criteria

Noise impact assessment criteria for monitoring are specified in the Development Consent are outlined in **Table 6.12** below.

Table 6.12 Noise criteria

Location	Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)	
	dBA, $LA_{eq(15min)}$	dBA, $LA_{eq(15min)}$	dBA, $LA_{eq(15min)}$	dBA, $LA1_{(1min)}$
1	35	35	35	45
2	35	35	35	45
3	35	35	35	45
4	35	37	35	46
5	35	35	35	46
6	35	37	36	46
7	38	38	35	55
8	39	38	36	55
9	39	39	37	56
10	42	42	40	53
11	35	35	35	47
12	37	37	36	47
13	40	38	37	47
14	35	35	35	47
15	35	35	35	47
16	35	35	35	45

6.6.3 Environmental outcomes

Attended noise monitoring was conducted on a quarterly basis during the report period. Attended noise monitoring was conducted by Muller Acoustic Consulting (2018a-d) at four representative monitoring locations surrounding the site during quarrying activities. Noise monitoring locations are generally considered representative of the nearest private receivers in various directions of the operational area. In accordance with the Lynwood NMP (Umwelt, 2016), each assessment included measurements on two separate days.

Noise monitoring was undertaken during March, June, September and December at the locations shown in **Figure 6.1** and listed in **Table 6.13**. As noted in the Lynwood Quarry NMP (Umwelt, 2016), monitoring at these locations are considered representative of all locations assessed as part of the Noise Impact Assessment (Umwelt, 2015).

Quarterly monitoring identified that noise emissions generated by Lynwood Quarry were audible during most measurements, however all results remained below relevant noise criteria at all assessed residential receivers. There were no exceedances of the impact assessment criteria detected during quarterly monitoring conducted during the report period as shown in **Table 6.14**.

Table 6.13 Noise Monitoring locations

Location	NMP ID	Address
N1	L1	South Eastern Boundary of 1114 Carrick Road, Marulan
N2	L6	End of Maclura Drive, Marulan
N3	L11	Northern Boundary, 16038 Hume Highway, Marulan
N4	L12	Corner of Dorset and Suffolk Road, Marulan

Table 6.14 Day Time Noise Monitoring Summary

Location	Criteria	Q1	Q2	Q3	Q4	Compliant
Day 1 dBA, $LA_{eq(15min)}$						
N1	35	<35	29	<33	32	Yes
N2	35	IA	35	<28	<30	Yes
N3	35	<34	33	33	34	Yes
N4	37	IA	36	33	<30	Yes
Day 2 dBA, $LA_{eq(15min)}$						
N1	35	<34	Nil*	<32	35	Yes
N2	35	IA	34	<25	<30	Yes
N3	35	IA	31	<35	<30	Yes
N4	37	IA	35	<35	<30	Yes

IA : Quarry activities inaudible during monitoring

* Lynwood Quarry contribution as assessed by Muller Acoustic Consulting (Muller Consulting, 2018b)

6.6.4 Trends in data

Monitoring results recorded during the report period indicates noise levels continue to trend below noise impact assessment criteria as stipulated within Development Consent. There have been no noise exceedances against the noise impact assessment criteria since the 2016 report period. The raw noise monitoring results are included in **Appendix 1**.

6.6.5 Proposed improvements

No additional management or mitigation measures are proposed to be implemented which are outside of the existing approved NMP.

6.7 Biodiversity

6.7.1 Environmental management measures

Lynwood takes a multifaceted approach to managing biodiversity values within the broader landscape with biodiversity and rehabilitation management controls detailed in the Lynwood Quarry Rehabilitation and Landscape Management Plan (RLMP) (Umwelt, 2018). Areas managed in accordance with the RLMP include habitat management areas, riparian zones and wildlife corridors. Pre-clearance inspections are undertaken to identify the presence of habitat features such as tree hollows or stags and fauna within the disturbance area that are able to be relocated. Pre-clearance surveys also identify if nest boxes are required to the installed following the removal of habitat features within the disturbance boundary.

6.7.2 Performance criteria

As noted in **Section 5.0** and in accordance with Schedule 3 Condition 48A of the Development Consent, Lynwood must retire Biodiversity Credits to the satisfaction of the Secretary and OEH. A summary of Biodiversity Credits required to be retired by Lynwood is summarised in **Table 6.15** below. It is noted that the current status of credits which have been retired are detailed in **Table 6.16**.

Table 6.15 Summary of Biodiversity Credits to be retired

Credit Type	Credits to be Retired
Ecosystem Credits	
HN614 *Yellow Box – Blakey's Red Gum grassy woodland on the tablelands. South Eastern Highland Bioregion*	2,124
HN570 *Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands. South Eastern Highlands Bioregion*	881
HN515 Broad-leaved Peppermint – Ribbon Gum grassy open forest in the north-east of the South Eastern Highlands Bioregion	33
Total	**3,038**
Species Credits	
Squirrel Glider (*Petaurus norfolcensis*)	1,725
Total	**1,725**

6.7.3 Environmental outcomes

Lynwood cleared approximately 26 ha as part of operations for the granite pit extension area. As noted within **Table 6.16** below, Lynwood retired a total of 3,669 Biodiversity Credits during the report period. A summary of the credits retired in 2018 and the number of credits required to be retired into the future (credit balance) is detailed in **Table 6.16**.

No nest boxes were noted as being disturbed by operations during the report period. Nest box monitoring was not undertaken during the report period however next box monitoring will be undertaken during 2019.

Table 6.16 Summary of Retired Biodiversity Credits

Credit Type	Credits Retired (2018)	Stage of Retirement	Credit Balance
HN614 *Yellow Box – Blakey's Red Gum grassy woodland on the tablelands. South Eastern Highland Bioregion*	1,063	Partially retired – credits retired for years 2016 – 2030 (inclusive)	1,061
HN570 *Red Stringybark – Brittle Gum – Inland Scribbly Gum dry open forest of the tablelands. South Eastern Highlands Bioregion*	881	Complete	0
HN515 Broad-leaved Peppermint – Ribbon Gum grassy open forest in the north-east of the South Eastern Highlands Bioregion	0	Not required – Area not be disturbed until 2036.	33
Squirrel Glider (*Petaurus norfolcensis*)	1,725	Complete	0

6.7.4 Trends in data

During the 2019 report period, next box monitoring will be undertaken with feral animal control also being undertaken as required. The management measures as detailed within the RLMP will also continue to be implemented for ongoing operations including the management requirements related to any clearing required to be undertaken on site.

6.7.5 Proposed improvements or Actions Next Reporting period

No additional management, mitigation measures or monitoring is proposed to be implemented outside of the scope of the approved RLMP.

6.8 Weeds and feral animals

6.8.1 Weeds

The dominant weed species that have been found previously within the site include Fireweed (*Chamerion angustifolium*), *Optunia sp*., Serrated tussock (*Nassella trichotoma*), Blackberry (*Rubus fruticosus*) and St John's Wort (*Hypercium perforate*). Weed management is conducted in accordance with the Rehabilitation and Landscape Management Plan (Umwelt, 2018).

Lynwood undertook weed inspections during the report period. Weed management activities primarily targeted the eradication of Serrated Tussock and Blackberry weed populations within the approval boundary during the report period. No additional management or mitigation measures are proposed to be implemented which are outside the scope of the existing approved RLMP during the next report period. A five (5) year plan for controlling weeds across the site will be developed & implementation commenced in 2019.

6.8.2 Feral animals

Lynwood noted a significant increase in reported kangaroo and vehicle strikes, increasing from three to 22 reported strikes from the previous report period. Lynwood engaged a contractor to undertake a cull across the approval area on multiple occasions during the report period.

No other feral animal management activities were undertaken during the report period.

Kangaroo culling may continue in future report periods should it be needed. No additional management or mitigation measures are proposed to be implemented which are outside the scope of the existing approved RLMP during the next report period.

6.9 Blasting and Vibration

6.9.1 Environmental management measures

A Blast Management Plan (BMP) (Umwelt, 2016) has been prepared in accordance with the Development Consent. The BMP sets out the criteria, monitoring frequencies and management measures for blasting during quarrying operations. Blast monitoring is undertaken at six monitoring locations (refer to **Figure 6.1**). Blasting operations within the Ignimbrite pit ceased during March 2018. No blasting activities occurred within the Ignimbrite pit following this time.

6.9.2 Performance criteria

Blasting performance criteria is set out in the EPL and Development Consent as outlined in **Table 6.17**

Table 6.17 Blast Criteria Summary

Airblast Overpressure Criteria		
Location	**Level (dB)**	**Allowable Exceedance**
Residence on Privately owned land	115	5% of the total number of blasts over a period of 12 months
	120	0%
Ground Vibration Impact Assessment Criteria		
Location	**Peak Particle Velocity (mm/s)**	**Allowable Exceedance**
Residence on Privately owned land	5	5% of the total number of blasts over a period of 12 months
	10	0%
Main Southern Railway Line	25	0%
Reservoir*		Not applicable
Gas Pipeline	100	0%

* Reservoir is not constructed. Blast monitoring not undertaken at this location.

6.9.3 Environmental outcomes

A summary of blast monitoring performance during the report period is provided in **Table 6.18**. Blast monitoring data is provided in **Appendix 1**. All blasts during the report period were undertaken between 9 am – 5 pm Monday – Saturday. No blasts were undertaken on Sundays or Public Holidays. Results from blast monitors during the report period did not exceed the blast criteria in **Table 6.17**.

Table 6.18 Blast Monitoring Summary

Parameter Summary	Number of Blasts	Percentage of Blast (%)
Total Number of Blasts	115	N/A
Blasts in Ignimbrite Pit	7	6%

Parameter Summary	Number of Blasts	Percentage of Blast (%)
Blasts in Granite Pit	108	94%
Blasts exceeding allowable overpressure criteria	0	0%
Blasts exceeding allowable ground vibration criteria	0	0%
Blast Capture Rate	115 (i.e. 100% capture rate)	100%

6.9.4 Trends in data

Blasting results continued to trend below compliance limits during the report period. As noted above, Lynwood ceased operations within the Ignimbrite Pit during the report period. No blasting activities occurred within the Ignimbrite Pit after 15 March 2018 and as such, blast monitoring was not required to be undertaken at monitoring locations B1, B2 and B3 after 15 March 2018.

6.9.5 Proposed improvements during Report Period

No additional blast management improvements are proposed outside the current approved BMP during the next report period.

6.10 Waste management

There were no changes to waste management practices during the report period. Waste streams at Lynwood Quarry are collected and disposed of by licenced waste contractors on an as needed basis. A summary of the types and quantities of waste generated during the report period is provided in **Table 6.19**.

Table 6.19 Waste generated in the report period

Waste	Quantity
Cardboard (t)	47
General Waste (t)	201.1
Steel (t)	106.96
Rubber (t)	14.24
Wood (t)	3.24
Oily Water (t)	5.36
Used Oil (L)	42,760
Oil Filter (number of bins)	24
Rags (number of bins)	1
Grease (L)	4

6.11 Indigenous heritage

An Aboriginal Heritage Management Plan (AHMP) (Umwelt 2011) has been prepared in accordance with the Development Consent. Lynwood Quarry also holds an Aboriginal Heritage Impact Permit (AHIP #1100264) for Quarry operation. The AHMP and AHIP set out relevant monitoring frequencies and

management measures required during quarrying operations. Results of Aboriginal Heritage monitoring undertaken are discussed in the sections below.

6.11.1 Results of Aboriginal Heritage Site Monitoring

In compliance with the requirements of the Development Consent, the Lynwood Quarry AHMP (Umwelt 2011) and AHIP (#1100264) (including relevant permit variations), Lynwood Quarry is required to undertake monitoring of Aboriginal sites located in proximity to the impact footprint boundary within the Ignimbrite Pit and Granite Pit areas. On a triennial basis, Holcim is required to monitor all of the Aboriginal sites within the broader Lynwood Quarry project area.

As the monitoring process is undertaken in either November or December each year and reported to the Office of Environment and Heritage (OEH) in the following year, the annual site monitoring process reported in this Annual Review relates to the results of the monitoring undertaken in December 2017 (Umwelt 2018a). Results of 2018 monitoring undertaken will be reported in the 2019 Annual Review.

The December 2017 annual site monitoring within the Lynwood Quarry project area found most sites were being managed in accordance with the relevant requirements. Vegetation was increasing in the majority of the sites and erosion had generally decreased or stabilised. Overall the majority of the sites had continued to improve with the removal of stock being the major contributor. While no Aboriginal sites had been adversely impacted by quarry activities a number of management recommendations were identified during the December 2017 site monitoring. These recommendations are set out below.

1. Install fencing, provide appropriate signage and install a name sign at sites LA33, LKIF1, LKAS5, LKAS6, LKST1 and MRN PAD6 fence the site areas.
2. Renew site name pegs in sites MRN3, MRN15, MRN34, MN69, MRN74, MRN76, MRN82 and MRN PAD1, MRN PAD2, MRN PAD3 and MRN PAD 4.
3. Repair fencing at site MRN3 and maintain stock is exclusion.
4. Repair fencing damaged by tree fall in MRN34 and by flood near MRN69.
5. Lock the gate currently allowing access from Stoney Creek Road into the CHMZ in the area of MRN69.
6. In a manner consistent with the AHMP remove blackberry from sites MRN3, MN69, MRN82 and MRN PAD1 and manage serrated tussock in sites LA33, LKAS5 and LKAS6.
7. Implement the following at MRN74:
    a. band the tree trunk above and below the scar
    b. treat the trunk and scar for white ants
    c. erect a roofed enclosure over the remaining scarred section of the tree
    d. to ensure visitor safety consider installing a pathway that will provide an even ground surface within the fenced enclosure.
8. Remove dead fall and leaf litter from around the MRN76 scarred tree site which has been identified as a bush fire hazard.

Lynwood Quarry will complete the above recommended actions. Progress against these recommendations will be reported in the 2019 Annual Review.

6.11.2 Meetings of the Aboriginal Heritage Management Committee

The Aboriginal Heritage Management Committee's (AHMC's) ongoing role is to provide guidance and contribute to indigenous related activities and initiatives at Lynwood Quarry as well as review the implementation of the AHMP. Holcim undertook one meeting with its AHMC on 26 November 2018. Present at the meeting were representatives of Gundungurra Aboriginal Heritage Association Inc., Gundungurra Tribal Council Aboriginal Corporation and Pejar Local Aboriginal Land Council.

Holcim is required to meet with its AHMC on a six monthly basis and therefore the next meeting will be undertaken during May 2019.

6.11.3 Keeping Place Contract Development

A meeting was held with the AHMC on 26 November 2018 to discuss the process for the construction and operation of the Keeping Place. At this time a draft process was agreed and discussions with the AHMC are still ongoing. Progress towards finalisation of the agreed process for the Keeping Place construction and management will occur in 2019.

