Strength. Performance. Passion

Holcim

ANNUAL REVIEW
1 January 2020 – 31 December 2020

Dunloe Sand Quarry

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SITE DETAILS

Name of operation	Dunloe Sand Quarry
Name of operator	Holcim (Australia) Pty Ltd
Project Approval	Project Approval 06 - 0030
Name of holder of Project Approval	Holcim (Australia) Pty Ltd
Annual review start date	January 1, 2020
Annual review end date	December 31, 2020

I, **Phillip Messenger**, certify that this audit report is a true and accurate record of the compliance status of the **DUNLOE SAND QUARRY** for the period of **1 JANUARY 2020 - 31 DECEMBER 2020** and that I am authorised to make this statement on behalf of **HOLCIM (AUSTRALIA) PTY LTD**.

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 authorised reporting officer	Phillip Messenger
Title of authorised reporting officer	Quarry Manager
Signature of authorised reporting officer	
Date	30/03/2021

1 STATEMENT OF COMPLIANCE

The statement of commitments for the 2019 reporting period for the Dunloe Sand Quarry is provided in **Table 1. Table 3** details the non-compliances of Project Approval (PA) 06-0030 identified within the 2020 reporting period, with the compliance status key provided in **Table 2**.

Table 1: Statement of Commitments

Were all conditions of the relevant approval(s) complied with?	
PA 06_0030	NO - see Table 3 for further details.
EPL 13077	YES

Table 2: DPIE Compliance Status Key

Risk level	Colour code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless of the 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
Admin NC	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 conditions)

Table 3: Non-Compliances of PA 06-0030 for 2020

Relevant approval	Condition	Condition Description	Compliance Status	Section addressed in Annual Review
PA 06_0030	Schedule 3 Condition 18	**Water Management and Monitoring** The Proponent must prepare a Soil and Water Management Plan for the project to the satisfaction of the Secretary. This plan must: b) include a: • Blue-Green Algae Management Plan • Surface Water Monitoring Program The Proponent must implement the plan as approved by the Secretary.	Low Risk Non-Compliant	**Section 7 Water Management** Full Vertical Profile Water Sampling Program missing some results from the monitoring program outlined within the *Soil and Water Management Plan*. January and February sampling of total algae count and total bio volume not undertaken as per the Blue – Green Algae Management Program (Component of the EMS and Soil and Water Management Plan). These missed sampling events were the result of miscommunications with monitoring contractors. This has been resolved by Holcim with a change in monitoring contractors.

2 INTRODUCTION

The Dunloe Sand Quarry was granted Project Approval (PA06_0030) on 24 November 2008, with subsequent modifications to this approval granted on 28 August 2009 (Mod 1) and 6 November 2018 (Mod 2).

The Dunloe Sand Quarry operations are located approximately 4.5 km south-southwest of Pottsville on the Pottsville Mooball Road, New South Wales (NSW). The site is located adjacent to Mooball Creek, and is approximately 4 km upstream of the creek mouth. Surrounding properties are currently used for agricultural purposes including sugar cane farming and grazing.

Figure 1: Aerial view of the Dunloe Sand Quarry located at Dunloe Park, Pottsville (Source: Near maps November 2019).

Figure 2: Site Location and Layout (Source GHD: 2017)

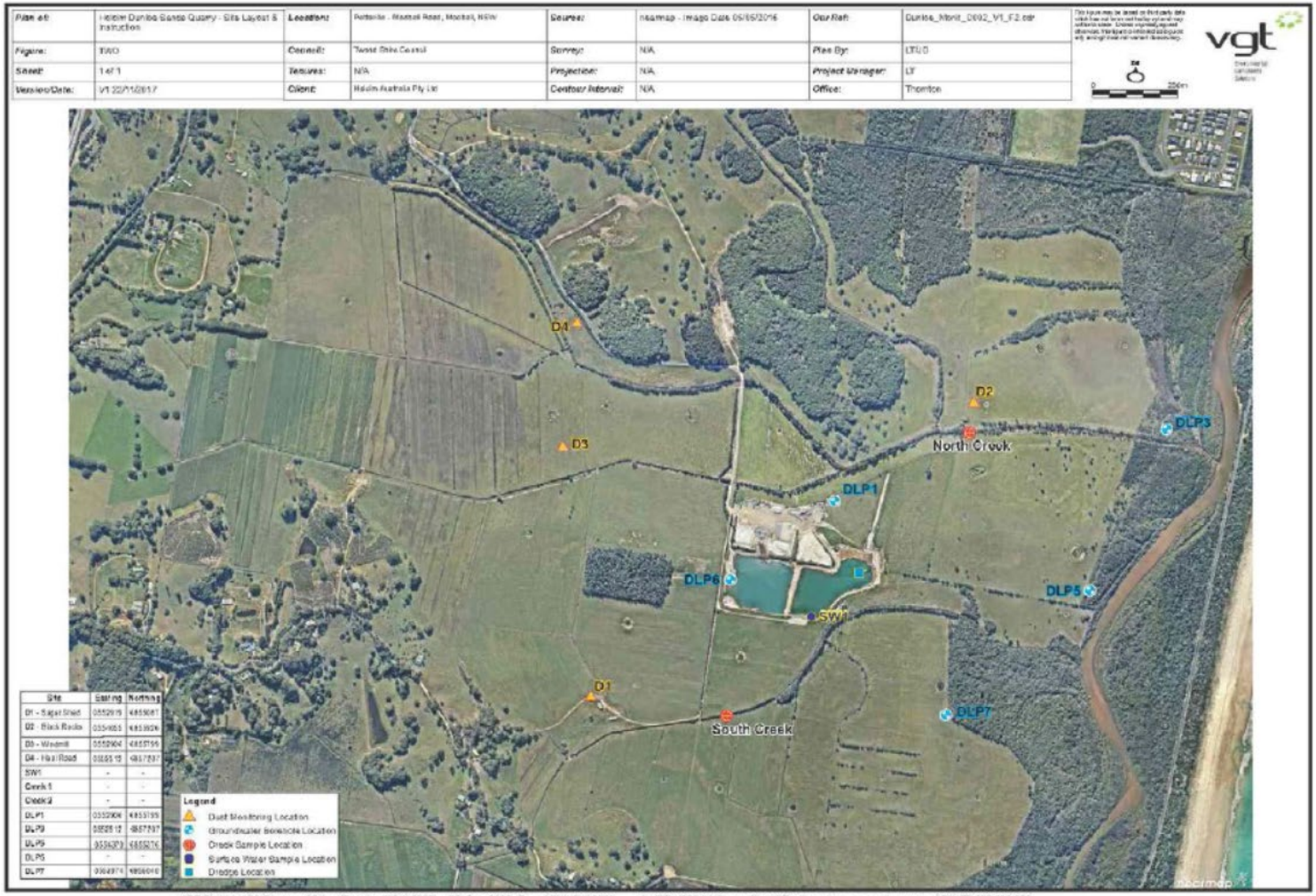

Figure 3: Environmental Monitoring Locations (Source: VGT)

Holcim commenced operations on the site on August 1, 2016 with all previous responsibilities falling under the management of Ramtech Pty Ltd (Ramtech). Ramtech have previously been responsible for the commencement and operation of the site since Project Approval was granted in 2007.

In accordance with Schedule 5, Condition 5 of the modified Project Approval (PA 06_0030) the site is required to undertake an Annual Review of the site in accordance with the conditions provided in **Table 4.**

Table 4: Annual Review Requirements

Condition	Section Addressed in Annual Review
5. ANNUAL REVIEW *Within 12 months of the date of this approval, and annually thereafter, the Proponent shall submit an Annual Review to the Secretary and relevant agencies. This report must:*	
a) identify the standards and performance measures that apply to the project;	Section 4 and 6
b) describe the works carried out in the last 12 months;	Section 4 and 6
c) describe the works that will be carried out in the next 12 months;	Section 13
d) include a summary of the complaints received during the past year, and compare this to the complaints received in previous years;	Section 9.3
e) include a summary of the monitoring results for the project during the past year;	Section 6 and 7
f) include an analysis of these monitoring results against the relevant: *• impact assessment criteria/limits;* *• monitoring results from previous years; and* *• predictions in the documents listed in condition 2 of Schedule 2.*	Section 6 and 7
g) identify any trends in the monitoring results over the life of the project;	Section 6 and 7 Appendix 2
h) identify any non-compliance during the previous year; and	Section 6, 7 and 11
i) describe what actions were, or are being, taken to ensure compliance.	Section 6, 7 and 11

This Annual Review has also been prepared in accordance with the *Annual Review Guideline: Post-approval requirements for State significance mining developments* (October 2015). This report documents the environmental performance of the site from 1 January to 31 December 2020.