6.11.4 Revisions to the Aboriginal Heritage Management Plan

In accordance with the conditions of MOD 4, Holcim was required to revise its AHMP to include management requirements for Aboriginal sites and potential archaeological deposits within the Granite Pit area. The revised AHMP (Umwelt 2018b) was prepared in 2017 and provided to the registered Aboriginal parties for their review in early 2018. Following registered Aboriginal party review the AHMP was finalised and provided to DPE in July 2018.

6.12 Non-indigenous heritage

No additional European Heritage management actions were undertaken during the 2018 report period. The Old Marulan European heritage report was reviewed during the 2017 report period. All actions arising from this review were completed during the 2017 report period.

6.13 Bushfire Management

Bushfire hazards are managed in accordance with the approved Rehabilitation and Landscape Management Plan (RLMP) (Umwelt, 2018). Measures and safeguards included in the RLMP to minimise bushfire risk at Lynwood Quarry include:

- Fire breaks in the form of access and haul roads, rail lines, electricity easements, quarry pits and out-of-pit emplacement areas;
- Fuel reduction activities, as required, in consultation with the local Rural Fire Service;
- Selective grazing to assist with management of fuel loads;
- Asset protection zones in the form of hardstand areas, lawn and bare earth around the quarry's permanent infrastructure;
- A range of onsite fire fighting equipment including two water carts, fire hydrants and hose reels, to be used as required, and extinguishers located on infrastructure, mobile equipment and light vehicles;
- Availability of water through the site water management system; and
- Emergency preparedness training for all quarry personnel.

There were no bushfire events within the Lynwood Quarry during the report period.

6.14 Public safety

Access to the site by members of the public is via contact at the quarry office where visitors or contractors can only be escorted by site personnel around the site. Warning signs have been placed on extremities of operations to make members of the public are aware of quarrying operations. There were no incidents related to public safety during the report period.

7.0 Water management

7.1 Water management system

A Water Management Plan (WMP) (Umwelt, June 2011) has been prepared in accordance with requirements of the Development Consent. The plan sets out the procedures and management requirements for water management onsite.

Lynwood notes a draft WMP (Umwelt, 2017 and Umwelt 2018) has been prepared and been submitted to DPE. The WMP was submitted to DPE and relevant authorities during the 2017 report period following the approval of Modification 4 of the Development Consent. Comments were received from DPE and relevant agencies during the 2018 report period requesting additional information to be included in the plan. Lynwood expects to finalise the draft WMP during Qtr 2 of the 2019 report period.

As shown in **Figure 6.1** the Lynwood water management system consists of a number of onsite storage dams and diversion drains. Control structures have been constructed to minimise the interaction between clean and dirty water and to provide controls to treat captured dirty water to a standard acceptable for discharge off site. In addition to the storage of external water, storage dams are used to opportunistically capture run-off from the disturbed catchment area along with any groundwater seepage into the quarry pits.

7.2 Water take and discharge

7.2.1.1 External Water Use

Water imported onto site is tracked on an ongoing basis against its licenced allocation. During the report period, Lynwood pumped approximately 76 ML of water from Johnniefields Dam for onsite use, which is approximately 95% of the 80 ML allowable to be sourced in agreement with the landholder. **Table 7.1** provides a summary of water take during the report period.

Table 7.1 2018 Water Take Summary

Water Licence	Water sharing plan, source and management zone (as applicable)	Entitlement	Passive take/ inflows	Active pumping	Total
WAL: 25575 (continuing, unregulated river) 10UA119159 (expires May 2025) Reference: 10AL102708 Other reference numbers: 10WA102709 (lower wollondilly management zone), 10BL164515.	Upper Nepean and Upstream Warragamba Water source.	130 units (ML) of which Holcim have access to 80 ML due to a landholder agreement.	0	76 units (ML)	76 units

7.2.1.2 Licenced Discharges

Lynwood did not undertake any controlled or any uncontrolled discharges from site during the report period.

7.3 Erosion and sedimentation

7.3.1 Environmental management measures

The WMP Erosion and Sediment Control (ESC) Plan provides a framework for the management of erosion and sedimentation at Lynwood. ESC measures are implemented to minimise impact on the surrounding environment. All ESC measures at Lynwood are designed and constructed to the standard consistent with:

- Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom 2004); and
- Managing Urban Stormwater – Soils and Construction, Volume 2E Mines and Quarries (DECC 2008d).

During the expansion and continued development of the Granite Pit in the report period, ESC structures and clean water diversions were constructed and maintained. One additional sediment dam was constructed during the report period. No sediment dams were mined through or decommissioned during the report period.

7.3.2 Proposed Improvements

No additional management or mitigation measures are proposed to be implemented which are outside of the existing approved WMP. During the 2019 report period, Lynwood Quarry will finalise the Water Management Plan which has been reviewed by DPE.

8.0 Rehabilitation

As with all quarry operations, the progression of the quarry pit will be based on market demand and will therefore be subject to change. The progression of the rehabilitation of the site is therefore also subject to market demand. Whilst every opportunity will be taken to rehabilitate areas not required for future operational use, rehabilitation opportunities were limited during the report period as the works undertaken during the report period focussed on continued Quarrying activities.

Rehabilitation of the Granite Pit benches will commence once the resource is exhausted and sufficient areas are available for rehabilitation. Due to the extent of the resource within the Granite Pit, rehabilitation of final benches will commence in approximately 30 years. Backfilling is proposed for the Lynwood Pit resulting in no final void located in this area. Once rehabilitated, these areas will be monitored and managed until self-sustaining. Final rehabilitation areas will achieve the rehabilitation completion criteria specified in the RLMP (Umwelt, 2018).

Ongoing opportunities for rehabilitation will be limited to rehabilitation following haul road construction, the western amenity bund and the southern edge of the overburden emplacement area. Where appropriate, temporary land shaping, seeding and other revegetation works may be undertaken in disturbed areas to minimise the potential for offsite impacts associated with the migration of windblown dust, particularly in regard to stockpiles and stripped soil surfaces not required for operational use. Topsoil stockpiles are temporarily stabilised via seeding to minimise the potential for loss of soil through wind or rainfall erosion.

8.1 Status of Quarrying and rehabilitation

There were limited opportunities for rehabilitation at Lynwood Quarry during 2018. Construction activities associated with the Granite Pit haul road were completed during 2018 with progressive rehabilitation of these road batters to continue to be undertaken during 2019. Construction of the visual amenity bund to the west of the Granit Pit also commenced in late 2018. Sections of the amenity bund are expected to become open for rehabilitation during the 2019 report period. Temporary seeding of topsoil stockpile areas was undertaken opportunistically to establish or enhance ground cover and reduce the potential for loss of soil substrate. This material is planned for use in the rehabilitation of the site following the completion of quarrying operations.

The total active disturbance increased during the report period as operations progressed within the Granite Pit and associated emplacement area. Construction of the Granite Pit haul road was completed during 2018 and construction of the visual amenity bund to the west of the Granit Pit was commenced during the report period. The rehabilitation status for Lynwood Quarry is presented in **Table 8.1**.

Table 8.1 Rehabilitation status

Quarry Area Type	Previous Report period (actual) 2017 (ha)	This Report period (actual) 2018 (ha)	Next Report period (forecast) 2019 (ha)
A. Total quarry footprint (all areas including active disturbance areas and rehabilitation areas)	28	36	45
B. Total active disturbance (areas within the footprint still requiring rehabilitation)	201	208	217

Quarry Area Type	Previous Report period (actual) 2017 (ha)	This Report period (actual) 2018 (ha)	Next Report period (forecast) 2019 (ha)
C. Land being prepared for rehabilitation	0	0	6
D. Land under active rehabilitation	0	0	3
E. Completed rehabilitation (areas that have achieved completion criteria and been signed-off by DRG)	0	0	0

8.2 Post rehabilitation land uses

The proposed final land use aims to emulate the pre-mining environment and will enhance local and regional ecological linkages throughout the pit and surface infrastructure areas and with the adjacent surrounding landscape. The primary objective of site revegetation and regeneration is to create a stable final landform with acceptable post-quarrying land use.

8.3 Rehabilitation activities

Rehabilitation areas will be monitored once established and will be managed until self-sustaining in accordance with the approved RLMP (Umwelt, 2018). Construction of a pre-coat plant was completed in January 2018. No other renovation or removal of buildings and no new rehabilitation areas were established during the 2018 report period. In the long term, rehabilitation areas are to become integrated with adjacent native vegetation communities with this process detailed in the RLMP (Umwelt, 2018) however there is not likely to be rehabilitation of active quarry areas during the 2019 report period. Rehabilitation of the noise bund will be undertaken as areas of the noise bund become available in 2019.

9.0 Community

9.1 Community Engagement

9.1.1 Community Consultative Committee Meetings

Two community consultative committee (CCC) meetings were held in 2018 with meetings on 27 April 2018 and 26 October 2018. During these meetings, information was presented on general quarrying operations, the Granite Pit operations, environmental management, compliance, complaints and community initiatives. The outcomes of the CCC meetings are detailed in the meeting minutes available on the Lynwood Quarry website.

9.1.2 Community Activities

Lynwood Quarry supported numerous community-based activities during the report period. These activities are listed below.

- Holcim Mayor's Charity Golf Day;
- Kite Festival;
- Apple Day;
- Tallong Soccer Day;
- Marulan Church driveway (labour assistance);
- White Ribbon Day;
- Lions Christmas Lights Tour and BBQ;
- Australia Day – Goulburn and Marulan; and
- Marulan Christmas event.

Lynwood Quarry also promotes activities of the Quarry through articles in the local newspaper.

9.1.3 Community Investment Fund

The Community Investment Fund (CIF), dedicated to the Marulan and surrounding communities, is designed to improve the quality of life of the members of our workforce, their families and the community. The CIF has been designed to improve economic, cultural and social development throughout the region. Lynwood Quarry budgets a total of $50,000.00 annually for projects within a 20 km radius of the quarry. **Table 9.1** details the approved CIF funded projects for the report period.

Table 9.1 Approved CIF funded projects in the report period

Project Name	Group/Organisation	Project Brief	Total Approved
Toilet Block for Rural Fire Service (RFS)	Marulan RFS	RFS will have a male and female ablution block for their team	$15,790.00
Sign at Towrang	Towrang Valley Progress Association	Electronic sign for community notices	$11,923.00
Local Schools Co creating a sustainable future	LachLandcare	Education program at Marulan School focused on sustainability	$4,000.00
Bungonia Community Engagement Program	Conservation Volunteers Australia (CVA)	Rehabilitation program in Bungonia National Park	$4,500.00
Marulan Highway Signage	Marulan Chamber of Commerce	Highway sign for Marulan village noting all the businesses	$8,190.00
Promotions for Australia Day Committee	Australia Day Committee	Banners and signs for annual event	$2,612.50
Muulii Murra (beautiful place)	Gundungurra Tribal Council Aboriginal Corporation	Cultural connectivity training at Lynwood and in Marulan	$2,984.00

9.1.4 Cultural Connectivity Training

Lynwood Quarry held a day with Aboriginal elders on site whereby material was collected and taken off site for use in cultural education programs, particularly the cultural connectivity project that received funding as part of the CIF. This is a new initiative that will continue to be implemented in addition to commitments in the Development Consent and the Aboriginal Heritage Management Plan.

9.2 Complaints

In accordance with Condition M5 of the EPL, a community complaints line is operated by Lynwood Quarry during the hours of operation. The complaints line is 1300 657 051 which is also displayed on the Lynwood Quarry website. This contact point provides the community with a mechanism by which to raise any concerns that they have with operations at Lynwood Quarry.

The Lynwood Quarry Environment Management Strategy (EMS) (Umwelt, 2016) details the complaints management and dispute resolution procedures for the site. The Quarry Works Manager is responsible for the implementation of the complaints management process so that complaints are responded to in a timely manner. Investigation findings and corrective actions implemented will be communicated to the complainant as appropriate.

Lynwood Quarry received a total of eight complaints during the report period. Complaints received consisted of:

- Six air quality complaints; and
- Two noise complaints.

Complaints were managed in accordance with the complaints management and dispute resolution procedure detailed in the Lynwood Quarry EMS (Holcim, 2016). Depositional dust and noise monitoring

data was reviewed following the complaints to determine compliance with Development Consent criteria. Lynwood quarry were below criteria for depositional dust and noise at the time the complaints were received.

Lynwood Quarry maintains a complaints register to record complaints received from the community, with the register contained on the Lynwood Quarry website. A summary of complaints received by Lynwood Quarry between 2014 and 2018 is presented in **Table 9.2**.

Table 9.2 Comparison of complaints for Lynwood 2014 - 2018

Complaint type	2014	2015	2016	2017	2018
Noise	0	0	0	1	2
Air quality (dust)	0	1	0	1	6
Blasting	0	2	1	1	0
Traffic	0	0	0	0	0
Water	0	0	0	0	0
Other	3	0	0	0	0
Total	**3**	**2**	**1**	**3**	**8**

10.0 Independent Audit

An Independent Environmental Audit (IEA) was conducted during 2014 in accordance with the Lynwood Quarry Development Consent. The audit timeframe covered the period from 24 April 2012 and 22 October 2014. An action plan was developed as an outcome of the audit findings. In accordance with the Development Consent, an IEA was also commenced in January 2018. As noted in **Section 1.0**, the IEA report has been submitted to DPE as a draft on 8 April 2019. As the 2018 IEA Audit Report has not been approved by DPE, it is not discussed further in this report. The 2018 IEA Report and accompanying action plan will be published on the Holcim website following DPE approval of the report.

11.0 Incidents and non-compliances during the report period

Non-compliances at Lynwood Quarry during the 2018 report period are detailed in **Section 1.0**. The Lynwood Quarry Pollution Incident Management Plan was not activated during the report period. Non-compliances identified during the IEA conducted during 2018, have been addressed through the development of an action plan to submitted to DPE with the draft IEA (refer to **Section 10.0**).

12.0 Activities to be completed in the next report period

Lynwood Quarry proposes to undertake a range of activities during the 2019 report period related to continued quarrying operations and also related to completion of actions required as a result of the 2018 IEA. Actions proposed to be undertaken by Holcim at Lynwood Quarry during 2019 include:

- Implementation of the action identified in the 2018 IEA Action Plan;
- Revision of the Lynwood Quarry WMP to address comments provided on the Draft WMP submitted to DPE in 2018 whilst also including a review of surface water and groundwater trigger levels for the Quarry;
- Revision of the site Rehabilitation Bond in accordance with Development Consent requirements;
- Meeting of Aboriginal Heritage Management Committee's during May 2019;
- Consultation with council regarding construction and occupation certificates required for pre-coat plant constructed in 2018;
- review and revision (if required) of the Lynwood Quarry management plans following the submission of this Annual Review in accordance with Condition 5 of Schedule 5 of the Development Consent;
- Review of power supply utilised for HVAS's located at the Quarry;
- Continued extraction within the Granite Pit; and
- Continue works associated with construction of the visual amenity bund to the west of the Granite Pit.

13.0 References

Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), 2000. Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, The Guidelines.

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Umwelt Pty Limited, 2016. Noise management plan. Prepared for Holcim (Australia) Pty Limited.

Umwelt Pty Limited, 2018. Rehabilitation and Landscape management plan. Prepared for Holcim (Australia) Pty Limited.

Appendix 1A - Environmental Monitoring Tables - PM10 Results

Date	HVAS 1			HVAS 2		
	PM10 Result	Run Hours	Compliant with Run Time	PM10 Result	Run Hours	Compliant with Run Time
1/01/2018	10.6	24	Y	2	24	Y
7/01/2018	22.2	22.7	N	1.3	24	Y
13/01/2018	3.2	23.6	Y	<1	24	Y
19/01/2018	18.1	24	Y	2.1	24	Y
25/01/2018	15.3	23.7	Y	1	24	Y
31/01/2018	8.8	23.3	Y	1.8	24	Y
6/02/2018	11	24	Y	2.5	24	Y
12/02/2018	7.5	24	Y	<1	24	Y
18/02/2018	22.1	23.1	Y	<1	24	Y
24/02/2018	19.4	24	Y	0	<1	N
2/03/2018	8.3	23	Y	4.3	72	N
8/03/2018	8.8	24	Y	5.8	13.9	N
14/03/2018	12.3	21.8	N	0	<1	N
20/03/2018	17.5	23.7	Y	0	<1	N
26/03/2018	9.3	24	Y	10	24	Y
1/04/2018	17.3	23.2	Y	18.2	24	Y
7/04/2018	19.8	22.6	N	0	<1	N
13/04/2018	21.8	21.7	N	30.8	24	Y
19/04/2018	11.7	17	N	12.9	24	Y
25/04/2018	28.7	20	N	29.8	24	Y
1/05/2018	4.1	19.1	N	4.8	24	Y
7/05/2018	9.9	18.2	N	13.4	24	Y
13/05/2018	<1	13.6	N	1.5	24	Y
19/05/2018	2.8	15.1	N	6.4	24	Y
25/05/2018	12.3	15.1	N	10.8	24	Y
31/05/2018	21.9	15.2	N	18.9	24	Y
6/06/2018	5	12.8	N	2	24	Y
12/06/2018	7.4	9.98	N	22	24	Y
18/06/2018	<1	11.9	N	2.8	24	Y
24/06/2018	5.5	13	N	6.2	24	Y
30/06/2018	<1	12.8	N	2.7	24	Y
6/07/2018	31.7	11.1	N	17.3	1	N
12/07/2018	4.3	12.4	N	12.7	24	Y
18/07/2018	31.1	12.4	N	31.4	24	Y
24/07/2018	31.4	13	N	27.1	24	Y
30/07/2018	29.4	13.8	N	19.9	24	Y
5/08/2018	13.6	13.4	N	12.8	24	Y
11/08/2018	22.6	13	N	27.5	24	Y
17/08/2018	4.9	14.1	N	8	24	Y

23/08/2018	9.6	8.2	N	12.7	24	Y
29/08/2018	2.2	15	N	8.1	24	Y
4/09/2018	1.5	11.1	N	4.5	24	Y
10/09/2018	3.3	15.4	N	6.3	24	Y
16/09/2018	3.7	17.6	N	8	24	Y
22/09/2018	14.4	14.9	N	15.1	24	Y
28/09/2018	24.4	17.2	N	37.8	24	Y
4/10/2018	14.9	6.63	N	5.5	24	Y
10/10/2018	10.9	8.17	N	5.9	24	Y
16/10/2018	6.1	14.6	N	9.6	24	Y
22/10/2018	3.4	16.9	N	5.7	24	Y
28/10/2018	8.6	16.7	N	9	24	Y
3/11/2018	12.3	19.2	N	20.7	24	Y
13/11/2018	4.2	18.8	N	<1	24	Y
15/11/2018	0.232	15.9	N	ND	<1	N
21/11/2018	37.3	14.4	N	ND	<1	N
28/11/2018	ND	0	N	ND	<1	N
3/12/2018	12.5	34.6	N	ND	0	N
9/12/2018	34.8	18.4	N	ND	0	N
4/12/2018	ND	0	N	ND	0	N
15/12/2018	57.2	16.8	N	ND	0	N
21/12/2018	5.1	11.4	N	ND	0	N
28/12/2018	19.5	18.3	N	ND	0	N

* ND: No Data available

Appendix 1B - Environmental Monitoring Tables - Surface Water

Note: **ND** - No Data Available (Dry or No Flow)
NS - Location not Sampled
Bold - Result above site based Trigger Level (WMP, 2011)

Surface Water Data
SW5

Date	pH	EC (us/cm)	TSS (mg/L)	N (mg/L)	P (mg/L)	Oil & Grease (mg/L)	Flow
19-Jan-18	ND	ND	ND	ND	ND	ND	No flow
14-Feb-18	ND	ND	ND	ND	ND	ND	No flow
15-Mar-18	**7.54**	707	5	1.33	0.05	<1	Low
20-Apr-18	**6.98**	**818**	**95**	**4.34**	**0.51**	<1	Low
18-May-18	**7.63**	**871**	3	1.4	0.03	<1	Low
14-Jun-18	**7.66**	**846**	3	1.36	0.03	<1	Low
16-Jul-18	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	Low
13-Aug-18	**7.73**	**1110**	13	1.74	0.07	<1	Low
17-Sep-18	ND	ND	ND	ND	ND	ND	Dry
23-Oct-18	ND	ND	ND	ND	ND	ND	Dry
15-Nov-18	ND	ND	ND	ND	ND	ND	Dry
17-Dec-18	**7.05**	**892**	13	**3.18**	0.03	**NS**	Low
Trigger Level	5.8 to 6.8	732	50	2	0.17	10 or none visible	N/A

Surface Water Data
SW6

Date	pH	EC (us/cm)	TSS (mg/L)	N (mg/L)	P (mg/L)	Oil & Grease (mg/L)	Flow
19-Jan-18	**7.38**	1060	4	0.94	0.02	<1	Low
14-Feb-18	**7.60**	**1200**	5	0.88	0.02	<1	Low
15-Mar-18	**7.35**	637	5	0.94	0.04	<1	Low
20-Apr-18	**7.34**	1030	4	0.71	0.02	<1	Low
18-May-18	**7.78**	1060	<2	0.72	0.01	<1	Low
14-Jun-18	**7.86**	1020	4	0.7	0.01	<1	Low
16-Jul-18	**8.00**	1020	<2	0.68	0.01	<1	Low
13-Aug-18	**7.90**	987	<2	0.55	0.02	<1	Low
17-Sep-18	**7.83**	1040	<2	0.7	0.01	<1	Low
23-Oct-18	6.82	1100	6	0.79	0.03	<1	Low
15-Nov-18	**7.66**	**1230**	7	0.8	0.03	<1	Low
17-Dec-18	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	Low
Trigger Level	6.2 to 7.2	1197	50	1	0.06	10 or none visible	N/A

Surface Water Data
SW8

Date	pH	EC (us/cm)	TSS (mg/L)	N (mg/L)	P (mg/L)	Oil & Grease (mg/L)	Flow
19-Jan-18	ND	ND	ND	ND	ND	ND	Dry
14-Feb-18	ND	ND	ND	ND	ND	ND	No flow
15-Mar-18	ND	ND	ND	ND	ND	ND	Dry
20-Apr-18	ND	ND	ND	ND	ND	ND	Dry
18-May-18	ND	ND	ND	ND	ND	ND	Dry
14-Jun-18	ND	ND	ND	ND	ND	ND	Dry
16-Jul-18	ND	ND	ND	ND	ND	ND	Dry
13-Aug-18	ND	ND	ND	ND	ND	ND	Dry
17-Sep-18	ND	ND	ND	ND	ND	ND	Dry
24-Oct-18	ND	ND	ND	ND	ND	ND	Dry
15-Nov-18	ND	ND	ND	ND	ND	ND	Dry
17-Dec-18	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	Dry
Trigger Level	6.5 to 7.5	2200	50	2.1	0.21	10 or none visible	N/A

Surface Water Data
SW9

Date	pH	EC (us/cm)	TSS (mg/L)	N (mg/L)	P (mg/L)	Oil & Grease (mg/L)	Flow
19-Jan-18	ND	ND	ND	ND	ND	ND	Dry
14-Feb-18	ND	ND	ND	ND	ND	ND	No flow
15-Mar-18	ND	ND	ND	ND	ND	ND	Dry
20-Apr-18	ND	ND	ND	ND	ND	ND	Dry
18-May-18	ND	ND	ND	ND	ND	ND	Dry
14-Jun-18	ND	ND	ND	ND	ND	ND	Dry
16-Jul-18	ND	ND	ND	ND	ND	ND	Dry
13-Aug-18	ND	ND	ND	ND	ND	ND	Dry
17-Sep-18	ND	ND	ND	ND	ND	ND	Dry
24-Oct-18	ND	ND	ND	ND	ND	ND	Dry
15-Nov-18	ND	ND	ND	ND	ND	ND	Dry
17-Dec-18	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	Dry
Trigger Level	6.5 to 7.5	2200	50	2.1	0.21	10 or none visible	N/A

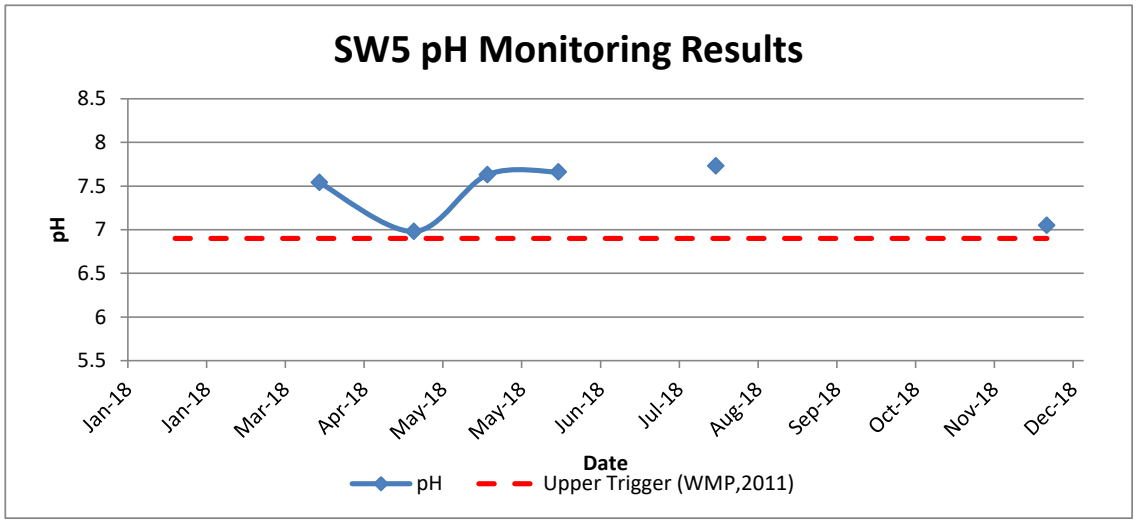
Surface Water Data SW10

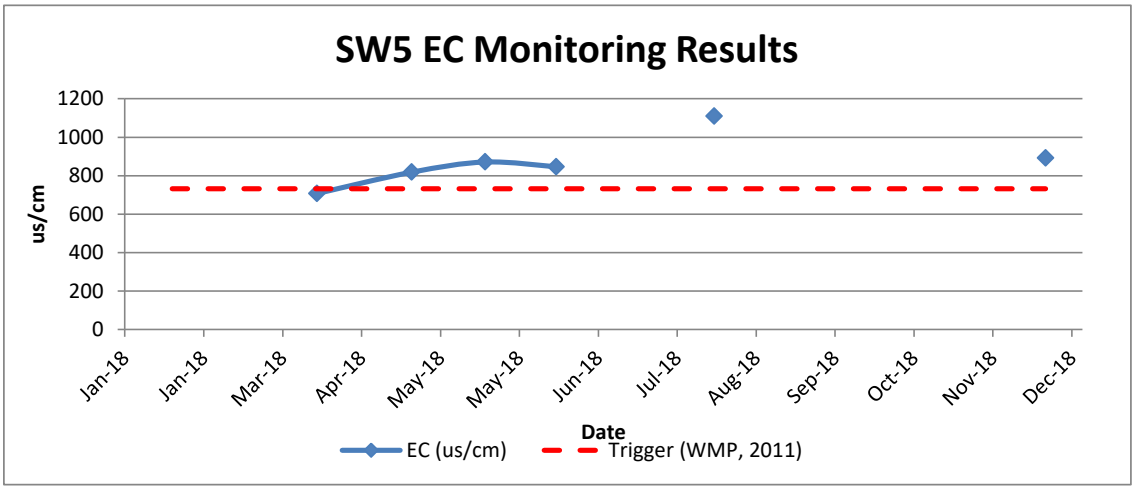
Date	pH	EC (us/cm)	TSS (mg/L)	N (mg/L)	P (mg/L)	Oil & Grease (mg/L)	Flow
19-Jan-18	ND	ND	ND	ND	ND	ND	Dry
14-Feb-18	ND	ND	ND	ND	ND	ND	No flow
15-Mar-18	ND	ND	ND	ND	ND	ND	Dry
20-Apr-18	ND	ND	ND	ND	ND	ND	Dry
18-May-18	ND	ND	ND	ND	ND	ND	Dry
14-Jun-18	ND	ND	ND	ND	ND	ND	Dry
16-Jul-18	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	Dry