2.1 Name and Contact Details

The key contact details for the site are outlined below:

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3 APPROVALS

The site operates under the approvals listed in **Table 5.**

Table 5: Approvals for the Dunloe Sand Quarry Operations

Approval	Regulatory Authority
PA 06_0030	NSW Department of Planning, Industry & Environment (DPIE)
EPL No. 13077	NSW Environment Protection Authority (EPA)
Bore Licence 30BL183076, 30BL183077, 30BL183078, 30BL183079, 30BL183080, 30BL183081, 30BL183082, 30BL183084 and 30BL183086	NSW Department of Industry - Water

Holcim holds Environment Protection Licence **(EPL) 13077** which covers its activities at the Dunloe Sand Quarry. **Table 6** outlines these licensing limits.

Table 6: EPL Fee-Based Activity at the Dunloe Sand Quarry

Scheduled Activity	Fee Based Activity	Scale
Extractive Activities	Land-based extractive activity	>100,000 – 500,000 T annual capacity to extract, process or store

3.1 Management Plan Approvals

The following Management Plans were updated and approved in the 2020 Annual Review period:

- Noise Management Plan (Dated July 2020);
- Environmental Management Strategy (Dated January 2020);
- Air Quality Management Plan (Dated February 2020);
- Soils and Water Management Plan (Dated October 2020); and
- Waste Management Plan (Dated July 2020).

All Management Plans listed above were approved by DPIE in November 2020 and have since been implemented at Dunloe Sand Quarry.

4 OPERATIONS SUMMARY

4.1 Exploration

There was no exploration undertaken at the Dunloe Sand Quarry during the Annual Review period.

4.2 Land Preparation

There was no land clearing in this report period.

4.3 Construction Activities

There were no construction activities undertaken at the Dunloe Sand Quarry during the 2020 reporting period.

4.4 Quarry Operations

The Dunloe Sand Quarry officially commenced operations under Holcim on August 1, 2016.

Activities undertaken in 2020 included:

- Stripping of topsoil and overburden within the existing extraction limit boundary;
- Load and haul activities;
- Washing, screening and stockpiling of product;
- Overburden removal and stockpiling;
- Maintenance of rehabilitation undertaken in the north and eastern areas of the site; and
- Load out and sales of topsoil, brickies loam and concrete sands to the local market.

Operating hours in 2020 were undertaken between 7am to 5pm, Monday to Friday and 7am-12pm on Saturdays. These timeframes were applied for all operations on-site with no works occurring outside the approved operating hours. All activities took place within the approved operating hours in 2020.

Table 7 includes a summary of the operations undertaken during the reporting period against the Project Approval conditions regarding product transported from the Dunloe Sand Quarry.

Table 7: Total Product Distributed (Dunloe Sand Quarry)

Material	Approval Limit (Tonnes/Annum)	2018 Reporting Period (Tonnes)	2019 Reporting Period (Tonnes)	2020 Reporting Period (Tonnes)
Product Distributed-Total	300,000	174,583	186,280	156,918

The total production volume in 2020 was within the approved limits.

4.5 Next Reporting Period

Development activities proposed at the Dunloe Sand Quarry in 2021, include:

- Stripping of topsoil and overburden within the existing extraction limit boundary;
- Load and haul activities;
- Washing, screening and stockpiling of product;
- Overburden removal and stockpiling;
- Maintenance of rehabilitation undertaken north eastern area; and
- Load out and sales of topsoil, brickies loam and concrete sands to the local market.

The site also plans on extending the dredge area in the next reporting period. No other exploration, land preparation, construction, or other operations are proposed to be undertaken in 2021.

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

5.1 Actions from 2019 Annual Review – DPIE Actions

DPIE reviewed the 2019 Annual Review and provided an approval letter to Holcim on 23 March 2020. This letter addressed three main concerns which were relating to:

- administrative reporting of non-compliance incidences;
- exceedances in the water quality and Blue-Green Algae monitoring programs; and
- timely updates of the quarterly complaints register on the project website.

5.2 Actions from 2019 Annual Review – Holcim Proposed Actions

Table 8 outlines the proposed actions for 2020 and the works undertaken in this period.

Table 8: Actions Proposed for 2020 - Holcim

Action from Previous Annual Review	Works Undertaken	Section
Ensure water quality monitoring is completed in accordance with the Environmental Management Strategy.	Environmental Management Strategy and Water Management Plan updated in the report period.	Section 7
Ensure dust monitoring is completed in accordance with the Environmental Management Strategy.	Air quality monitoring for depositional dust and PM_{10} was undertaken during 2020.	Section 6.3
Conduct fauna box monitoring annually.	Biodiversity or rehabilitation monitoring including fauna box monitoring was conducted in 2020.	Section 8

6 ENVIRONMENTAL PERFORMANCE

6.1 Meteorological Monitoring

Condition M4 of the EPL requires the installation of a rainfall depth measuring device for Dunloe Sands Quarry. This meteorological station was installed in February 2020. Data from this station was used to guide daily operations at the site, including those related to noise and dust impacts. Due to the absence of January 2020 data collected from the on-site station, this report uses 2020 weather data collected from the Bureau of Meteorology's Ballina Airport station. These meteorological results are presented in **Table 9**.

Holcim continues to improve meteorological monitoring in consultation with Ramboll.

Table 9: Meteorological Monitoring Results 2020 (Ballina Airport AWS, station 058198)

Month	Total Rainfall (mm)	Minimum Temperature (°C)	Maximum Temperature (°C)
January	24.62	20.4	34.4
February	668.0	18.9	34.5
March	85.2	12.7	32.0
April	95.8	10.3	32.6
May	230.8	8.9	25.1
June	139.8	7.6	24.5
July	174.8	2.9	24.5
August	55.0	3.6	25.6
September	45.8	5.0	28.2
October	88.8	10.0	29.0
November	38.2	13.0	31.7
December	382.2	15.7	32.2
Annual TOTAL	2029.02		

6.2 Noise

6.2.1 EIS Predictions

The EIS (2007) stated that based on noise modelling the operations within the south west corner of the southern extraction pond (stage 2) may generate levels which exceed the relevant noise impact requirements.

The EIS (2007) stated that to mitigate this minor impact, the dredge is to have acoustical treatment when operating within the southern extraction pond.

6.2.2 Approved Criteria

In accordance with Schedule 3, Condition 2 of PA 06_0030, the approved noise criteria for the Dunloe Sand Quarry are outlined in **Table 10.**

Table 10: Noise Impact Criteria for the Dunloe Sand Quarry (PA 06_0030)

2. The Proponent must ensure that the noise generated by the project does not exceed the criteria in Table 1 at any residence on privately-owned land.

Table 1: *Noise Impact Assessment Criteria*

Receiver Location	***Day LAeq (15 min) dB(A)***
R6 and R7	42
R8	48
All other residences	41

Noise generated by the project must be monitored and measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the NSW Noise Policy for Industry *(EPA, 2017).*

The noise criteria in Table 1 do not apply if the Proponent has an agreement with the owner/s of the relevant residence or land to exceed the noise criteria, and the Proponent has advised the Department in writing of the terms of this agreement.

6.2.3 Key Environmental Performance

Attended noise monitoring was undertaken quarterly at the Dunloe Sand Quarry in 2020 by Muller Acoustic Consulting (MAC) on the following dates:

- 30th January 2020;
- 15th May 2020;
- 8th September 2020; and
- 25th November 2020.

The compliance assessments for each residential receiver (R1, R2, R3, R4, R6, R7, and R8) are presented in **Table 11**. MAC measured at receivers R1, R2, R3, and R4 for quarters 1 and 2 of 2020 in accordance with the Dunloe Sands Noise Management Plan (2016), EPA's Noise Policy for Industry (2017), and Australian Standard AS 1055:2018. From September 2020, MAC began measuring at receivers R6, R7, and R8 to satisfy the commitment to monitor at these locations for two years following the approval of the Dunloe Sand Noise Management Plan (2020). Results at R1, R2, and R3 in quarter 3 and 4 2020 are not shown in **Table 11** due to not being required from the Noise Management Plan (2020).

The assessments identified that noise emissions generated by the Dunloe Sand Quarry were compliant with relevant statutory noise criteria specified in the Project Approval on all occasions at all assessed residential receivers. Copies of the quarterly noise monitoring reports for 2020 are attached as **Appendix 1**.

Table 11: Noise Monitoring Assessment for the Dunloe Sand Quarry (MAC, 2020)

Assessment Period	Receiver No.	Quarrying Noise Criteria LAeq(15min)	Q1 January 2020		Q2 May 2020		Q3 September 2020		Q4 November 2020	
			Quarry Noise Contribution LAeq(15min)	Compliant	Quarry Noise Contribution LAeq(15min)	Compliant	Quarry Noise Contribution LAeq(15min)	Compliant	Quarry Noise Contribution LAeq(15min)	Compliant
Day	R1	41	<30	✓	<30	✓	-	-	-	-
	R2	41	<40	✓	<30	✓	-	-	-	-
	R3	41	<40	✓	<30	✓	-	-	-	-
	R4	41	<30	✓	<30	✓	-	-	-	-
	R6	42	-	-	-	-	<30	✓	<35	✓
	R7	42	-	-	-	-	<30	✓	<35	✓
	R8	48	-	-	-	-	<30	✓	<40	✓

Long-term Trends:

Noise monitoring completed over several years for this project has generally been inaudible and within criteria. This trend continued for noise monitoring in 2020.