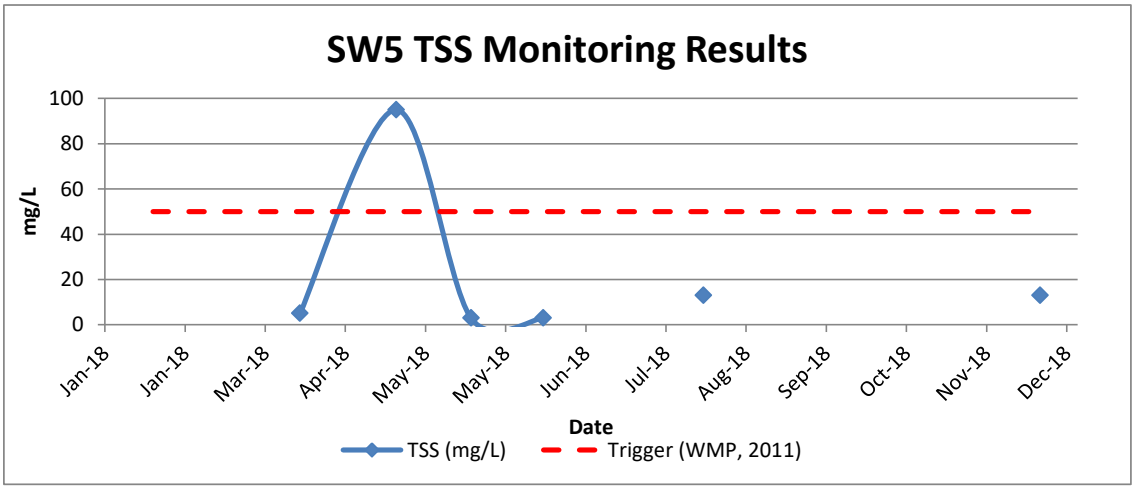
13-Aug-18	ND	ND	ND	ND	ND	ND	Dry
17-Sep-18	ND	ND	ND	ND	ND	ND	Dry
24-Oct-18	ND	ND	ND	ND	ND	ND	Dry
15-Nov-18	ND	ND	ND	ND	ND	ND	Dry
17-Dec-18	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	Dry
Trigger Level	6.5 to 7.5	2200	50	2.1	0.21	10 or none visible	N/A

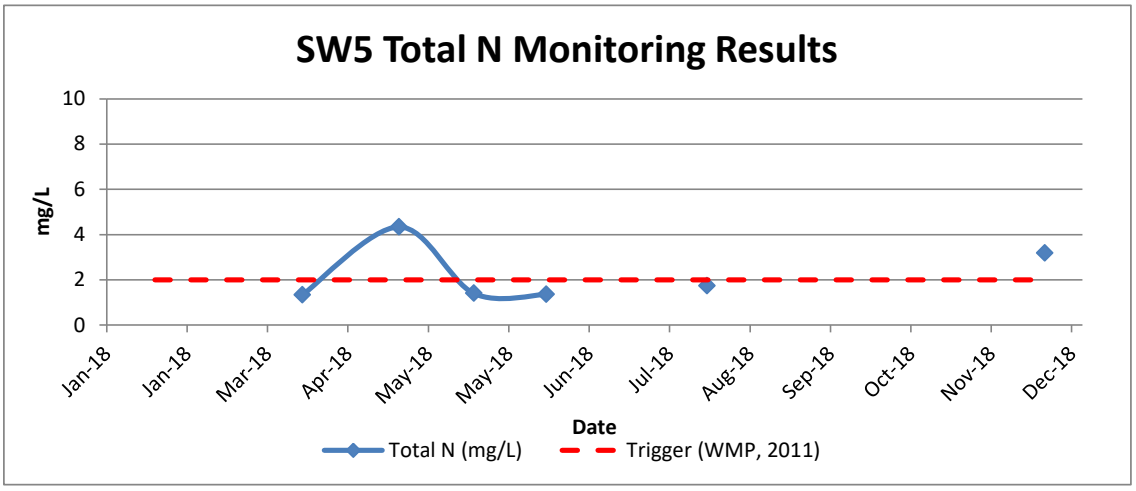
Surface Water Data SW11

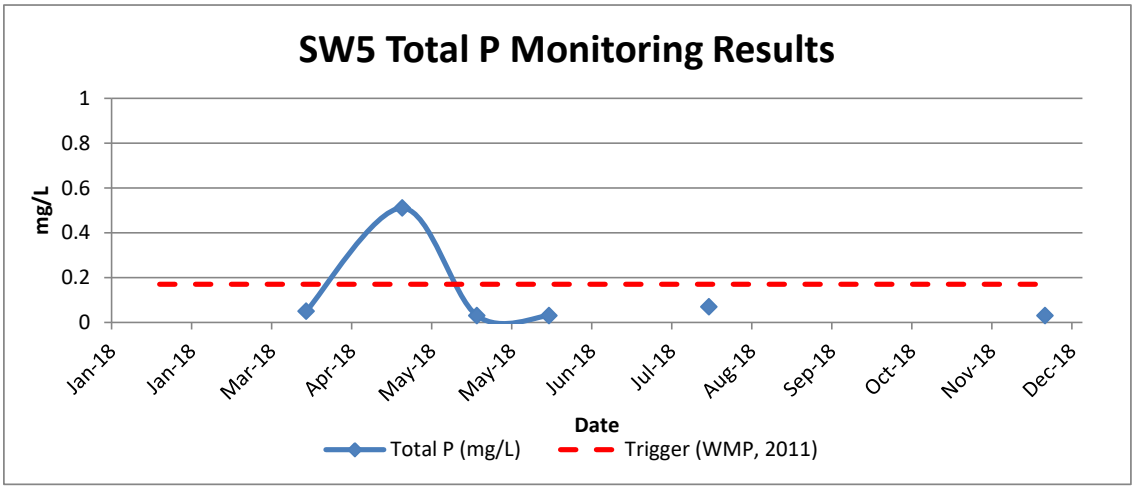
Date	pH	EC (us/cm)	TSS (mg/L)	N (mg/L)	P (mg/L)	Oil & Grease (mg/L)	Flow
19-Jan-18	ND	ND	ND	ND	ND	ND	Dry
14-Feb-18	ND	ND	ND	ND	ND	ND	No flow
15-Mar-18	ND	ND	ND	ND	ND	ND	Dry
20-Apr-18	ND	ND	ND	ND	ND	ND	Dry
18-May-18	ND	ND	ND	ND	ND	ND	Dry
14-Jun-18	ND	ND	ND	ND	ND	ND	Dry
16-Jul-18	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	Dry
13-Aug-18	ND	ND	ND	ND	ND	ND	Dry
17-Sep-18	ND	ND	ND	ND	ND	ND	Dry
23-Oct-18	ND	ND	ND	ND	ND	ND	Dry
15-Nov-18	ND	ND	ND	ND	ND	ND	Dry
17-Dec-18	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	Dry
Trigger Level	6.5 to 7.5	2200	50	2.1	0.21	10 or none visible	N/A


SW5 pH Monitoring Results
8.5
8
7.5
7
6.5
6
5.5
pH
Jan-18
Jan-18
Mar-18
Apr-18
May-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Date
pH
Upper Trigger (WMP,2011)


SW5 EC Monitoring Results
1200
1000
800
600
400
200
0
us/cm
Jan-18
Jan-18
Mar-18
Apr-18
May-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Date
EC (us/cm)
Trigger (WMP, 2011)


SW5 TSS Monitoring Results
100
80
60
40
20
0
mg/L
Jan-18
Jan-18
Mar-18
Apr-18
May-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Date
TSS (mg/L)
Trigger (WMP, 2011)


SW5 Total N Monitoring Results
10
8
6
4
2
0
mg/L
Jan-18
Jan-18
Mar-18
Apr-18
May-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Date
Total N (mg/L)
Trigger (WMP, 2011)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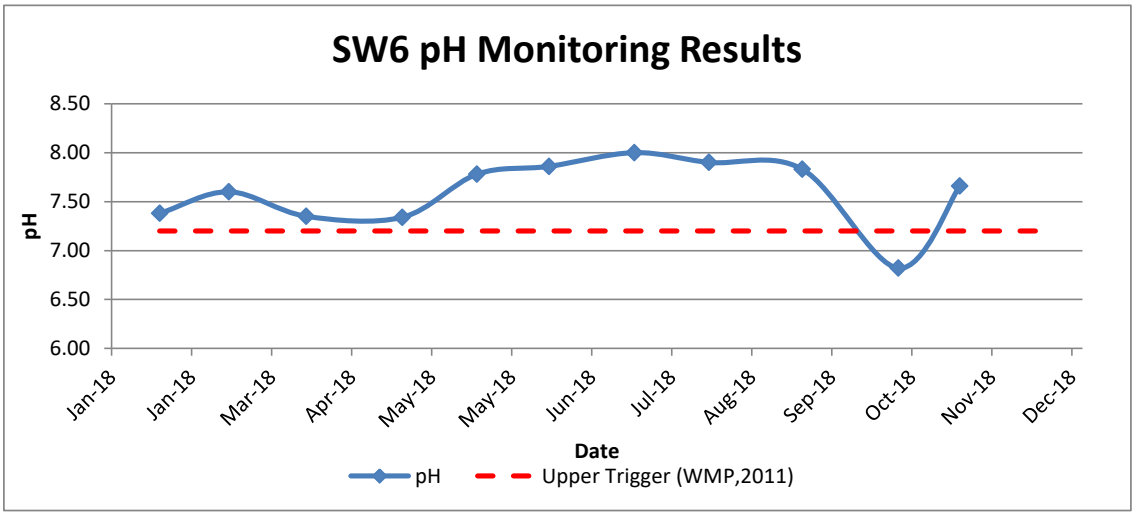
1
0.8
0.6
0.4
0.2
0
mg/L
Jan-18
Jan-18
Mar-18
Apr-18
May-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Date
Total P (mg/L)
Trigger (WMP, 2011)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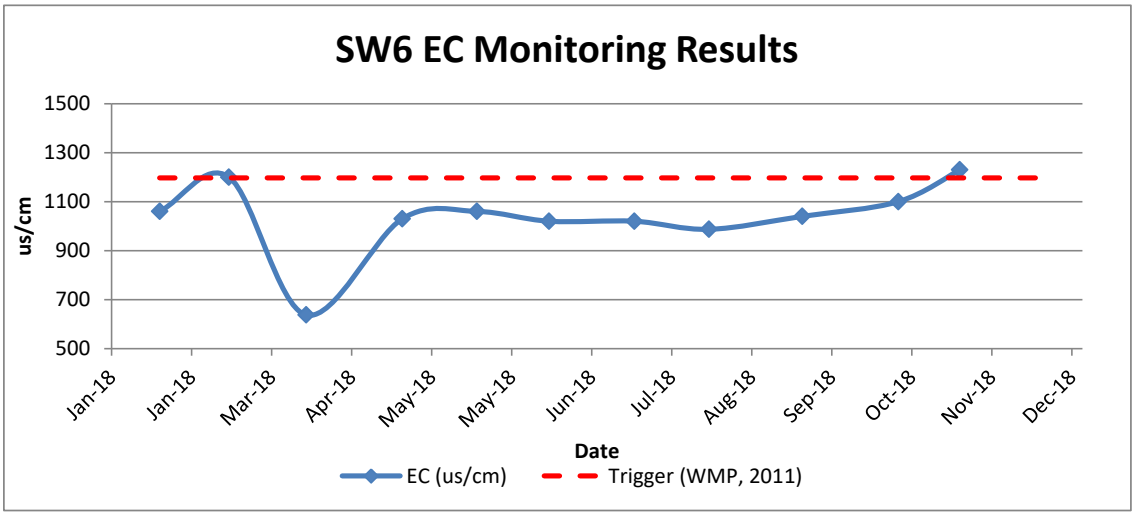
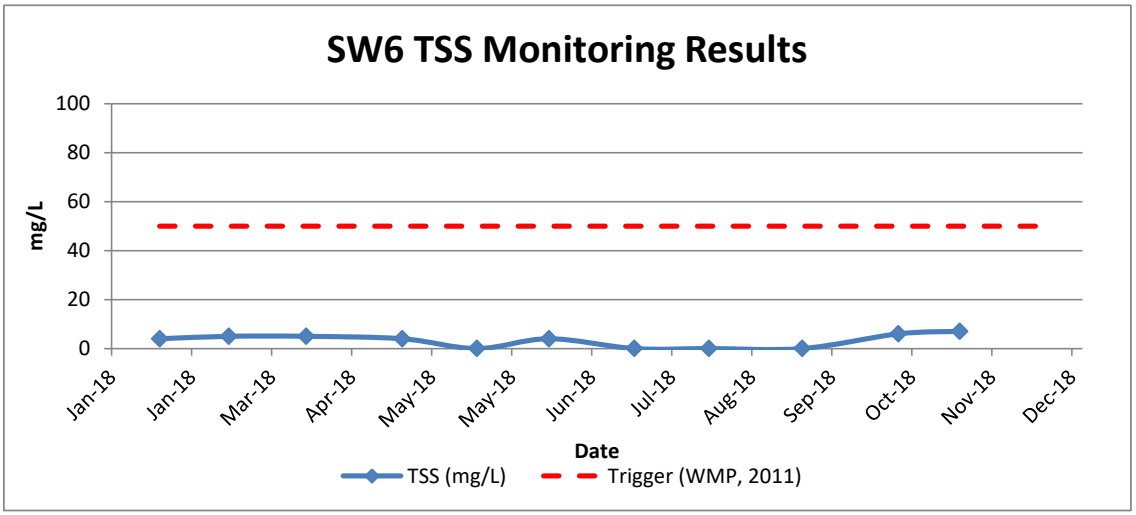
8.50
8.00
7.50
7.00
6.50
6.00
pH
Jan-18
Jan-18
Mar-18
Apr-18
May-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Date
pH
Upper Trigger (WMP,2011)


SW6 EC Monitoring Results
1500
1300
1100
900
700
500
us/cm
Jan-18
Jan-18
Mar-18
Apr-18
May-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Date
EC (us/cm)
Trigger (WMP, 2011)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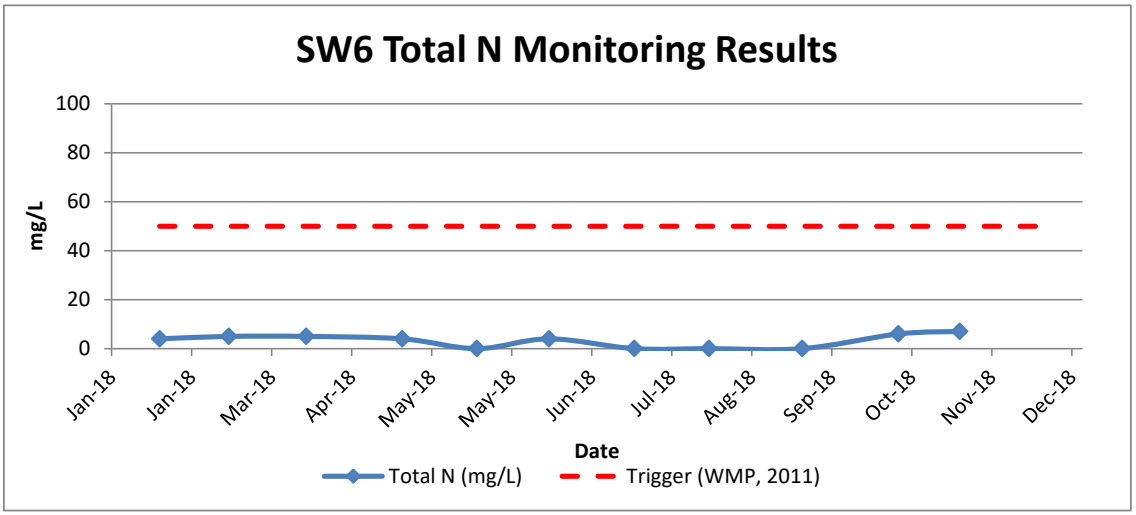
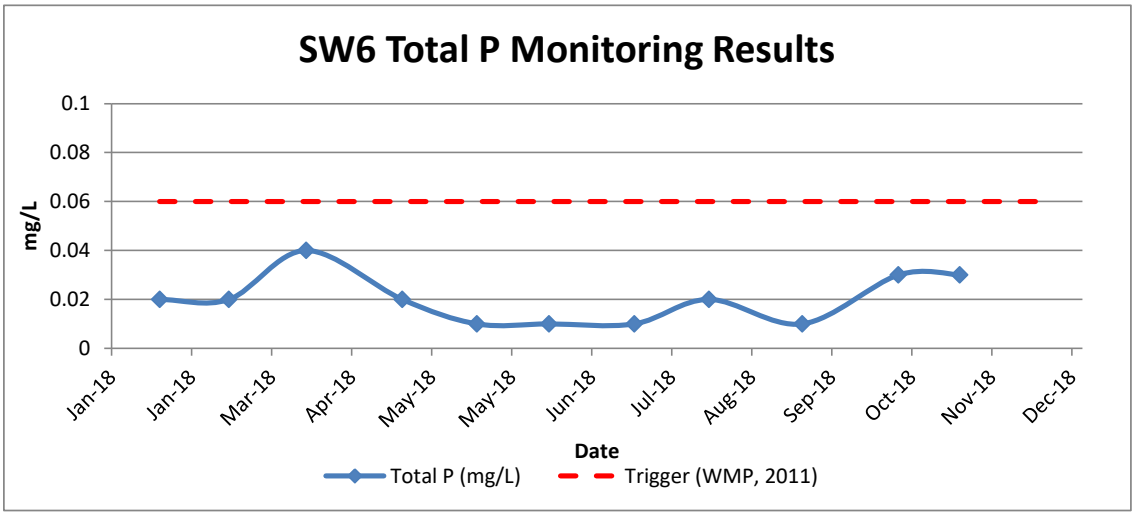
100
80
60
40
20
0
mg/L
Jan-18
Jan-18
Mar-18
Apr-18
May-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Date
TSS (mg/L)
Trigger (WMP, 2011)


SW6 Total N Monitoring Results
100
80
60
40
20
0
mg/L
Jan-18
Jan-18
Mar-18
Apr-18
May-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Date
Total N (mg/L)
Trigger (WMP, 2011)


SW6 Total P Monitoring Results
0.1
0.08
0.06
0.04
0.02
0
mg/L
Jan-18
Jan-18
Mar-18
Apr-18
May-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Date
Total P (mg/L)
Trigger (WMP, 2011)

Appendix 1C - Environmental Monitoring Tables - Groundwater

NS - Not Sampled at this location
Note: Bold - Result recorded above trigger level (WMP, 2011)

Parameter	Units	MP1			
		Q1	Q2	Q3	Q4
Depth to Water level	m	1.9	1.8	2.0	2.1
pH	pH Unit	6.3	5.8	6.6	6.2
Conductivity	µS/cm	1060.0	1100.0	1130.0	1180.0
Nutrients					
Sulfate	mg/L	23.0	22.5	23.9	21.8
Nitrate as N	mg/L	<0.1	<0.1	<0.1	<0.1
Phosphate as P	mg/L	<0.4	<0.4	<0.4	<0.4
Total Petroleum Hydrocarbons					
C6 - C9 Fraction	µg/L	<20	<20	<20	<20
C10 - C14 Fraction	µg/L	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	<50	<50	<50	<50
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	<2
Ethylbenzene	µg/L	<2	<2	<2	<2
Total Xylenes	µg/L	<2	<2	<2	<2
Other					
Bicarbonate Alkalinity as CaCO3	mg/L	169.00	169.00	168.00	172.00
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	169.00	169.00	168.00	172.00
Bicarbonate Alkalinity as CaCO3	mg/L	167.00	166.00	158.00	164.00
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	167.00	166.00	158.00	164.00
Aluminium	mg/L	<0.02	<0.02	<0.02	<0.02
Boron	mg/L	<0.10	<0.10	<0.10	0.03
Calcium	mg/L	39.60	40.50	36.90	39.70
Chromium	mg/L	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	7.18	7.14	6.18	7.80
Magnesium	mg/L	35.60	34.50	31.40	35.40
Manganese	mg/L	0.69	0.68	0.62	0.68
Potassium	mg/L	2.70	2.80	2.80	2.90
Sodium	mg/L	137.00	132.00	109.00	133.00
Zinc	mg/L	0.01	0.01	<0.005	0.01
Antimony	µg/L	<3	<3	<3	<3
Barium	µg/L	226.00	213.00	211.00	240.00

Beryllium	µg/L	0.30	0.40	0.50	0.30
Cadmium	µg/L	<0.05	<0.05	<0.05	<0.05
Cobalt	µg/L	<0.2	0.20	<0.2	<0.2
Copper	µg/L	<1	<1	<1	<1
Lead	µg/L	<0.2	<0.2	<0.2	<0.2
Mercury	µg/L	<0.1	<0.1	<0.1	<0.1
Molybdenum	µg/L	<1	<1	<1	<1
Nickel	µg/L	2.90	4.10	2.00	<0.005
Selenium	µg/L	3.00	5.00	3.00	<1
Silver	µg/L	<1	<1	<1	<1
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Weak Acid Dissociable Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	**NS**	0.38	0.45	0.47
Ammonia as N	mg/L	<0.1	<0.1	<0.1	0.30
Nitrite + Nitrate as N	mg/L	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen as N	mg/L	0.16	0.11	<0.05	0.59
Total Nitrogen as N	mg/L	0.16	0.11	<0.05	0.59
Total Phosphorus as P	mg/L	0.91	0.49	0.13	3.02
Reactive Phosphorus as P	mg/L	0.03	<0.02	<0.02	<0.02
Ionic Balance	%	6.62	7.59	1.52	8.06
Total Anions	meq/L	9.94	9.49	9.88	9.54
Total Cations	meq/L	11.30	11.00	9.58	11.20
Parameter	**Units**	**MP2**			
		Q1	**Q2**	**Q3**	**Q4**
Depth to Water level	m	15.7	15.9	15.9	15.9
pH	pH Unit	**5.1**	**5.0**	**5.7**	**5.3**
Conductivity	µS/cm	311.0	389.0	422.0	422.0
Nutrients					
Sulfate	mg/L	7.0	6.2	5.8	5.8
Nitrate as N	mg/L	<0.1	<0.1	<0.1	<0.1
Phosphate as P	mg/L	<0.4	<0.4	<0.4	<0.4
Total Petroleum Hydrocarbons					
C6 - C9 Fraction	µg/L	<20	<20	<20	<20
C10 - C14 Fraction	µg/L	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	<50	<50	<50	<50
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	<2
Ethylbenzene	µg/L	<2	<2	<2	<2
Total Xylenes	µg/L	<2	<2	<2	<2
Other					
Bicarbonate Alkalinity as CaCO3	mg/L	15.5	22.8	24	26.5
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	16	23	24	26
Bicarbonate Alkalinity as CaCO3	mg/L	14.7	22.8	16.6	25.5

Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	15	23	16	25
Aluminium	mg/L	<0.02	<0.02	<0.02	<0.02
Boron	mg/L	<0.10	<0.10	<0.10	0.04
Calcium	mg/L	4.74	6.24	6.02	6.03
Chromium	mg/L	0.001	<0.001	<0.001	<0.001
Iron	mg/L	1.14	3.98	5.26	3.62
Magnesium	mg/L	7.56	9.9	9.42	8.37
Manganese	mg/L	1.66	1.83	1.74	1.38
Potassium	mg/L	2.1	2.6	2.4	2.4
Sodium	mg/L	39.8	45.2	37.9	40.7
Zinc	mg/L	0.053	0.075	0.054	0.074
Antimony	µg/L	<3	<3	<3	<3
Barium	µg/L	35.7	43.4	46.1	41.9
Beryllium	µg/L	0.2	0.2	0.2	0.1
Cadmium	µg/L	<0.05	0.16	<0.05	0.1
Cobalt	µg/L	6.6	6	6.2	4.8
Copper	µg/L	<1	8	2	4
Lead	µg/L	<0.2	<0.2	<0.2	<0.2
Mercury	µg/L	<0.1	<0.1	<0.1	0.1
Molybdenum	µg/L	<1	<1	<1	<1
Nickel	µg/L	2.9	4.2	3.4	<0.005
Selenium	µg/L	3	4	1	<1
Silver	µg/L	<1	<1	<1	<1
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Weak Acid Dissociable Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	**NS**	0.09	0.07	0.07
Ammonia as N	mg/L	<0.1	<0.1	<0.1	0.3
Nitrite + Nitrate as N	mg/L	<0.05	<0.05	<0.05	0.13
Total Kjeldahl Nitrogen as N	mg/L	0.22	0.16	0.13	0.85
Total Nitrogen as N	mg/L	0.22	0.16	0.13	0.98
Total Phosphorus as P	mg/L	0.02	0.03	0.02	0.1
Reactive Phosphorus as P	mg/L	<0.02	<0.02	<0.02	<0.02
Ionic Balance	%	1.29	2.58	7.08	0.86
Total Anions	meq/L	2.64	3.21	3.54	3.1
Total Cations	meq/L	2.71	3.38	3.07	3.04
Parameter	**Units**	**MP4**			
		Q1	**Q2**	**Q3**	**Q4**
Depth to Water level	m	19.2	19.3	19.4	19.6
pH	pH Unit	6.2	**5.9**	6.4	6.4
Conductivity	µS/cm	439.0	460.0	471.0	450.0
Nutrients					
Sulfate	mg/L	5.1	4.6	4.4	5.0
Nitrate as N	mg/L	<0.1	<0.1	<0.1	<0.1
Phosphate as P	mg/L	<0.4	<0.4	<0.4	<0.4

Total Petroleum Hydrocarbons					
C6 - C9 Fraction	µg/L	<20	<20	<20	<20
C10 - C14 Fraction	µg/L	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	<50	<50	<50	<50
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	<2
Ethylbenzene	µg/L	<2	<2	<2	<2
Total Xylenes	µg/L	<2	<2	<2	<2
Other					
Bicarbonate Alkalinity as CaCO3	mg/L	124	126	136	139
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	124	126	136	139
Bicarbonate Alkalinity as CaCO3	mg/L	120	134	126	137
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	120	121	126	137
Aluminium	mg/L	<0.02	<0.02	<0.02	<0.02
Boron	mg/L	<0.10	<0.10	<0.10	0.04
Calcium	mg/L	13.6	13.6	12.7	12.5
Chromium	mg/L	0.001	<0.001	<0.001	<0.001
Iron	mg/L	1.12	0.68	0.63	0.52
Magnesium	mg/L	9.96	10.2	9.45	9.59
Manganese	mg/L	0.409	0.307	0.283	0.4
Potassium	mg/L	1.8	1.8	1.8	1.7
Sodium	mg/L	70.7	69.3	57.9	65.8
Zinc	mg/L	0.017	0.025	0.017	0.017
Antimony	µg/L	<3	<3	<3	<3
Barium	µg/L	92.1	90.7	95.9	95.4
Beryllium	µg/L	0.5	0.4	0.6	0.4
Cadmium	µg/L	<0.05	<0.05	<0.05	<0.05
Cobalt	µg/L	1.4	1	1	1.5
Copper	µg/L	<1	<1	1	<1
Lead	µg/L	0.8	0.7	0.7	0.6
Mercury	µg/L	<0.1	<0.1	<0.1	<0.1
Molybdenum	µg/L	4	4	4	5
Nickel	µg/L	2.7	3.6	2.6	<0.005
Selenium	µg/L	2	2	<1	<1
Silver	µg/L	<1	<1	<1	<1
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Weak Acid Dissociable Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	**NS**	1.02	1.2	1.1
Ammonia as N	mg/L	<0.1	<0.1	<0.1	<0.1
Nitrite + Nitrate as N	mg/L	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen as N	mg/L	0.09	0.13	0.09	0.13

Total Nitrogen as N	mg/L	0.09	0.13	0.09	0.13
Total Phosphorus as P	mg/L	0.03	0.04	0.06	0.06
Reactive Phosphorus as P	mg/L	<0.02	<0.02	<0.02	0.02
Ionic Balance	%	7.99	8.41	3.2	0.63
Total Anions	meq/L	3.99	3.9	4.28	4.29
Total Cations	meq/L	4.68	4.62	4.01	4.35
Parameter	**Units**	**MP5**			
		Q1	**Q2**	**Q3**	**Q4**
Depth to Water level	m	20.4	21.5	20.6	20.6
pH	pH Unit	6.1	**6.0**	6.7	6.5
Conductivity	µS/cm	839.0	870.0	881.0	859.0
Nutrients					
Sulfate	mg/L	<0.4	<0.4	<0.4	<0.4
Nitrate as N	mg/L	<0.1	<0.1	<0.1	<0.1
Phosphate as P	mg/L	<0.4	<0.4	<0.4	<0.4
Total Petroleum Hydrocarbons					
C6 - C9 Fraction	µg/L	<20	<20	<20	<20
C10 - C14 Fraction	µg/L	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	<50	<50	<50	<50
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	<2
Ethylbenzene	µg/L	<2	<2	<2	<2
Total Xylenes	µg/L	<2	<2	<2	<2
Other					
Bicarbonate Alkalinity as CaCO3	mg/L	197	225	201	230
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	197	225	201	230
Bicarbonate Alkalinity as CaCO3	mg/L	80.8	121	198	229
Carbonate Alkalinity as CaCO3	mg/L	16.6	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	197	219	198	229
Aluminium	mg/L	0.03	0.04	0.04	0.04
Boron	mg/L	<0.10	<0.10	<0.10	0.04
Calcium	mg/L	78	78.3	73.9	74.4
Chromium	mg/L	0.002	0.001	0.002	0.002
Iron	mg/L	7.2	7.05	6.62	7.03
Magnesium	mg/L	12.8	13	12	12.2
Manganese	mg/L	1.23	1.25	1.16	1.22
Potassium	mg/L	5.3	5.5	5.5	5.3
Sodium	mg/L	78.2	75.7	65.4	71.7
Zinc	mg/L	0.009	0.01	0.005	0.012
Antimony	µg/L	<3	<3	<3	<3
Barium	µg/L	221	203	208	223
Beryllium	µg/L	0.2	<0.1	0.3	0.2