Comparison to EIS Predictions:

As noise levels were within criteria in 2020, results were within the EIS predictions.

6.2.4 Management Measures

Management measures relating to noise are outlined within the Dunloe Sand *Environmental Management Strategy* (2020) and the *Noise Management Plan* (2020). These include:

- Restriction of operation hours of the Dunloe Sand Quarry to Monday to Friday 7.00 am to 5.00 pm and Saturday 7.00 to 12.00 pm;
- No work on Sundays or Public Holidays;
- All trucks to be well maintained and fitted with residential mufflers;
- Acoustic testing at commencement of quarry operations to ensure compliance with noise limit criteria;
- Dredge to be fitted with suitable mufflers if noise limit criteria is exceeded;
- Trucks to be limited to a speed of 25km/h on internal roads;
- Prescribed buffer zones around the extraction ponds to be planted and maintained;
- Cessation of excessively noisy activities during unfavourable meteorological conditions (refer to EPA's 2017 *NSW Noise Policy for Industry*); and
- Signage at the entrance of the site detailing a phone number and permanent site contact to ensure noise complaints are received and addressed in a timely manner.

6.2.5 Proposed Improvements

Since the *Dunloe Sand Noise Management Plan* was modified and approved in this reporting period, there are no proposed improvements regarding noise management for 2021. However, Dunloe Sand Quarry is committed to continuing to identify areas of improvement within noise management procedures.

6.3 Air Quality

6.3.1 EIS Predictions

The EIS (2017) Executive Summary states the following:

Airborne particulate matter concentrations and dust deposition from the proposed development were predicted to exceed the relevant requirements prescribed by the Office of Environment and Heritage (OEH) at three of the eight monitoring locations.

In particular, exceedances are expected as a result of dust generated from the use of unsealed access roads by haul vehicles. In order to meet prescribed requirements, proposed dust controls include sealing of the entire internal roadway length, planting of a vegetated buffer along the southern boundary adjoining Warwick Park Road and the proposed outbound internal road.

6.3.2 Approved Criteria

Air Quality monitoring conducted at Dunloe Sand Quarry is compared to the monitoring criteria stipulated in PA 06-0030 and listed in **Table 12, Table 13** and **Table 14.**

Table 12: Long Term Impact Assessment Criteria for Deposited Dust

Pollutant	Averaging Period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited Dust	Annual	2 g/m^2/month	4 g/m^2/month

Table 13: Short Term Impact Assessment Criteria for Particulate Matter

Pollutant	Averaging Period	Criterion
Particulate Matter < 10 µm (PM_{10})	24 Hour	50 µg/m^3

Table 14: Long Term Impact Assessment Criteria for Particulate Matter

Pollutant	Averaging Period	Criterion
Total suspended particulate (TSP) matter	Annual	90 µg/m^3
Particulate Matter < 10 µm (PM_{10})	Annual	30 µg/m^3

6.3.3 Key Environmental Performance

6.3.3.1 Depositional Dust

Dust deposition monitoring was undertaken at 4 locations during the 2020 reporting period (see **Table 15**).

Table 15: 2020 Dust Monitoring (Depositional Dust) at Dunloe Sand Quarry

Sample Date	Insoluble Solids (g/m^2/month)			
	Haul Road DDG 1	Wind Mill DDG 2	Sugar Shed DDG 3	Black Rock DDG 4
17/01/2020	2.3	2.5	1.3	NS
14/02/2020	0.3	NS	NS	NS
18/03/2020	0.4	6.1*	0.5*	5.4*
16/04/2020	1	0.6	0.5	0.6
14/05/2020	2	3.6	0.3	0.6
11/06/2020	0.1	0.9	0.3	2.5*
9/07/2020	0.1	2.1	0.2	4
10/08/2020	1.4	0.7	0.2	3
10/09/2020	0.5	0.6	0.7	0.8
8/10/2020	0.5	0.4	1	7.7
9/11/2020	1.1	1.6	0.4	3
10/12/2020	1	NS	0.4	3.8
Minimum	0.1	0.4	0.2	0.6
Maximum	2.3	3.6	1.3	7.7
Annual Average	**0.89**	**1.44**	**0.53**	**2.94**
Result (compared against 4g/m^2/month)	**Within Criteria**	**Within Criteria**	**Within Criteria**	**Within Criteria**

*Note: Samples with * are contaminated and are not included in the calculation of the annual average. NS stands for No Sample.*

All four monitoring points were found to be well below the annual average (4g/m^2/month) and in compliance with the Project Approval.

Some sampling events at DDG2, DDG3, and DDG4 in January and February were not performed due to a miscommunication in sampling requirements during the transfer of the Holcim environmental monitoring contract from the previous contractor to the current.

Contamination occurred at 3 of the monitoring gauges – Black Rock, Sugar Shed, and Wind Mill. This was most often caused by insects and water entering the gauge funnel. Elevated samples, as seen at DDG4 (Black Rock) in October, are suspected as being highly impacted by agricultural activity on neighbouring properties rather than a reflection of dust emissions from site. Sampling did not occur (NS) when equipment was faulty. For example, a broken funnel prevented a sample being collected at DDG 2 (Wind Mill) for December 2020.

A comparison of results from 2016 - 2020 has been undertaken in **Table 16**.

Table 16: Depositional Dust Monitoring Summary (2016-2020)

Dust Depositional Gauge	Monitoring Summary for Annual Review Period	Monitoring Period				
		2020	2019	2018	2017	2016
		(g/m^2/month)				
DDG1	Min. Insoluble Solids	0.1	0.1	0.1	0.1	0.13
	Max. Insoluble Solids	2.3	1.8	2.7	0.8	0.8
	Insoluble Solids Reporting Period Average	0.89	0.7	0.6	0.4	0.4
DDG2	Min. Insoluble Solids	0.4	0.2	0.1	<0.1	0.4

Dust Depositional Gauge	Monitoring Summary for Annual Review Period	Monitoring Period				
		2020	2019	2018	2017	2016
		(g/m^2/month)				
	Max. Insoluble Solids	3.6	1.8	0.7	0.9	4.7
	Insoluble Solids Reporting Period Average	1.44	0.6	0.31	0.32	1.23
DDG3	Min. Insoluble Solids	0.2	0.2	0.1	0.2	0.2
	Max. Insoluble Solids	1.3	1.6	1.6	2.4	1.6
	Insoluble Solids Reporting Period Average	0.53	0.6	0.8	0.8	0.5
DDG4	Min. Insoluble Solids	0.6	0.2	0.1	<0.1	0.3
	Max. Insoluble Solids	7.7	1.8	0.7	0.9	1.6
	Insoluble Solids Reporting Period Average	2.94	0.9	0.4	0.4	0.6

The 2020 results for the annual average decreased for DDG3 (Sugar Shed) but increased at the other locations when compared against 2019 results. All gauges remained below the annual average criteria of 4 g/m^2/month. Some gauges were affected by contamination; however this information was not outlined in laboratory results. This would likely cause increases to some of the gauges.

Long-term Trends:

The annual average depositional dust levels recorded in the 2020 reporting period at DDG1, DDG2, and DDG3 are generally consistent with those recorded in 2016-2019. There is an emerging trend at DDG1 of gradually increasing insoluble solids with this likely due to contamination in gauges. Annual averages for depositional dust were well below the Project Approval criteria.

Comparison to EIS Predictions:

Most results for depositional dust were below the predicted limits of the EIS predictions (see **Section 6.3.1**). However, the maximum increase in deposited dust level (2 g/m^2/month) from 2019 to 2020 was exceeded which does not meet the EIS predictions.

6.3.3.2 PM_{10} Monitoring

PM_{10} monitoring is required to be undertaken in accordance with the criteria provided in **Table 13** and **Table 14.**

During 2016, the DPIE advised Holcim of the requirement to undertake monitoring at the Dunloe Sand Quarry, unless changes were made to the site *Air Quality Management Plan*.

The updated *Dust Monitoring Program*, proposing PM_{10} monitoring only be required once extraction on the site exceeded 200,000 tonnes per annum, was submitted to the DPIE for approval on 23 October 2016. During this time, Holcim worked to procure a mobile PM_{10} monitor whilst an updated management plan was under review by DPIE.

On 15 November 2016, Holcim received what was mistakenly understood by the former Holcim Planning & Environment Coordinator, to be approval of the *Dust Monitoring Program*, subject to the comment from DPIE being noted and complied with. This happened prior obtaining the mobile PM_{10} monitor on site.

Holcim provided DPIE a letter on 22 September 2017 detailing the reasons behind the site's failure to monitor PM_{10}. Holcim were issued with an Official Caution from DPIE on 4 October 2017.

In 2018, PM_{10} monitoring was completed from 1 January 2018 until 18 July 2018.

It should be noted that with the revision and approval of the *Dust Monitoring Program* by the DPIE on 27 July 2018, Holcim is no longer required to monitor for PM_{10} unless the annual production rates increase to 200,000 tonnes or above.

Annual production remained below 200,000 tonnes per annum in 2020 (production was 156,918t in 2020), therefore no PM_{10} monitoring was undertaken. This was also the case in the 2019 reporting period, with production at 165,562 tonnes. Regardless of production volumes, the site has maintained dust suppression measures throughout the reporting period in accordance with the requirements of the EMS.

Long-term Trends

Trends relating to PM_{10} monitoring are outlined in **Table 17.**

Table 17: PM_{10} Monitoring Trends

Monitoring Summary for Annual Review Period	Monitoring Results 2020 Period (µg/m^3)	Monitoring Results 2019 Period (µg/m^3)	Monitoring Results January – July 2018 Period (µg/m^3)	Monitoring Results November and December 2017 Period (µg/m^3)
PM_{10} Reporting Period Average	NS	NS	24.9	10.97
Max. PM_{10}	NS	NS	125	35.9
Min. PM_{10}	NS	NS	2	1.2

NS – Not Sampled

6.3.4 Management Measures

Management measures relating to air quality are outlined within the *Dunloe Sand Quarry Environmental Management Strategy* and *Air Quality Management Plan*, which were updated in this 2020 reporting period. These measures include:

- Sealing access and egress road from the Quarry to Pottsville Road;
- The wheel shaker screen is to be utilised by all traffic leaving the quarry;
- The route for trucks within the quarry will be wet down daily by a water sprinkler/spray system;
- Additional vegetation rehabilitation areas throughout the site contributing as a buffer to Mooball Creek and surrounding areas;
- Loaded trucks will be covered before exiting the site;
- Dust that is transported onto the access road immediately outside the active quarry area will be removed from the road at least once per month using a local street sweeper;
- Visual daily inspections of all stockpiles will be undertaken to ensure that dust emissions do not occur;
- Visual review of exposed areas, and whether these areas are generating dust, should be undertaken daily;
- Dust generation is generally limited to freshly disturbed areas. To facilitate dampening, a portable hose or water spray/sprinkler system has been installed. The system installed is capable of servicing the entire site;
- Topsoil will not be stripped during windy weather conditions; and
- Six monthly audits of dust levels are to be undertaken by management.

6.3.5 Proposed Improvements

Dunloe Sand Quarry continued to complete management measures and monitoring in accordance with the updated *Air Quality Management Plan*, *Environmental Management Strategy*, and Project Approval requirements. There are two proposed improvements:

- Laboratory results should outline when contamination occurs for depositional dust gauges; and
- Improvements to ensure depositional dust monitoring occurs monthly.

6.4 Traffic Management

6.4.1 EIS Predictions

The proposed operational times outlined within the EIS are outlined below:

Table 18: Estimated Operational Times, Periods and Truck Movements (EIS 2007)

Yearly Operation	Days Per Week	Hours per Week	Daily Times Operating	Truck Movements per Hour
50 weeks/year	5.5	46	Mon-Fri: 7:30am -5:00pm Sat: 7:30am -12:30pm	4

6.4.2 Approved Criteria

As per the Project Approval (Schedule 3 Condition 3), operations will be conducted Monday to Saturday. No operations are to be undertaken on Sunday or public holidays.

Table 19: Operational Times, Periods and Truck Movements

Yearly Operation	Days Per Week	Hours per Week	Daily Times Operating	Truck Movements per Hour
52 weeks/year	5.5	55	Mon-Fri: 7:00am -5:00pm Sat: 7:00am -12:00pm	24*

** Not to exceed more than 24 heavy vehicle movements (in and out) per hour*

Truck speeds are limited to a maximum of 40km/hr within the site, with internal roads signposted to a 25-30km/h speed limit.

6.4.3 Key Environmental Performance

Holcim was notified during due diligence activities by representatives of Ramtech that operations prior to the acquisition by Holcim were based on a maximum of 8 movements per hour (i.e. – 8 trucks in, 8 out). The DPIE compliance team corrected this to Holcim on October 20, 2016, outlining that the site was only allowed 4 movements per hour (i.e. – 4 trucks in, 4 out).

Holcim operated in accordance with DPIE's advice until an application to modify this condition to allow for greater flexibility was approved in November 2018. Schedule 2 Condition 8 of Mod 2 Project Approval extends truck movements to 24 movements per hour (12 trucks per hour).

Daily records of truck movements are recorded by Holcim.

6.4.4 Management Measures

Management measures relating to transport management are outlined within the *Dunloe Sand Quarry Environmental Management Strategy (2020)* and the *Traffic Management Plan (2019)*, including:

- Construction of a dedicated haulage road (sealed) to provide vehicular access between the sand extraction area and Pottsville-Mooball Road;
- Average truck movements limited to 24 movements per hour (24 in, 24 out);
- All vehicles to observe speed limits for public roads;
- No trucks are to leave the site via Warwick Park Road;
- Appropriate advisory signage placed on public roads to notify of trucks entering Pottsville – Mooball Road;
- Appropriate relevant advisory signage placed along the haulage road (especially approaches to the intersections with Kelleher's Road and Pottsville – Mooball Road);
- Truck speed on the internal roads is to be limited to a maximum of 40km/h;
- All loaded vehicles entering or leaving the site are to have their loads covered; and
- Holcim shall ensure that all loaded vehicles leaving the site are cleaned of materials that may fall on the road before they leave the site.

6.4.5 Proposed Improvements

There are no proposed changes to transport management. Truck movements will continue to be monitored and recorded in the oncoming reporting period to ensure that they remain within the approved criteria.

6.5 Biodiversity

6.5.1 EIS Predictions

As part of the EIS (2007), a number of threatened species were identified within the surrounding vegetated areas of the site with none being found, or expected to occur, within the previously disturbed areas of the site (including proposed extraction areas).

Rehabilitation and revegetation measures proposed will provide improved flora and fauna links, additional food resources for identified threatened species, improved opportunities for breeding through the installation of breeding boxes and other benefits associated with visual screening and the like.

No clearing of vegetation is required in respect of the proposal, inclusive of haulage routes and operational areas. There is no proposed clearing for 2021.

6.5.2 Approved Criteria

There are no specific criteria associated with biodiversity management for the site. Activities need to be completed in accordance with the EIS.

6.5.3 Key Environmental Performance

There were no biodiversity issues identified during the Annual Review period. An area was stripped of grass in 2020 but no other clearing occurred. No weed spraying occurred in 2020.

Biodiversity and rehabilitation monitoring was undertaken throughout 2020 as per the *Landscape Management Plan* (2019) and Project Approval. Routine rehabilitation monitoring occurred at each rehabilitation zone and investigated site conditions, forest structure, floristic composition, and fauna nest boxes. Site weeds, fire management, biodiversity, and general management were also assessed. The main findings were that no vegetation regeneration performance criteria were exceeded, all fences were in good condition, weeds continue to put pressure on native species, and the use of fauna nest boxes by fauna was limited.

6.5.4 Management Measures

Management measures relating to biodiversity are outlined in the *Dunloe Sand Quarry Rehabilitation and Revegetation Management Plan,* the *Dunloe Sand Vegetation Management Plan*, and the *Environmental Management Strategy* (2020). These include:

- Detailed clearing protocol as per Section 5.1 of the *Dunloe Sand Quarry Rehabilitation and Revegetation Management Plan;*
- Weed management;
- Installation of next boxes; and
- Rehabilitation/Ecological monitoring as per the *Dunloe Sand Quarry Environmental Monitoring Program* (2019).

6.5.5 Proposed Improvements

The implementation of commitments within the *Dunloe Sand Quarry Rehabilitation and Revegetation Management Plan*, the *Dunloe Sand Vegetation Management Plan*, and the updated *Environmental Management Strategy (2020*) will continue to occur in the 2021 report period. Biodiversity management measures as well as the maintenance of existing fauna nest boxes will continue in 2021.

6.6 Heritage

6.6.1 EIS Predictions

A heritage assessment focusing on both Aboriginal and non-Aboriginal heritage was completed for the EIS (2007). An area of potential Aboriginal heritage significance was cordoned off.

6.6.2 Approved Criteria

There are no specific criteria associated with heritage relating to the project.

6.6.3 Key Environmental Performance

There were no issues relating to Aboriginal and historic heritage during the reporting period. An area suspected of Aboriginal heritage significance was reviewed in 2018 with the assistance of Aboriginal Groups. It was not found to be an area of heritage significance. No quarrying activity occurred in 2020 in this area. Excavations in 2018 and 2019 were conducted in accordance with Condition 32(c) of Schedule 3 of the development consent. No Aboriginal objects or places were identified in these activities as is reported in the *Aboriginal Cultural Heritage Assessment Report – Dunloe Sand Quarry, Pottsville, NSW* (RPS 2019).