Cadmium	µg/L	<0.05	<0.05	<0.05	<0.05
Cobalt	µg/L	3.4	3.8	3.7	3.5
Copper	µg/L	<1	<1	<1	2
Lead	µg/L	0.3	<0.2	0.2	<0.2
Mercury	µg/L	3.5	3.3	2.8	7.4
Molybdenum	µg/L	12	13	12	14
Nickel	µg/L	7.8	10.3	6.7	0.005
Selenium	µg/L	4	4	1	<1
Silver	µg/L	<1	<1	<1	<1
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Weak Acid Dissociable Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	**NS**	0.54	0.6	0.59
Ammonia as N	mg/L	0.4	0.4	0.3	0.6
Nitrite + Nitrate as N	mg/L	0.06	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen as N	mg/L	0.78	0.81	0.8	0.87
Total Nitrogen as N	mg/L	0.84	0.81	0.8	0.87
Total Phosphorus as P	mg/L	0.1	0.11	0.12	0.11
Reactive Phosphorus as P	mg/L	<0.02	<0.02	<0.02	<0.02
Ionic Balance	%	8.12	6.32	3.14	4.91
Total Anions	meq/L	7.57	7.78	7.56	7.61
Total Cations	meq/L	8.91	8.83	8.05	8.4
Parameter	**Units**	**MP7**			
		Q1	**Q2**	**Q3**	**Q4**
Depth to Water level	m	16.0	17.0	17.3	17.2
pH	pH Unit	6.5	**5.8**	6.4	7.2
Conductivity	µS/cm	4740.0	7780.0	7800.0	730.0
Nutrients					
Sulfate	mg/L	59.2	25.6	22.5	22.9
Nitrate as N	mg/L	0.3	<0.1	<0.1	<0.1
Phosphate as P	mg/L	<0.4	<0.4	<0.4	<0.4
Total Petroleum Hydrocarbons					
C6 - C9 Fraction	µg/L	<20	<20	<20	<20
C10 - C14 Fraction	µg/L	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	<50	<50	<50	<50
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	<2
Ethylbenzene	µg/L	<2	<2	<2	<2
Total Xylenes	µg/L	<2	<2	<2	<2
Other					
Bicarbonate Alkalinity as CaCO3	mg/L	292	299	354	357
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	292	299	354	357
Bicarbonate Alkalinity as CaCO3	mg/L	218	339	295	355
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1

Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	218	298	295	355
Aluminium	mg/L	0.03	0.04	0.05	0.04
Boron	mg/L	<0.10	<0.10	<0.10	0.04
Calcium	mg/L	358	639	608	636
Chromium	mg/L	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.03	9.2	7.78	8.95
Magnesium	mg/L	149	260	244	247
Manganese	mg/L	0.558	4.86	4.27	4.67
Potassium	mg/L	3.6	5.2	6.8	5.2
Sodium	mg/L	428	506	476	497
Zinc	mg/L	0.016	0.01	0.008	0.017
Antimony	µg/L	<3	<3	<3	<3
Barium	µg/L	248	581	565	603
Beryllium	µg/L	0.2	1.2	1	0.6
Cadmium	µg/L	0.48	0.14	0.09	0.07
Cobalt	µg/L	1.8	3.9	3.2	1.3
Copper	µg/L	2	5	5	2
Lead	µg/L	<0.2	0.3	0.2	<0.2
Mercury	µg/L	0.3	0.1	0.2	0.8
Molybdenum	µg/L	10	2	3	3
Nickel	µg/L	23.4	68.8	40.8	<0.005
Selenium	µg/L	20	57	39	<1
Silver	µg/L	<1	<1	<1	<1
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Weak Acid Dissociable Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	ND	0.6	0.78	0.76
Ammonia as N	mg/L	<0.1	<0.1	<0.1	<0.1
Nitrite + Nitrate as N	mg/L	0.31	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen as N	mg/L	0.12	0.15	0.13	0.11
Total Nitrogen as N	mg/L	0.43	0.15	0.13	0.11
Total Phosphorus as P	mg/L	<0.01	0.25	0.02	<0.01
Reactive Phosphorus as P	mg/L	<0.02	<0.02	<0.02	<0.02
Ionic Balance	%	<1.00	2.97	2.2	0.73
Total Anions	meq/L	49	71.6	74.9	73.2
Total Cations	meq/L	48.9	76	71.7	74.3
Parameter	**Units**	**MP10**			
		Q1	**Q2**	**Q3**	**Q4**
Depth to Water level	m	5.4	6.4	5.7	5.8
pH	pH Unit	6.5	**5.8**	6.7	**6.0**
Conductivity	µS/cm	6850.0	7340.0	7330.0	737.0
Nutrients					
Sulfate	mg/L	27.5	25.7	22.1	24.8
Nitrate as N	mg/L	<0.1	<0.1	<0.1	<0.1
Phosphate as P	mg/L	<0.4	<0.4	<0.4	<0.4
Total Petroleum Hydrocarbons					

C6 - C9 Fraction	µg/L	<20	<20	<20	<20
C10 - C14 Fraction	µg/L	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	<50	<50	<50	<50
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	<2
Ethylbenzene	µg/L	<2	<2	<2	<2
Total Xylenes	µg/L	<2	<2	<2	<2
Other					
Bicarbonate Alkalinity as CaCO3	mg/L	315	354	330	359
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	315	354	330	359
Bicarbonate Alkalinity as CaCO3	mg/L	270	350	285	358
Carbonate Alkalinity as CaCO3	mg/L	3.6	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	274	350	285	358
Aluminium	mg/L	0.03	0.03	0.04	0.03
Boron	mg/L	<0.10	<0.10	<0.10	0.04
Calcium	mg/L	317	330	326	328
Chromium	mg/L	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.6	1.07	1.18	1.66
Magnesium	mg/L	248	254	240	238
Manganese	mg/L	1.93	2.02	1.74	1.84
Potassium	mg/L	7.3	9	11.7	8.8
Sodium	mg/L	782	769	659	720
Zinc	mg/L	0.014	0.012	0.021	0.012
Antimony	µg/L	<3	<3	<3	<3
Barium	µg/L	369	374	413	400
Beryllium	µg/L	<0.1	<0.1	<0.1	<0.1
Cadmium	µg/L	<0.05	0.06	<0.05	<0.05
Cobalt	µg/L	13.2	19.4	16.9	12.1
Copper	µg/L	3	4	6	2
Lead	µg/L	<0.2	0.3	0.5	<0.2
Mercury	µg/L	<0.1	<0.1	<0.1	0.3
Molybdenum	µg/L	5	6	6	6
Nickel	µg/L	29.7	43.7	29.3	0.008
Selenium	µg/L	33	57	33	<1
Silver	µg/L	<1	<1	<1	<1
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Weak Acid Dissociable Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	**NS**	0.66	0.85	0.85
Ammonia as N	mg/L	<0.1	<0.1	<0.1	0.1
Nitrite + Nitrate as N	mg/L	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen as N	mg/L	0.11	0.1	0.19	0.08
Total Nitrogen as N	mg/L	0.11	0.1	0.19	0.08

Total Phosphorus as P	mg/L	0.03	0.02	0.04	0.01
Reactive Phosphorus as P	mg/L	<0.02	<0.02	<0.02	<0.02
Ionic Balance	%	1.12	2.06	3.12	0.91
Total Anions	meq/L	72.1	68.2	69.3	66.4
Total Cations	meq/L	70.5	71.1	65.1	67.6
Parameter	**Units**	**MP11**			
		Q1	**Q2**	**Q3**	**Q4**
Depth to Water level	m	12.1	12.4	12.3	12.5
pH	pH Unit	6.8	6.2	6.8	6.8
Conductivity	µS/cm	669.0	695.0	711.0	692.0
Nutrients					
Sulfate	mg/L	4.3	4.2	3.2	4.4
Nitrate as N	mg/L	<0.1	<0.1	<0.1	0.1
Phosphate as P	mg/L	<0.4	<0.4	<0.4	<0.4
Total Petroleum Hydrocarbons					
C6 - C9 Fraction	µg/L	<20	<20	<20	<20
C10 - C14 Fraction	µg/L	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	<50	<50	<50	<50
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	<2
Ethylbenzene	µg/L	<2	<2	<2	<2
Total Xylenes	µg/L	<2	<2	<2	<2
Other					
Bicarbonate Alkalinity as CaCO3	mg/L	336	386	368	382
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	336	386	368	382
Bicarbonate Alkalinity as CaCO3	mg/L	278	372	322	380
Carbonate Alkalinity as CaCO3	mg/L	16	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	294	372	322	380
Aluminium	mg/L	<0.02	<0.02	0.02	<0.02
Boron	mg/L	<0.10	<0.10	<0.10	0.03
Calcium	mg/L	114	115	109	110
Chromium	mg/L	0.001	<0.001	<0.001	<0.001
Iron	mg/L	2.36	2.49	2.05	2.16
Magnesium	mg/L	6.3	6.57	6.17	6.15
Manganese	mg/L	1.28	1.38	1.28	1.28
Potassium	mg/L	1.8	1.9	1.9	1.8
Sodium	mg/L	32.8	32.6	29.1	30.8
Zinc	mg/L	0.009	0.012	0.008	0.008
Antimony	µg/L	<3	<3	<3	<3
Barium	µg/L	653	674	733	700
Beryllium	µg/L	<0.1	<0.1	<0.1	<0.1
Cadmium	µg/L	<0.05	<0.05	<0.05	<0.05

Cobalt	µg/L	0.4	0.7	0.5	0.3
Copper	µg/L	<1	<1	1	<1
Lead	µg/L	<0.2	<0.2	<0.2	<0.2
Mercury	µg/L	<0.1	<0.1	<0.1	0.1
Molybdenum	µg/L	2	3	3	3
Nickel	µg/L	7.4	12.4	6.3	0.005
Selenium	µg/L	<1	2	<1	<1
Silver	µg/L	<1	<1	<1	<1
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Weak Acid Dissociable Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	**NS**	0.61	0.68	0.71
Ammonia as N	mg/L	0.1	0.1	0.1	0.2
Nitrite + Nitrate as N	mg/L	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen as N	mg/L	0.18	0.22	0.23	0.19
Total Nitrogen as N	mg/L	0.18	0.22	0.23	0.19
Total Phosphorus as P	mg/L	0.03	0.03	0.04	0.02
Reactive Phosphorus as P	mg/L	<0.02	<0.02	<0.02	<0.02
Ionic Balance	%	11.1	4.88	3.61	0.14
Total Anions	meq/L	6.27	7.15	6.88	7.53
Total Cations	meq/L	7.84	7.88	7.4	7.51
Parameter	**Units**	**GPZ01**			
		Q1	**Q2**	**Q3**	**Q4**
Depth to Water level	m	10.7	10.8	10.9	11.1
pH	pH Unit	**7.5**	7.0	**7.8**	**7.5**
Conductivity	µS/cm	961.0	993.0	1020.0	985.0
Nutrients					
Sulfate	mg/L	23.5	22.4	23.6	20.4
Nitrate as N	mg/L	<0.1	<0.1	<0.1	<0.1
Phosphate as P	mg/L	**0.7**	**0.8**	**0.7**	**0.7**
Total Petroleum Hydrocarbons					
C6 - C9 Fraction	µg/L	<20	<20	<20	<20
C10 - C14 Fraction	µg/L	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	<50	<50	<50	<50
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	<2
Ethylbenzene	µg/L	<2	<2	<2	<2
Total Xylenes	µg/L	<2	<2	<2	<2
Other					
Bicarbonate Alkalinity as CaCO3	mg/L	359	346	340	394
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	359	346	340	394
Bicarbonate Alkalinity as CaCO3	mg/L	307	400	321	390
Carbonate Alkalinity as CaCO3	mg/L	48.2	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1

Total Alkalinity as CaCO3	mg/L	355	344	321	390
Aluminium	mg/L	<0.02	<0.02	0.02	<0.02
Boron	mg/L	<0.10	<0.10	<0.10	0.07
Calcium	mg/L	80.6	84	77	78.4
Chromium	mg/L	0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.87	0.98	0.82	0.8
Magnesium	mg/L	35.2	35.5	31.5	32.5
Manganese	mg/L	0.954	0.942	0.806	0.816
Potassium	mg/L	4.9	5.3	5.9	5.3
Sodium	mg/L	87.7	86.4	73.5	81.7
Zinc	mg/L	0.007	<0.005	<0.005	<0.005
Antimony	µg/L	<3	<3	<3	<3
Barium	µg/L	169	185	195	200
Beryllium	µg/L	<0.1	<0.1	<0.1	<0.1
Cadmium	µg/L	<0.05	<0.05	<0.05	<0.05
Cobalt	µg/L	1.4	1.9	1.4	1.3
Copper	µg/L	<1	<1	<1	<1
Lead	µg/L	<0.2	<0.2	<0.2	<0.2
Mercury	µg/L	<0.1	<0.1	<0.1	0.1
Molybdenum	µg/L	16	20	19	20
Nickel	µg/L	5.4	10.2	4.6	<0.005
Selenium	µg/L	1	3	<1	<1
Silver	µg/L	<1	<1	<1	<1
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Weak Acid Dissociable Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	**NS**	0.47	0.51	0.53
Ammonia as N	mg/L	0.2	0.2	0.2	<0.1
Nitrite + Nitrate as N	mg/L	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen as N	mg/L	0.29	0.27	0.25	0.22
Total Nitrogen as N	mg/L	0.29	0.27	0.25	0.22
Total Phosphorus as P	mg/L	1.39	1.3	1.27	0.97
Reactive Phosphorus as P	mg/L	1.13	0.93	0.86	0.9
Ionic Balance	%	7.31	9.74	2.98	2.77
Total Anions	meq/L	9.44	9.12	9.28	9.76
Total Cations	meq/L	10.9	11.1	9.84	10.3
Parameter	**Units**	**GPZ02**			
		Q1	**Q2**	**Q3**	**Q4**
Depth to Water level	m	8.2	8.3	8.6	9.4
pH	pH Unit	7.0	6.5	7.2	7.0
Conductivity	µS/cm	2970.0	3150.0	3220.0	3200.0
Nutrients					
Sulfate	mg/L	20.2	19.2	21.2	17.0
Nitrate as N	mg/L	<0.1	<0.1	0.1	<0.1
Phosphate as P	mg/L	<0.4	<0.4	<0.4	<0.4
Total Petroleum Hydrocarbons					
C6 - C9 Fraction	µg/L	<20	<20	<20	<20