The *Dunloe Sand Quarry Aboriginal Cultural Heritage Management Plan* was updated in December 2019 and implemented in this report period.

6.6.4 Management Measures

Management measures relating to heritage are outlined within the *Dunloe Sand Quarry Aboriginal Cultural Heritage Management Plan*. These include:

- Training of all staff and contractors through the induction process;
- Detailed excavation strategy and control of any finds; and
- Procedure for impacts of unexpected finds.

6.6.5 Proposed Improvements

There are no proposed improvements to heritage management in 2021.

6.7 Acid Sulphate Soils Management and Management of Fines

Holcim undertakes fines management in accordance with Schedule 3 of Conditions 10 and 11, Project Approval 06_0030, in the following manner:

> *10. The Proponent shall ensure that all excavated potential acid sulfate soil fines material is returned back to below the water table as soon as possible to prevent oxidation. No potential acid sulfate soil shall be removed from the site, unless adequately neutralised in accordance with methods approved under the Soil and Water Management Plan.*
>
> *11. The Proponent shall ensure that all potential acid sulfate soil fines material is discharged into the pond at a depth of no less than 3 metres from the water surface, and that all fines are deposited to a final depth of at least 8 metres from the water surface, unless an alternative method(s) is approved by OOW and the Director-General.*

Under the operation of Holcim, the site has undertaken a number of improvement works to ensure the effective management of **Acid Sulphate Soils (ASS) and Potential Acid Sulphate Soils (PASS)** during extraction, processing and sales operations. Details of specific management measures are outlined below.

6.7.1 Acid Sulphate Soils Sampling

Holcim undertakes acid sulphate soils sampling in advance of extraction. A sand core drilling program was undertaken in 2016, in accordance with the site's Environmental Management Plan (EMP), for an area of extraction required for the following 2-3 years. The drilling program was developed and undertaken in line with the following activities:

1. A minimum of 2 sand cores are drilled per hectare;

2. All samples are sent to Soil Surveys Australia Pty Ltd for immediate testing in accordance with the ASSMAC Guidelines;

3. Soil Surveys Australia Pty Ltd (NATA Accredited lab) test results provided a volume per m^2 for lime to be seeded across each hectare before stripping takes place;

4. Lime was spread across the reserve and then stripped to expose the loam and sand product; and

5. Stockpiled topsoil is tested by a NATA accredited laboratory to confirm there is no presence of PASS.

The ongoing management of acid sulphate soils during extraction in the sampled area is undertaken in accordance with the site's EMS and Acid Sulfate Soil Management Plan (2020). Further to the 2016 monitoring program, acid sulphate soils monitoring was completed in 2020 in accordance with Acid Sulfate Soil Identification and Treatment procedures. Monitoring was incorporated into the ecological monitoring program in 2020. It was found that there was no impact on the site as a result of the project in 2020.

6.7.2 Extraction

Excavation of loam, dredging and washing activities is undertaken in accordance with the EMS and has been developed in line with the following activities:

1. Excavated loam is stockpiled and tested by NATA accredited laboratory to confirm there is no presence of PASS;

2. In the event that PASS is present in loam stockpiles a NATA accredited laboratory will provide a detailed report with liming rates for lime to be added by Holcim staff to screened loam to ensure no presence of PASS;

3. All dredged material is sent through the plant with fines re-interned below the 3 metre water mark at a depth of 8 metres in the returns pond; and

4. Testing of stockpiles to ensure that no PASS are present in concrete sands.

6.7.3 Stockpiling & Sales

Holcim have developed and implemented a testing regime using a NATA accredited laboratory to ensure compliance with PASS requirements for all sales of sand materials. This process includes:

1. Routine sampling of sales material stockpiles at designated locations; and

2. Implementation of a series of sales and production stockpiles to ensure any materials that have not been tested are isolated until tests confirm no presence of PASS thereafter sales loading occurs.

6.8 Summary of Environmental Performance

A summary of the performance of environmental management measures and sampling results for 2020 are detailed in **Table 20.**

Table 20: Environmental Performance at the Dunloe Sand Quarry in 2020

Aspect	Approval Criteria / EIS Prediction	Performance during 2020 reporting period	Trend / key management implications	Implemented / proposed management actions
Meteorology	EIS predictions are all below Project Approval criteria.	Meteorological data collected from the on-site meteorological station.	Full monitoring began in February 2020. Data collected was verified against BOM data during the report period.	Continue to refine meteorological monitoring station functionality and results.
Noise	EIS predictions are all below Project Approval criteria.	Quarterly monitoring has met the Project Approval Criteria.	Consistently meets criteria.	None Required.
Air Quality	EIS predictions are all below Project Approval criteria.	A valid sample for depositional dust was not taken for every month of 2020 due to regional bushfires. Missed samples occurred in January (1 location), February (3 locations) and December (1 location). PM_{10} monitoring is not required at the site when production remains below 200,000T/annum. Therefore, no PM_{10} monitoring was undertaken in 2020.	Laboratory results should outline when contamination occurs for depositional dust gauges.	Ensure air quality monitoring is done in accordance with the *Air Quality Management Plan.*
Traffic Management	EIS predictions are all below Project Approval criteria.	Met operating criteria (number of trucks per day).	Continual improvement from some past years.	None Required.
Water Management	EIS predictions are all below Project Approval criteria.	Criteria meets EIS, EPL and Project Approval criteria. Non-compliance occurred in terms of the required frequency of sampling for quarterly vertical profile sampling for surface water in the extraction area.	Groundwater consistent with trend data. Water monitoring generally consistent with trend data.	Ensure water quality monitoring and analysis is completed in accordance with the Soil and Water Management Plan.

Aspect	Approval Criteria / EIS Prediction	Performance during 2020 reporting period	Trend / key management implications	Implemented / proposed management actions
		Some sampling missed for Blue-Green Algae monitoring parameters in January and February 2020.		
Biodiversity	No impacts to threatened species. No Project Approval criteria.	Biodiversity monitoring was undertaken in 2020 as per the requirements of the *Rehabilitation and Revegetation Plan*.	Rehabilitation monitoring continued from 2019 into 2020.	Biodiversity monitoring continued in 2021 in accordance with the *Dunloe Sands Quarry Rehabilitation and Revegetation Plan*.
Heritage	No impacts to Aboriginal Heritage. No Project Approval criteria.	No impacts were recorded in 2020.	Consistently no impacts.	None required.

7 WATER MANAGEMENT

7.1 EIS Predictions

The site is located within the Mooball Creek catchment and Sheens Creek sub-catchment areas. Detailed flood modelling confirms that the proposal will have no significant impact upon existing drainage regimes within the catchment.

Extraction operations have been designed in conformity with best practice environmental management procedures, including the use of appropriate sediment and water quality devices and the retention of ground cover in areas outside of the extraction ponds.

No negative impacts to water are predicted with controls in place.

7.2 Criteria

Holcim was given a Notice of Variation of EPL 13077 by the EPA on the 20 October 2020. This variation modified several conditions with the general areas of these being discharge concentration criteria, noise monitoring location descriptions, and annual reporting of extraction limits.

The site has the requirement to monitor discharges from the two Licenced Discharge Points (LDP) as per the criteria listed in EPL 13077 and reproduced in **Table 21.** LDP001 refers to Silt Pond discharge and monitoring point (Point 1) and LDP002 refers to Dredge Pond discharge and monitoring point (Point 2).

Table 21: Discharge Criteria – LDP001 and LDP002

POINT 1

Pollutant	Units of Measure	50 Percentile concentration limit	90 Percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Oil and Grease	Visible				nil
pH	pH				6.5 - 8.5
TSS	milligrams per litre				50

POINT 2

Pollutant	Units of Measure	50 Percentile concentration limit	90 Percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Oil and Grease	Visible				nil
pH	pH				6.5 - 8.5
TSS	milligrams per litre				50

Exceedance of quality limits specified in EPL 13077 for the discharge of TSS, pH or Oil and Grease from LDP001 or LDP002 is permitted if the discharge from LDP001 or LDP002 occurs solely as the result of rainfall on site exceeding a total of 82.5 mm over any consecutive five-day period. Holcim must take all practical measures to avoid or minimise TSS, pH and Oil and Grease exceedances in wet weather discharges.

Table 22: LDP001 and LDP002 monitoring requirements from EPL 13077

POINT 1,2

Pollutant	Units of measure	Frequency	Sampling Method
Oil and Grease	Visible	Special Frequency 1	Visual Inspection
pH	pH	Special Frequency 1	Probe
TSS	milligrams per litre	Special Frequency 1	Grab sample

Special Frequency 1 means: sampling once <24 hours prior to; and sampling the discharge daily during, each discharge event arising from rainfall of less than 82.5 mm falling in total over a period of up to five days duration.

The site also has criteria outlined within the Soil and Water Management Plan. This includes commitments to undertaking monthly and quarterly monitoring at the Dredge Pond (Dam 1) and Silt Pond (Dam 2) (see **Table 23**,**Table 24, Table 25**). Other sampling criteria and commitments from the EMP are outlined within **Tables 26-29**.

Table 23: Monthly Surface Water Quality Criteria – Dam 1 and Dam 2

Parameter	Interim Target Criteria	Baseline monitoring 9/06-8/07
pH	5.0 – 8.5	3.55-8.44 (6.49)
Electrical Conductivity (EC)	<5.50 mS/cm	0.286 - 45mS/cm (11.930mS/cm)
Dissolved Oxygen (DO)	>4.00 mg/L	0.81-7.49 (4.34)mg/L
Turbidity	<20 (NTU)	3-67 (14.4) NTU
Oil and Grease	10 mg/L	

Table 24: Quarterly Surface Water Quality Criteria – Dam 1 and Dam 2

Quarterly monitoring

Quarterly monitoring shall include the above parameters as well as the parameters listed in the table below.

Parameter	Interim Target Criteria	Baseline monitoring 9/06-8/07
Manganese	0.15 mg/L	0.01 – 0.56 mg/L
Magnesium	40 mg/L	0.8 – 173.0 (20) mg/L
Sodium	280 mg/L	7-1770 (213) mg/L
Potassium	17.5 mg/L	0 – 71 (12) mg/L
Bicarbonate	400 mg/CaCo3	-
Chloride	285 mg/L	15-3500 (356)mg/L
Sulphate	175 mg/L	9-753 (100) mg/L
Aluminium	0.75 mg/L	<0.01-4.96 (0.50) mg/L
Arsenic	<0.005 mg/L	<0.005 – 0.027 (0.01) mg/L
Iron	<7.5 ug/L	0.03-43 (6.12) ug/L
Chlorophyll a	2-10 ug/L	2-10 ug/L

Table 25: Quarterly Vertical Profile Water Quality Criteria – Dam 1 and Dam 2

Pollutant	*Unit of Measure*	*Water Quality Objectives*
Turbidity	NTU	5 – 20 NTU
pH	pH	6.5 – 8.5
Oil and Grease	mg/L	10 mg/L
Salinity	µS/cm	<3,000 µS/cm
Dissolved oxygen	mg/L	>6 mg/L
Chorophyll-a	µg/L	2-10 µg/L
Faecal coliforms	Median No./100mL	<1000 cfu/100mL
Enterococci	Median No./100mL	<230 cfu/100mL
Algae and blue-green algae	No.cells/mL (M.aeruginosa)	<50,000 cells/mL
	mm^3/L (total biovolume)	<4 mm3/L
Sodium	mg/L	500mg/L
Potassium ion	mg/L	40mg/L
Magnesium ion	mg/L	100mg/L
Chloride ion	mg/L	1000mg/L
Sulphate ion	mg/L	800mg/L
Bicarbonate ion	mg/L	400mg/L
Soluble iron	mg/L	20mg/L
Soluble aluminium ion	mg/L	0.5mg/L
Ammonium ion	mg/L	20mg/L

1) *The Department acknowledges that short term exceedances of these objectives may occur during natural events such as flooding.*

2) *The Department acknowledges that pre-existing water quality may not meet the objectives for some analytes, including salinity. The proponent shall strive to meet the water quality objectives through implementation of the Soil and Water Management Plan (see condition 18 below), as far as is reasonable and feasible and within the Proponent's control, to the satisfaction of the Secretary.*

The site has a commitment to Blue Green Algae monitoring within the extraction ponds at the site in accordance with the criteria listed in **Table 26**.

Table 26: Monthly Monitoring Criteria – Blue Green Algae

Algae and Blue-green algae	No.cells/mL (M.aeruginosa)	<50,000
	mm^3/L (total biovolume)	<4

The site has a commitment to complete quarterly creek water monitoring within the surrounding environment in accordance with the criteria listed in **Table 27.**

Table 27: Quarterly Surface Water Quality Criteria – Surrounding Environment

Pollutant	*Unit of Measure*	*Interim Target Criteria*	*Baseline Monitoring 9/06-8/07*
pH	pH	5.5 – 7.5	3.55-8.44 (6.49)
Electrical Conductivity	uS/cm	1800-24000	286-45000 (11930)
Dissolved Oxygen	mg/L	>6	0.81-7.49 (4.34)
Turbidity	NTU	<20	3-67 (14.4)
Suspended Solids	mg/L	<25	1.5-48 (19)

Groundwater

The site has the requirement to monitor water quality from the five groundwater bores installed on site annually as per the criteria listed in EPL 13077 and reproduced in **Table 28.**

Table 28: Groundwater monitoring requirements (DLP3-DLP7) from EPL 13077

POINT 3,4,5,6,7

Pollutant	Units of measure	Frequency	Sampling Method
Ammonia	milligrams per litre	Yearly	Grab sample
Chloride	milligrams per litre	Yearly	Grab sample
Electrical conductivity	microsiemens per centimetre	Yearly	Grab sample
Oil and Grease	milligrams per litre	Yearly	Grab sample
pH	pH	Yearly	Grab sample
Standing Water Level	metres (Australian Height Datum)	Yearly	No method specified
Sulfate	milligrams per litre	Yearly	Grab sample

The site also has a commitment to complete monthly groundwater monitoring within the surrounding environment in accordance with the criteria listed in **Table 29**.

Table 29: Monthly Groundwater Quality Criteria – Surrounding Environment

Monthly Monitoring

Parameter	Interim Target Criteria	Baseline Monitoring 9/06-8/07 Range (mean)
pH	4.2 – 7.0	3.58-7.54 (5.43)
Electrical Conductivity (EC)	<2.0 mS/cm	0.07-6.47 (1.24)
Dissolved Oxygen (DO)	>1.50 mg/L	0.16 – 4.83 (0.84)
REDOX Potential	Maximum (mg/L)	
Groundwater level	M (AHD)	0.25-1.52 (0.68)

The site has a commitment to complete quarterly groundwater monitoring within the surrounding environment in accordance with the criteria listed in **Table 30**.

Table 30: Quarterly Groundwater Quality Criteria – Surrounding Environment

Parameter	Interim Target Criteria	Baseline monitoring 9/06-8/07
Calcium	55	0.7-114 (26)
Manganese	0.15	0.01 – 0.56
Magnesium	40	0.8 – 173.0 (20)
Sodium	280	7-1770 (213)
Potassium	17.5	0 – 71 (12)
Bicarbonate	400	-
Chloride	285	15-3500 (356)
Alkalinity	185	0-534 (109)
Sulphate	175	9-753 (100)
Aluminium	0.75	<0.01-4.96 (0.50)
Arsenic	0.005	<0.005 – 0.027 (0.01)
Iron	7.5	0.03-43 (6.12)

7.3 Surface Water Monitoring

It should be noted that there were no surface water discharges in 2020 therefore criteria related to **Table 21** have not been triggered. A summary of results obtained from monthly sampling in the ponds is provided in **Table 31**. Both the Dredge Pond and Silt Pond did not meet the target criteria for pH, with respective annual averages of 4.2 and 5.2. The Silt Pond exceeded turbidity criteria of less than 20 NTU with an average of 83.7 NTU. All other results were within their respective criteria range. The annual average for Silt Pond was calculated with 11 samples due to January sampling occurring. Sampling did not occur at the Dredge Pond in January and February, so its annual average is calculated using 10 sampling events.

Table 31: Monthly Dredge Pond (Dam 1) and Silt Pond (Dam 2) Water Quality Monitoring 2020 Results

Parameter	Interim Target Criteria	Dredge Pond (Dam 1)			Silt Pond (Dam 2)		
		Min	Max	Average	Min	Max	Average
pH	6.5-8.5	3.7	6.5	**4.2**	4.3	6.6	**5.2**
EC (uS/cm)	<2000	245.0	710.0	573.1	565.0	753.0	645.3
DO (mg/L)	>4	3.8	8.6	6.4	4.4	9.1	6.7
Turbidity (NTU)	<20	0.0	61.5	12.1	0.0	739.0	**83.7**
Oil and Grease (mg/L)	10	5.0	10.0	7.1	5.0	10.0	6.9

Long-term monitoring results for the Dredge Pond and Silt Pond from the 2018 to the 2020 reporting periods are presented in **Table 32.**

Table 32: Long-term Results for Dredge Pond (Dam 1) and Silt Pond (Dam 2)

Parameter	Interim Target Criteria	Baseline (2006/2007)	Dredge Pond (Dam 1)			Silt Pond (Dam 2)	
			2018	2019	2020	2019	2020
pH	6.5-8.5	3.55-8.44	**4.2**	**4.4**	**4.2**	6.94	**5.2**
EC (uS/cm)	<2000	286-450	388	545	573.1	508	645.3

Parameter	Interim Target Criteria	Baseline (2006/2007)	Dredge Pond (Dam 1)			Silt Pond (Dam 2)	
			2018	2019	2020	2019	2020
DO (mg/L)	>4	0.81-7.49	22.4	35.7	6.4	33.3	6.7
Turbidity (NTU)	<20	3.0-67.0	5.3	7.5	12.1	12.2	83.7
Oil and Grease (mg/L)	10	-	<5	<5	7.1	5	6.9

As seen in the comparison of 2018 to 2020 in **Table 32** the Dredge Pond has been consistently acidic and has not reached target criteria levels. The Dredge Pond 2020 average returned the same result as in 2018, 4.2. There was a decline in pH at the Silt Pond, from within criteria levels to falling to 5.2.