C10 - C14 Fraction	µg/L	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	<50	<50	<50	<50
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	<2
Ethylbenzene	µg/L	<2	<2	<2	<2
Total Xylenes	µg/L	<2	<2	<2	<2
Other					
Bicarbonate Alkalinity as CaCO3	mg/L	336	390	343	384
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	336	390	343	384
Bicarbonate Alkalinity as CaCO3	mg/L	386	374	326	383
Carbonate Alkalinity as CaCO3	mg/L	38.8	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	325	374	326	383
Aluminium	mg/L	0.02	0.02	0.02	0.02
Boron	mg/L	<0.10	<0.10	<0.10	0.04
Calcium	mg/L	154	158	149	153
Chromium	mg/L	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.97	0.62	0.12	<0.01
Magnesium	mg/L	129	134	125	124
Manganese	mg/L	1.02	0.98	0.333	0.028
Potassium	mg/L	3.7	4	7.4	5.6
Sodium	mg/L	290	287	252	276
Zinc	mg/L	0.008	0.006	0.006	0.005
Antimony	µg/L	<3	<3	<3	<3
Barium	µg/L	187	190	190	183
Beryllium	µg/L	<0.1	<0.1	<0.1	<0.1
Cadmium	µg/L	<0.05	<0.05	<0.05	<0.05
Cobalt	µg/L	1.7	2	0.9	0.3
Copper	µg/L	1	2	1	<1
Lead	µg/L	<0.2	<0.2	<0.2	<0.2
Mercury	µg/L	<0.1	<0.1	<0.1	<0.1
Molybdenum	µg/L	2	2	2	3
Nickel	µg/L	11.6	19.5	8.8	<0.005
Selenium	µg/L	12	26	9	<1
Silver	µg/L	<1	<1	<1	<1
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Weak Acid Dissociable Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	**NS**	0.53	0.6	0.58
Ammonia as N	mg/L	<0.1	<0.1	<0.1	<0.1
Nitrite + Nitrate as N	mg/L	<0.05	<0.05	0.06	<0.05
Total Kjeldahl Nitrogen as N	mg/L	0.06	0.07	0.05	0.07
Total Nitrogen as N	mg/L	0.06	0.07	0.11	0.07
Total Phosphorus as P	mg/L	0.05	0.1	0.14	0.06

Reactive Phosphorus as P	mg/L	0.04	0.06	0.06	0.06
Ionic Balance	%	1.21	3.24	0.0427	3.71
Total Anions	meq/L	30.4	29.5	28.9	27.8
Total Cations	meq/L	31.1	31.5	28.9	30
Parameter	**Units**	**GPZ04**			
		Q1	**Q2**	**Q3**	**Q4**
Depth to Water level	m	7.7	7.7	7.9	8.1
pH	pH Unit	6.6	6.3	7.3	6.9
Conductivity	µS/cm	2460.0	2330.0	2040.0	1970.0
Nutrients					
Sulfate	mg/L	15.8	23.7	22.2	19.5
Nitrate as N	mg/L	**1.7**	**1.9**	**2.9**	**2.4**
Phosphate as P	mg/L	<0.4	<0.4	<0.4	<0.4
Total Petroleum Hydrocarbons					
C6 - C9 Fraction	µg/L	<20	<20	<20	<20
C10 - C14 Fraction	µg/L	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	<50	<50	<50	<50
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	<2
Ethylbenzene	µg/L	<2	<2	<2	<2
Total Xylenes	µg/L	<2	<2	<2	<2
Other					
Bicarbonate Alkalinity as CaCO3	mg/L	524	594	400	452
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	524	594	400	452
Bicarbonate Alkalinity as CaCO3	mg/L	333	437	340	441
Carbonate Alkalinity as CaCO3	mg/L	9.4	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	342	437	340	441
Aluminium	mg/L	0.03	<0.02	0.02	<0.02
Boron	mg/L	<0.10	<0.10	<0.10	0.03
Calcium	mg/L	158	120	90.8	84.7
Chromium	mg/L	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.01	<0.01	<0.01	<0.01
Magnesium	mg/L	137	123	99	100
Manganese	mg/L	0.53	0.707	0.438	0.363
Potassium	mg/L	8.1	6.4	5	4.1
Sodium	mg/L	146	149	134	150
Zinc	mg/L	0.008	0.006	0.007	0.011
Antimony	µg/L	<3	<3	<3	<3
Barium	µg/L	494	651	636	642
Beryllium	µg/L	0.1	<0.1	<0.1	<0.1
Cadmium	µg/L	<0.05	<0.05	<0.05	<0.05
Cobalt	µg/L	1.8	2.2	1.6	1.2

Copper	µg/L	2	1	5	2
Lead	µg/L	<0.2	<0.2	<0.2	<0.2
Mercury	µg/L	<0.1	<0.1	<0.1	<0.1
Molybdenum	µg/L	2	3	3	3
Nickel	µg/L	13.2	13.6	6.7	0.008
Selenium	µg/L	9	14	8	<1
Silver	µg/L	<1	<1	<1	<1
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Weak Acid Dissociable Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	**NS**	0.52	0.68	0.7
Ammonia as N	mg/L	<0.1	<0.1	<0.1	0.1
Nitrite + Nitrate as N	mg/L	1.88	1.84	2.99	2.69
Total Kjeldahl Nitrogen as N	mg/L	0.34	0.67	0.1	0.48
Total Nitrogen as N	mg/L	2.22	2.51	3.09	3.17
Total Phosphorus as P	mg/L	2.67	6.39	0.95	0.46
Reactive Phosphorus as P	mg/L	0.03	0.05	0.07	0.12
Ionic Balance	%	1.93	2.17	0.576	2.66
Total Anions	meq/L	26.8	23.8	18.8	18.1
Total Cations	meq/L	25.8	22.8	18.6	19.1
Parameter	**Units**	**GPZ05**			
		Q1	**Q2**	**Q3**	**Q4**
Depth to Water level	m	7.0	7.1	7.1	7.2
pH	pH Unit	**7.5**	7.2	**7.8**	**7.6**
Conductivity	µS/cm	3680.0	3890.0	3820.0	3750.0
Nutrients					
Sulfate	mg/L	14.5	13.0	12.5	11.8
Nitrate as N	mg/L	<0.1	<0.1	<0.1	<0.1
Phosphate as P	mg/L	<0.4	<0.4	<0.4	<0.4
Total Petroleum Hydrocarbons					
C6 - C9 Fraction	µg/L	**80.0**	<20	**60.0**	**50.0**
C10 - C14 Fraction	µg/L	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	<50	<50	<50	<50
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	<2
Ethylbenzene	µg/L	<2	<2	<2	<2
Total Xylenes	µg/L	<2	<2	<2	<2
Other					
Bicarbonate Alkalinity as CaCO3	mg/L	659	757	702	757
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	680	757	702	757
Bicarbonate Alkalinity as CaCO3	mg/L	575	757	558	730
Carbonate Alkalinity as CaCO3	mg/L	98.2	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	673	757	558	730

Aluminium	mg/L	<0.02	0.02	0.03	0.02
Boron	mg/L	<0.10	<0.10	<0.10	0.08
Calcium	mg/L	32.9	33.8	48.3	47.6
Chromium	mg/L	0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.39	0.96	1.32	0.1
Magnesium	mg/L	21.8	22.9	29.6	28.7
Manganese	mg/L	1.17	1.16	1.22	1.24
Potassium	mg/L	7.6	8.7	10.8	8.4
Sodium	mg/L	866	826	635	725
Zinc	mg/L	0.006	<0.005	<0.005	0.005
Antimony	µg/L	<3	<3	<3	<3
Barium	µg/L	301	332	463	401
Beryllium	µg/L	<0.1	<0.1	<0.1	<0.1
Cadmium	µg/L	0.09	0.42	<0.05	0.53
Cobalt	µg/L	0.4	0.4	0.4	0.3
Copper	µg/L	<1	<1	<1	<1
Lead	µg/L	<0.2	<0.2	<0.2	<0.2
Mercury	µg/L	0.1	<0.1	<0.1	0.2
Molybdenum	µg/L	558	594	550	525
Nickel	µg/L	3.2	3.6	3.2	<0.005
Selenium	µg/L	10	22	11	<1
Silver	µg/L	<1	<1	<1	<1
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Weak Acid Dissociable Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	**NS**	0.43	0.47	0.48
Ammonia as N	mg/L	0.6	0.6	0.4	0.3
Nitrite + Nitrate as N	mg/L	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen as N	mg/L	0.99	1.03	0.77	0.41
Total Nitrogen as N	mg/L	0.99	1.03	0.77	0.41
Total Phosphorus as P	mg/L	0.58	0.58	0.47	0.22
Reactive Phosphorus as P	mg/L	0.26	0.35	0.17	0.19
Ionic Balance	%	5.93	4.7	1.87	3.9
Total Anions	meq/L	36.7	36.3	34.1	33.8
Total Cations	meq/L	41.4	39.8	32.9	36.5
Parameter	**Units**	**GPZ06**			
		Q1	**Q2**	**Q3**	**Q4**
Depth to Water level	m	5.8	5.4	6.0	6.0
pH	pH Unit	6.8	6.2	7.0	6.6
Conductivity	µS/cm	1890.0	1970.0	1970.0	1930.0
Nutrients					
Sulfate	mg/L	26.1	26.1	27.6	25.5
Nitrate as N	mg/L	**4.4**	**4.5**	**4.5**	**4.3**
Phosphate as P	mg/L	<0.4	<0.4	<0.4	<0.4
Total Petroleum Hydrocarbons					
C6 - C9 Fraction	µg/L	<20	**90.0**	<20	<20
C10 - C14 Fraction	µg/L	<50	<50	<50	<50

C15 - C28 Fraction	µg/L	<100	<100	<100	<100
C29 - C36 Fraction	µg/L	<50	<50	<50	<50
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	<2
Ethylbenzene	µg/L	<2	<2	<2	<2
Total Xylenes	µg/L	<2	<2	<2	<2
Other					
Bicarbonate Alkalinity as CaCO3	mg/L	468	460	475	529
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	468	460	475	529
Bicarbonate Alkalinity as CaCO3	mg/L	461	449	436	525
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	461	449	436	525
Aluminium	mg/L	<0.02	0.02	0.02	<0.02
Boron	mg/L	<0.10	<0.10	<0.10	0.03
Calcium	mg/L	118	121	113	111
Chromium	mg/L	0.001	<0.001	<0.001	<0.001
Iron	mg/L	<0.01	<0.01	<0.01	<0.01
Magnesium	mg/L	66.4	65.1	59.3	59.6
Manganese	mg/L	0.019	0.017	0.017	0.017
Potassium	mg/L	3.8	4.1	4.4	4
Sodium	mg/L	214	207	178	195
Zinc	mg/L	0.006	0.006	0.005	0.011
Antimony	µg/L	<3	<3	<3	<3
Barium	µg/L	176	185	206	184
Beryllium	µg/L	<0.1	<0.1	<0.1	<0.1
Cadmium	µg/L	<0.05	0.07	<0.05	0.08
Cobalt	µg/L	0.6	0.7	0.5	0.3
Copper	µg/L	1	1	1	2
Lead	µg/L	<0.2	<0.2	<0.2	<0.2
Mercury	µg/L	<0.1	<0.1	<0.1	<0.1
Molybdenum	µg/L	25	20	24	46
Nickel	µg/L	9.4	12.9	6.3	<0.005
Selenium	µg/L	6	10	3	<1
Silver	µg/L	<1	<1	<1	<1
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Weak Acid Dissociable Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	**NS**	0.41	0.47	0.49
Ammonia as N	mg/L	<0.1	<0.1	<0.1	0.2
Nitrite + Nitrate as N	mg/L	4.42	4.19	4.54	4.57
Total Kjeldahl Nitrogen as N	mg/L	0.09	0.54	<0.05	0.43
Total Nitrogen as N	mg/L	4.51	4.73	4.42	5
Total Phosphorus as P	mg/L	4.15	4.96	0.96	0.77
Reactive Phosphorus as P	mg/L	0.07	0.05	0.06	0.09

Ionic Balance	%	4.6	6.1	0.273	3.41
Total Anions	meq/L	18.9	18.1	18.3	17.8
Total Cations	meq/L	20.7	20.5	18.4	19
Parameter	**Units**	**GPZ07**			
		Q1	**Q2**	**Q3**	**Q4**
Depth to Water level	m	2.6	2.7	2.8	2.8
pH	pH Unit	7.2	6.8	**7.5**	6.2
Conductivity	µS/cm	681.0	738.0	685.0	8020.0
Nutrients					
Sulfate	mg/L	3.1	0.8	<0.4	2.3
Nitrate as N	mg/L	<0.1	<0.1	<0.1	<0.1
Phosphate as P	mg/L	<0.4	<0.4	<0.4	<0.4
Total Petroleum Hydrocarbons					
C6 - C9 Fraction	µg/L	**70.0**	<20	<20	<20
C10 - C14 Fraction	µg/L	**2420.0**	<50	<50	<50
C15 - C28 Fraction	µg/L	**2160.0**	<100	<100	**540.0**
C29 - C36 Fraction	µg/L	**1160.0**	<50	<50	**500.0**
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	<2
Ethylbenzene	µg/L	<2	<2	<2	<2
Total Xylenes	µg/L	<2	<2	<2	<2
Other					
Bicarbonate Alkalinity as CaCO3	mg/L	274	337	316	329
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	274	337	316	329
Bicarbonate Alkalinity as CaCO3	mg/L	274	324	237	322
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	274	324	237	322
Aluminium	mg/L	<0.02	<0.02	<0.02	<0.02
Boron	mg/L	<0.10	<0.10	<0.10	0.03
Calcium	mg/L	45.9	50	41.7	47.4
Chromium	mg/L	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.38	0.67	0.16	0.41
Magnesium	mg/L	24.6	25.8	22.5	24.4
Manganese	mg/L	0.246	0.265	0.215	0.22
Potassium	mg/L	3.1	3.4	3.2	3.2
Sodium	mg/L	71.3	74.8	60	71.3
Zinc	mg/L	<0.005	<0.005	<0.005	<0.005
Antimony	µg/L	<3	<3	<3	<3
Barium	µg/L	19.5	21.6	41.7	27.7
Beryllium	µg/L	0.1	<0.1	<0.1	<0.1
Cadmium	µg/L	<0.05	<0.05	<0.05	<0.05
Cobalt	µg/L	0.3	0.3	<0.2	<0.2
Copper	µg/L	<1	<1	<1	<1