There was a significant increase in average EC at the Dredge Pond from 388 uS/cm in 2018 to 545 uS/cm in 2019. The 2020 average also saw an increase in EC. The Silt Pond EC results see a significant increase from 2019 (508 uS/cm) to 2020 (645.3 uS/cm).

Dissolved Oxygen (DO) decreased significantly in 2020 compared to 2018 and 2019 results at both the Dredge Pond (6.4 mg/L) and Silt Pond (6.7 mg/L). These levels are just above the target criteria (>4 mg/L) and consistent with the baseline levels from 2006 and 2007.

Turbidity results increased at both sample sites. The most significant increase was seen at the Silt Pond, from an average of 12.2 NTU in 2019 to 83.7 NTU in 2020. The 2020 result significantly exceeds the target criteria values of <20 NTU.

Oil and grease levels slightly increased from previous annual averages of 5 mg/L to 7.1 mg/L at the Dredge Pond and 6.9 mg/L at the Silt Pond. However, it should be noted that oil and grease were assessed as “not visible” in the visual inspection sampling method for Dam 1 and Dam 2 on all sampling events in this report period.

A summary of the long-term chemical analysis results from years 2018 to 2020 is provided in **Table 33**.

Table 33: Long-term Chemical Analysis Monitoring Results

Parameter (mg/L)	Interim Target Criteria	Baseline Target (2006/07)	Dredge Pond (Dam 1)			Silt Pond (Dam 2)	
			2018	2019	2020	2019	2020
Manganese	**0.15**	**0.01-0.56**	0.25	0.26	0.24	0.14	0.31
Magnesium	**40**	**0.8-173.0**	6.00	10.00	10.23	10.00	10.00
Sodium	**280**	**7-1,770**	24.00	45.00	45.33	42.00	45.00
Potassium	**17.5**	**0-71**	3.70	4.80	4.83	4.00	4.70
Bicarbonate	**400**	**-**	-	1.00	21.67	12.00	20.00
Chloride	**285**	**15-3,500**	42.00	79.00	85.67	72.00	92.50
Sulphate	**175**	**9-753**	114.00	170.00	185.33	163.00	210.00
Aluminium	**0.75**	**<0.01-4.96**	0.74	0.80	1.11	0.16	1.15
Arsenic	**0.005**	**<0.005-0.027**	Not detected	0.00	0.00	0.00	0.00
Iron (Dissolved)	**7.5**	**0.03-43**	0.09	0.30	0.42	0.05	0.21

Parameter (mg/L)	Interim Target Criteria	Baseline Target (2006/07)	Dredge Pond (Dam 1)			Silt Pond (Dam 2)	
			2018	2019	2020	2019	2020
Chlorophyll a	**2 --10**	**2 -- 10**	-	1.00	5.67	4.00	5.00

Results obtained from quarterly chemical analysis of extraction pond water shows the results to be generally in accordance with the baseline criteria and interim target criteria of the EMP. Chloride levels continued to increase in 2020 which had an average of 85.67 mg/L. Compared to the 2019 averages, 2020 saw average increases in manganese, bicarbonate, chloride, sulphate, aluminium, dissolved iron, and Chlorophyll a at both the Dredge Pond and Silt Pond. However, all parameters fell within their baseline target range.

Manganese in the Dredge Pond (Dam 1) was above interim criteria in 2017, 2018, 2019 and 2020.

Results for the Quarterly Vertical Profile for Dam 1 and Dam 2 commitments outlined in **Table 25**, is shown below in **Table 34**. This table excludes those results which have already been presented in this Annual Review due to these results being taken at the same quarterly frequency or more often.

Table 34: Quarterly Vertical Profile Results for Dam 1 and Dam 2

Parameter	Unit of Measure	Objective Values	Dredge Pond – Dam 1	Silt Pond – Dam 2	
			Quarter 1 (14/02/2020)	Quarter 1 (14/02/2020)	Quarter 4 (09/11/2020)
Faecal coliforms	Median No./1000mL	<1000 CFU/100mL	10	24	10
Enterococci	Median No./1000mL	<230 CFU/100mL	10	12	10
Soluble iron	mg/L	20	0.54	0.05	0.08
Ammonium ion	mg/L	20	0.01	0.02	0.01
Soluble aluminium ion	mg/L	0.5	1.8	0.03	0.79

Results from the vertical profile monitoring at Dams 1 and 2 show that these water bodies do not exceed these parameters. However, complete quarterly monitoring did not occur throughout the report period, with sampling for these parameters occurring only for quarter 1 and quarter 4. This does not fulfill the requirements of the Soil and Water Management Plan for Dunloe Sands and is therefore a non-compliance against the Development Consent. Results for the excluded parameters are presented in and discussed alongside **Table 31**, **Table 32**, **Table 33**, and **Table 37**.

The site has also committed to completing quarterly creek monitoring within the surrounding environment in accordance with the EMP. A summary of results obtained from quarterly water quality monitoring is provided in **Table 35** and **Table 36.**

Table 35: Quarterly Northern Creek Water Quality Monitoring 2020 Results with 2019 Comparison

Parameter (mg/L)	Interim Target Criteria	Baseline (2006/07)	SW3				SW4			
			Min	Max	2020 Average	2019 Average	Min	Max	2020 Average	2019 Average
pH	5.5-7.5	3.55-8.44	3.7	5.0	4.3	6.7	5.0	7.3	5.8	7.2
EC	1800-24000	286-45000	778	4600	2942	19988	778	16900	6742	23298
DO	>6	0.81-7.49	2.0	6.0	4.6	32.2	5.3	2200.0	558.8	31.3
Turbidity	<20	3-67	0	104	37	9	0	43	15	3
Suspended Solids	<25	1.5-48	24.0	170.0	97.0	7.0	13.0	27.0	18.0	6.0

Table 36: Quarterly Southern Creek Water Quality Monitoring 2020 with 2019 Comparison

Parameter (mg/L)	Interim Target Criteria	Baseline (2006/07)	SW9				SW10			
			Min	Max	2020 Average	2019 Average	Min	Max	2020 Average	2019 Average
pH	5.5-7.5	3.55-8.44	7.09	7.31	7.20	7.1	3.37	5.95	4.47	6.6
EC	1800-24000	286-45000	12500	15700	14100	12907	646	7240	3079	15138
DO	>6	0.81-7.49	6.32	6.75	6.54	22.9	2.52	3.71	**3.21**	18.3
Turbidity	<20	3-67	0	18.1	9.05	2	2.2	149	74.10	17
Suspended Solids	<25	1.5-48	16	58	37	6	30	46	38	10

Results obtained from quarterly water quality monitoring show the results are generally in accordance with the baseline criteria and interim target criteria of the EMP.

The results of the monthly algae monitoring for the 2020 reporting period are displayed within **Table 37**.

Table 37: Surface Water Quality Monitoring 2020 Results – Blue Green Algae

Date	Dredge Pond		Silt Pond	
	M. aeruginosa (cells/mL) Criteria: <50,000	Total Biovolume (mm^3/L) Criteria: <4	M. aeruginosa (cells/mL) Criteria: <50,000	Total Biovolume (mm^3/L) Criteria: <4
14/01/2020	NS	NS	NS	NS
14/02/2020	NS	NS	5.00	0.00
18/03/2020	735.00	1.02	727.00	1.03

Date	Dredge Pond		Silt Pond	
	M. aeruginosa (cells/mL) Criteria: <50,000	Total Biovolume (mm^3/L) Criteria: <4	M. aeruginosa (cells/mL) Criteria: <50,000	Total Biovolume (mm^3/L) Criteria: <4
16/04/2020	430	0.00	0	0.00
14/05/2020	90	0	270	0.12
11/06/2020	0	0	0	0.00
9/07/2020	0.00	0	110	0.00
10/08/2020	210	0	170	0.02
8/09/2020	326	0	2252	0.01
8/10/2020	0	0	148	0.00
9/11/2020	1	0.01	1	0.01
10/12/2020	1	0.01	1	0.01
Minimum	**0**	**0.00**	**0**	**0.00**
Maximum	**735**	**1.02**	**2252**	**1.03**
Average	**179.3**	**0.11**	**334.91**	**0.11**

Note: NS stands for No Sample

Monthly monitoring of both extraction ponds for Blue Green Algae was conducted in 2020. Sampling did not occur in January, as was the case for other surface water monitoring parameters. February monitoring did not occur at the Dredge Pond due to the site flooding. Holcim has improved its monitoring of Blue Green Algae from only monitoring algae quarterly in 2019, to conducting monthly monitoring in this reporting period.