Lead	µg/L	<0.2	<0.2	<0.2	<0.2
Mercury	µg/L	<0.1	<0.1	<0.1	<0.1
Molybdenum	µg/L	6	4	7	10
Nickel	µg/L	3.5	5.4	2	<0.005
Selenium	µg/L	1	3	<1	<1
Silver	µg/L	<1	<1	<1	<1
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Weak Acid Dissociable Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	**NS**	0.32	0.39	0.36
Ammonia as N	mg/L	0.5	0.2	0.3	0.2
Nitrite + Nitrate as N	mg/L	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen as N	mg/L	0.92	0.4	0.46	0.26
Total Nitrogen as N	mg/L	0.92	0.4	0.46	0.26
Total Phosphorus as P	mg/L	0.21	0.2	0.19	0.12
Reactive Phosphorus as P	mg/L	0.13	0.05	0.14	0.07
Ionic Balance	%	9.77	4.48	1.97	2.44
Total Anions	meq/L	6.21	7.33	6.93	7.24
Total Cations	meq/L	7.56	8.02	6.66	7.6
Parameter	**Units**	**GPZ08**			
		Q1	**Q2**	**Q3**	**Q4**
Depth to Water level	m	8.7	8.8	8.7	8.0
pH	pH Unit	6.7	6.3	7.1	6.9
Conductivity	µS/cm	2360.0	2520.0	2520.0	2490.0
Nutrients					
Sulfate	mg/L	<0.4	<0.4	<0.4	<0.4
Nitrate as N	mg/L	<0.1	<0.1	<0.1	<0.1
Phosphorus as P	mg/L	<0.4	<0.4	<0.4	<0.4
Total Petroleum Hydrocarbons					
C6 - C9 Fraction	µg/L	<20	<20	<20	<20
C10 - C14 Fraction	µg/L	**150.0**	**60.0**	**120.0**	<50
C15 - C28 Fraction	µg/L	**960.0**	**1340.0**	**1220.0**	480.0
C29 - C36 Fraction	µg/L	**630.0**	**720.0**	**920.0**	**440.0**
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<2	<2	<2	<2
Ethylbenzene	µg/L	<2	<2	<2	<2
Total Xylenes	µg/L	<2	<2	<2	<2
Other					
Bicarbonate Alkalinity as CaCO3	mg/L	406	443	434	436
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	406	443	434	436
Bicarbonate Alkalinity as CaCO3	mg/L	406	443	385	431
Carbonate Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Hydroxide Alkalinity as CaCO3	mg/L	<0.1	<0.1	<0.1	<0.1
Total Alkalinity as CaCO3	mg/L	406	443	385	431
Aluminium	mg/L	0.02	0.03	0.03	0.03

Boron	mg/L	<0.10	<0.10	<0.10	0.04
Calcium	mg/L	184	185	178	177
Chromium	mg/L	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	11.9	12.9	12	11.8
Magnesium	mg/L	96.8	96.2	93.8	94.6
Manganese	mg/L	11.2	10.4	8.21	7.85
Potassium	mg/L	6.6	7	7.5	6.7
Sodium	mg/L	149	149	133	144
Zinc	mg/L	0.006	0.006	<0.005	0.007
Antimony	µg/L	<3	<3	<3	<3
Barium	µg/L	2300	2800	2750	2910
Beryllium	µg/L	0.1	<0.1	<0.1	<0.1
Cadmium	µg/L	<0.05	<0.05	<0.05	<0.05
Cobalt	µg/L	8.1	10.8	11	13
Copper	µg/L	1	2	1	1
Lead	µg/L	<0.2	<0.2	<0.2	<0.2
Mercury	µg/L	<0.1	<0.1	<0.1	<0.1
Molybdenum	µg/L	13	16	18	20
Nickel	µg/L	20.1	25.7	13.5	<0.005
Selenium	µg/L	10	17	8	<1
Silver	µg/L	<1	<1	<1	<1
Total Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Weak Acid Dissociable Cyanide	mg/L	<0.004	<0.004	<0.004	<0.004
Fluoride	mg/L	**NS**	0.44	0.5	0.5
Ammonia as N	mg/L	1.8	1.7	1.6	1.5
Nitrite + Nitrate as N	mg/L	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen as N	mg/L	2.29	1.84	1.79	1.83
Total Nitrogen as N	mg/L	2.29	1.84	1.79	1.83
Total Phosphorus as P	mg/L	0.07	0.1	0.06	0.06
Reactive Phosphorus as P	mg/L	0.02	0.04	<0.02	<0.02
Ionic Balance	%	2.48	3.38	0.9292	5.46
Total Anions	meq/L	23.4	23	22.9	21.4
Total Cations	meq/L	24.6	24.7	23.4	23.8

Appendix 1E - Environmental Monitoring Tables - Blast Results

Note: No blasts undertaken in Ignimbrite Pit after 15 March 2018. As noted in BMP (2016) Ignimbrite Pit requires monitoring at B1-3, Granite Pit requires monitoring at B4-6.

Blasting												
			Ignimbrite				Granite					
Date of Blast	Time of Blast	Location	B1- Rail	B2- Pipeline	B3- Resident		B4- Resident		B5- Resident		B6- Rail	B6 - Pipeline
			PPV (mm/s)	PPV (mm/s)	PPV (mm/s)	Overpressure (dB)	PPV (mm/s)	Overpressure (dB)	PPV (mm/s)	Overpressure (dB)	PPV (mm/s)	PPV (mm/s)
January												
11/01/2018	13:21	Granite	Monitoring not required at these locations for Granite Pit Blasts				0	0	0	0	0	0
19/01/2018	13:23	Granite	Monitoring not required at these locations for Granite Pit Blasts				0	0	0	0	0.81	0.81
25/01/2018	13:57	Ignimbrite	0	2.91	0	0	Monitoring not required at these locations in Ignimbrite Pit Blasts					
30/01/2018	13:56	Granite	Monitoring not required at these locations for Granite Pit Blasts				0	0	0	0	0.65	0.65
31/01/2018	13:25	Granite	Monitoring not required at these locations for Granite Pit Blasts				0	0	0	0	0	0
February												
1/02/2019	11:35	Ignimbrite	0.95	2.42	0	0						
6/02/2018	13:10	Granite	Monitoring not required at these locations for Granite Pit Blasts				0	0	0	0	0	0
8/02/2018	13:39	Granite					0	0	0	0	0	0
12/02/2018	12:32	Granite					0	0	0	0	0	0
14/02/2018	14:28	Ignimbrite	1.08	2.1	0	0	Monitoring not required at these locations in Ignimbrite Pit Blasts					
19/02/2019	14:01	Ignimbrite	0	1.35	0	0	Monitoring not required at these locations in Ignimbrite Pit Blasts					
21/02/2019	13:02	Granite	Monitoring not required at these locations for Granite Pit Blasts				0	0	0	0	0	0
22/02/2019	13:18	Ignimbrite	0	2.13	0	0	Monitoring not required at these locations in Ignimbrite Pit Blasts					
26/02/2019	13:27	Ignimbrite	0.8	3.24	0.72	64.6	Monitoring not required at these locations in Ignimbrite Pit Blasts					
March												
1/03/2018	15:45	Granite	Monitoring not required at these locations for Granite Pit Blasts				0	0	0	0	0	0
7/03/2018	10:49	Granite					0	0	0	0	0	0
8/03/2018	13:37	Granite					0	0	0	0	0	0
13/03/2018	15:00	Granite					0	0	0	0	0.67	0.67
15/03/2018	16:56	Ignimbrite	0	2.98	0	0	Monitoring not required at these locations in Ignimbrite Pit Blasts					
20/03/2018	12:06	Granite	Monitoring not required at these locations for Granite Pit Blasts				0	0	0	0	0	0
22/03/2018	16:08	Granite					0	0	0	0	0	0
27/03/2018	15:40	Granite					0	0	0	0	0.56	0.56
April												
4/04/2018	13:18	Granite	Monitoring not required at these locations for Granite Pit Blasts				0	0	0	0	0.85	0.85
10/04/2018	14:02	Granite					0	0	0	0	0.78	0.78
11/04/2018	15:25	Granite					0	0	0	0	0	0
16/04/2018	15:43	Granite					0	0	0	0	1.02	1.02
18/04/2018	16:07	Granite					0	0	0	0	0	0
27/04/2018	14:34	Granite					0	0	0	0	0.6	0.6
27/04/2018	15:28	Granite					0	0	0	0	1.11	1.11
May												
9/05/2018	15:06	Granite	Monitoring not required at these locations for Granite Pit Blasts				0	0	0	0	0.65	0.65
10/05/2018	14:09	Granite					0	0	0	0	0	0
16/05/2018	15:31	Granite					0	0	0	0	1.12	1.12
17/05/2018	16:44	Granite					0	0	0	0	0	0
21/05/2018	15:43	Granite					0	0	0	0	0	0
22/05/2018	14:49	Granite					0	0	0	0	0	0
25/05/2018	14:36	Granite					0	0	0	0	0	0
29/05/2018	12:00	Granite					0	0	0	0	0.93	0.93
30/05/2018	14:53	Granite					0	0	0	0	0	0
31/05/2018	12:51	Granite					0	0	0	0	0.63	0.63
June												
7/06/2018	13:08	Granite	Monitoring not required at these locations for Granite Pit Blast				0	0	0	0	0.57	0.57
12/06/2018	14:45	Granite					0	0	0	0	0	0
19/06/2018	16:18	Granite					0	0	0	0	0	0
21/06/2018	12:27	Granite					0	0	0	0	0.52	0.52
22/06/2018	12:23	Granite					0	0	0	0	0	0
27/06/2018	11:28	Granite					0	0	0	0	0	0
28/06/2018	11:36	Granite					0	0	0	0	0	0
29/06/2018	15:49	Granite					0	0	0	0	0.58	0.58
July												
6/07/2018	14:00	Granite	Monitoring not required at these locations for Granite Pit Blast				0	0	0	0	1.02	1.02
9/07/2018	10:43	Granite					0	0	0	0	0	0
10/07/2018	11:29	Granite					0	0	0	0	0	0
11/07/2018	12:54	Granite					0	0	0	0	0	0
12/07/2018	12:00	Granite					0	0	0	0	0.8	0.8
13/07/2018	13:54	Granite					0	0	0	0	0	0
17/07/2018	10:17	Granite					0	0	0	0	0	0
18/07/2018	14:11	Granite					0	0	0	0	0.67	0.67
19/07/2018	14:08	Granite					0	0	0	0	0	0
24/07/2018	12:44	Granite					0	0	0	0	0.87	0.87
25/07/2018	12:53	Granite					0	0	0	0	0	0
26/07/2018	11:24	Granite					0	0	0	0	1.52	1.52
27/07/2018	14:34	Granite					0	0	0	0	0	0
30/07/2018	10:50	Granite					0	0	0	0	0	0
31/07/2018	14:24	Granite					0	0	0	0	0.75	0.75
August												
3/08/2018	12:41	Granite	Monitoring not required at these locations for Granite Pit Blast				0	0	0	0	0.75	0.78
7/08/2018	10:41	Granite					0	0	0	0	0.9	0.9
8/08/2018	11:26	Granite					0	0	0	0	0	0
10/08/2018	13:15	Granite					0	0	0	0	0	0
14/08/2018	11:48	Granite					0	0	0	0	0	0
17/08/2018	11:06	Granite					0	0	0	0	1.02	1.02
23/08/2018	13:10	Granite					0	0	0	0	0.76	0.76
27/08/2018	11:04	Granite					0	0	0	0	1.01	1.01
September												
4/09/2018	13:30	Granite	Monitoring not required at these locations for Granite Pit Blast				0	0	0	0	1.32	1.32
6/09/2018	12:33	Granite					0	0	0	0	0	0
10/09/2018	14:38	Granite					0	0	0	0	0.7	0.7
13/09/2018	12:57	Granite					0	0	0	0	0	0
18/09/2018	10:59	Granite					0	0	0	0	0.81	0.81
20/09/2018	12:38	Granite					0	0	0	0	0	0
25/09/2018	14:30	Granite					0	0	0	0	0.65	0.65
27/09/2018	11:10	Granite					0	0	0	0	0	0

October										
2/10/2018	14:13	Granite	Monitoring not required at these locations for Granite Pit Blast	0	0	0	0	0.99	0.99
4/10/2018	12:24	Granite		0	0	0	0	0.57	0.57
5/10/2018	12:24	Granite		0	0	0	0	0.64	0.64
9/10/2018	11:38	Granite		0	0	0	0	0	0
10/10/2018	11:44	Granite		0	0	0	0	0.66	0.66
11/10/2018	12:24	Granite		0	0	0	0	0.7	0.7
16/10/2018	13:46	Granite		0	0	0	0	0	0
17/10/2018	11:44	Granite		0	0	0	0	0	0
18/10/2018	12:02	Granite		0	0	0	0	0.72	0.72
23/10/2018	11:06	Granite		0	0	0	0	0.75	0.75
24/10/2018	11:04	Granite		0	0	0	0	0.7	0.7
25/10/2018	13:38	Granite		0	0	0	0	1.26	1.26
27/10/2018	12:24	Granite		0	0	0	0	0.58	0.58
30/10/2018	12:44	Granite		0	0	0	0	0	0
November										
2/11/2018	15:33	Granite	Monitoring not required at these locations for Granite Pit Blast	0	0	0	0	1.06	1.06
6/11/2018	12:06	Granite		0	0	0	0	0.88	0.88
7/11/2018	13:21	Granite		0	0	0	0	0.54	0.54
9/11/2018	11:03	Granite		0	0	0	0	0.73	0.73
13/11/2018	11:01	Granite		0	0	0	0	1.46	1.46
14/11/2018	13:22	Granite		0	0	0	0	0.88	0.88
15/11/2018	11:52	Granite		0	0	0	0	0	0
16/11/2018	13:06	Granite		0	0	0	0	0.58	0.58
20/11/2018	12:12	Granite		0	0	0	0	0.76	0.76
22/11/2018	12:43	Granite		0	0	0	0	0.69	0.69
23/11/2018	10:28	Granite		0	0	0	0	0	0
27/11/2018	12:02	Granite		0	0	0	0	0	0
28/11/2018	12:53	Granite		0	0	0	0	1.11	1.11
30/11/2018	13:15	Granite		0	0	0	0	0.8	0.8
December										
4/12/2018	11:29	Granite	Monitoring not required at these locations for Granite Pit Blast	0	0	0	0	1.1	1.1
5/12/2018	10:05	Granite		0	0	0	0	0	0
6/12/2018	14:07	Granite		0	0	0	0	0.75	0.75
7/12/2018	12:40	Granite		0	0	0	0	0.74	0.74
11/12/2018	12:58	Granite		0	0	0	0	0.56	0.56
12/12/2018	12:21	Granite		0	0	0	0	0.65	0.65
13/12/2018	11:33	Granite		0	0	0	0	0.69	0.69
17/12/2018	12:51	Granite		0	0	0	0	1.53	1.53
19/12/2018	13:21	Granite		0	0	0	0	0.7	0.7