Both the algal cell count and total biovolume for the Dredge Pond and Silt Pond fell considerably below the criteria committed to in the Environmental Management Strategy and the Soil and Water Management Plan.

Total algae count was not monitored in 2020 as it done in 2018 and 2019.

The total algae count results gathered at site across several years have illustrated a large degree of variability. It is noted that variations in total algae count results are not identified as exceedances of the monitoring criteria listed in the Environmental Management Strategy and the key to monitoring Blue Green Algae activity generally lies with total algae count readings.

Long-term Trends:

Key parameters continued to follow long-term trends, including:

- There was no surface water discharge in 2020;
- Generally acidic pH readings;
- High variability of turbidity;
- Variable levels of total algae, but within long-term trends; and
- EC was highly variable, but within long-term trends.

Comparison to EIS Predictions:

There was no evidence of any detrimental impact from the Quarry on surface water. This is consistent with the EIS predictions.

7.4 Groundwater Results

Monthly groundwater monitoring was undertaken at 5 locations (DLP 1, DLP 3, DLP 5, DLP 6 and DLP 7) during the 2020 reporting period. Results obtained at each bore in 2020 have been generally consistent at each location with previous results.

DLP3 and DLP7 present annual average conductivity levels above the maximum interim target of 2000 µS/cm stated within the EMP, with this also being the case in previous years.

DLP 7 sits immediately adjacent to the existing wetland, which act as a 'drawer' of permanently saline conditions in order to sustain its dominant vegetative makeup. It is therefore considered likely that some localised salinisation of surficial groundwater has occurred within the vicinity of DLP3 and DLP 7 due to tidal influences within these nearby waterways and wetlands. This trend has previously been identified in Annual Reports prepared under the previous operator and is considered to be consistent with the natural salinity levels in the local environment.

A summary of monthly groundwater results for pH and EC is provided in **Table 38**.

Table 38: Monthly Groundwater Quality Monitoring 2020 Results Summary (pH and EC)

Location	Parameter	Interim Target Criteria	2020 Minimum	2020 Maximum	2020 Average	2019 Average	2018 Average	2017 Average
DLP1	pH	4.2-7.0	4.43	7.78	5.7	4.9	4.4	4.3
	EC (uS/cm)	<2000	132	451	214.5	698	146	134
DLP3	pH	4.2-7.0	5.64	7.64	6.1	5.5	5.9	6
	EC (uS/cm)	<2000	6800	8920	7639.2	6731	7320	7464
DLP5	pH	4.2-7.0	4.15	7.92	5.5	5.4	4.7	5.1
	EC (uS/cm)	<2000	4.83	4140	1121.1	1782	847.5	406
DLP6	pH	4.2-7.0	4.09	7.14	5.1	4.6	3.9	3.8
	EC (uS/cm)	<2000	207	2250	546.1	2561	607.5	1270
DLP7	pH	4.2-7.0	4.75	7.49	6.8	6.3	7.0	6.9
	EC (uS/cm)	<2000	276	3500	2939.7	3039	3379	3125

From 2017 to 2020 pH annual averages were slightly acidic across all locations and did not exceed the interim target criteria range. Electrical conductivity (EC) displayed high variability across locations, from DLP1's minimum of 132 uS/cm to DLP3's maximum of 8920 uS/cm. DLP3 and DLP7 exceeded the criteria with the respective values of 7639.2 uS/cm and 2939.7 uS/cm. The annual average results for pH and EC levels have shown similarity between 2017 and 2020.

A summary of quarterly monitoring for Manganese and Magnesium is outlined in **Table 39**.

Table 39: Quarterly Groundwater Quality Monitoring 2020 Results (Manganese and Magnesium)

Location	Parameter	Interim Target Criteria	Q1 18/03/2020	Q2 11/06/2020	Q3 24/09/2020	Q4 09/11/2020	2020 Average	2019 Average	2018 Average	2017 Average
DLP1	Manganese (mg/L)	0.15	0.10	0.11	NS	0.14	0.12	0.039	0.014	0.024
	Magnesium (mg/L)	40	3.1	3.9	5.0	8.1	5.03	1.25	0.87	0.65
DLP3	Manganese (mg/L)	0.15	0.80	0.68	NS	0.66	**0.71**	0.92	0.65	0.63
	Magnesium (mg/L)	40	160.0	120.0	120.0	100.0	**125.00**	175.3	131.2	126.7
DLP5	Manganese (mg/L)	0.15	0.54	0.081	NS	0.01	**0.21**	0.13	0.031	0.060
	Magnesium (mg/L)	40	96.0	17.0	5.0	9.0	31.75	39.3	11.2	14.5
DLP6	Manganese (mg/L)	0.15	0.28	0.16	0.15	0.31	**0.22**	0.47	0.49	1.12
	Magnesium (mg/L)	40	2.1	2.2	5.0	5.2	3.63	7.0	6.8	14.45
DLP7	Manganese (mg/L)	0.15	0.08	0.05	NS	0.07	0.06	0.077	0.21	0.068
	Magnesium (mg/L)	40	44.0	37.0	33.0	33.0	36.75	39.00	39.25	37.3

Annual averages for Manganese and Magnesium in the 2020 reporting period are generally consistent with 2019 results. DLP3 values for 2020 follow the long-term trend of exceeding the interim target criteria for both Manganese (0.71 mg/L) and Magnesium (125.00 mg/L). Both DLP5 and DLP6 exceeded the interim criteria for Manganese with the respective annual averages of 0.21 mg/L and 0.22 mg/L. However, the 2020 results for Manganese and Magnesium at DLP1 increased significantly from 2019 levels. 2020 DLP1 results are also considerably greater than those for 2018 and 2017. Magnesium levels at all locations but DLP1 have decreased since 2019.

Long-term Trends:

Results for Manganese and Magnesium are similar to previous years. DLP3 has consistently been above the interim target criteria.

Comparison to EIS Predictions:

There was no evidence of any detrimental impact from the Quarry on groundwater. This is consistent with the EIS predictions.

7.5 Water Take

There is no water take associated with the Dunloe Sand Quarry.

8 REHABILITATION AND LANDSCAPE MANAGEMENT

8.1 Rehabilitation Performance during the Reporting Period

As part of the site's approved EMP, revegetation and regenerative landscaping is required (Appendix C of the EMP). Ongoing management of the surrounding vegetation is being carried out by Ramtech Pty Ltd over the lifetime of the Dunloe Sand Quarry operations.

The regenerative works have been undertaken via a combination of assisted and natural regrowth and all areas have been fenced so as to limit the intrusion of cattle. In this regard, depending on soil types and topography, each of the areas has been very successful in establishing quality regrowth.

The only limiting factors have been some cattle getting in and around existing fences (primarily at low tide where they have been able to traverse the creek lines.

Quarterly rehabilitation monitoring was undertaken during 2020 as per Condition 28 in Schedule 3 of the Project Approval.

A summary of rehabilitation at the Dunloe Sand Quarry is outlined in **Table 39.**

Table 40: Rehabilitation Performance in 2020

Guideline Requirement	Site Comment
Extent of the operations and rehabilitation at completion of the reporting period	There was no rehabilitation at site in 2020.
Agreed post-rehabilitation land use	The proposed rehabilitation aims to return the land to an endangered ecological community (EEC) Swamp Sclerophyll plus Eucalypt Open Forest species and EEC Coastal Wetland within the localised soaks.
Key rehabilitation performance indicators	Criteria are outlined in the *Rehabilitation and Revegetation Management Plan*.
Renovation or removal of buildings	None during reporting period.
Any other Rehabilitation taken including: ● Exploration activities; ● Infrastructure; ● Dams; and ● The installation or maintenance of fences, bunds and any other works.	No rehabilitation of these features was completed.
Any rehabilitation areas which have received formal sign off from the Resources Regulator.	None.
Variations to activities undertaken to those proposed (including why there were variations and whether Resources Regulator was notified)	No variations to the *Rehabilitation and Revegetation Management Plan*.
Outcomes of trials, research projects and other initiatives	No specific trials done.
Key issues that may affect successful rehabilitation	There are several potential issues including availability of material, seed stock, climatic events, tidal inundation and rehabilitation methodology.

8.2 Summary of Current Rehabilitation and Performance

A summary of the rehabilitation and disturbance status is outlined in **Table 41**. This is also shown in **Figure 4**.

Table 41: Rehabilitation and Disturbance Status

Quarry Area Type	2018	2019	2020	2021 (Forecast)
	(ha)			
A. Total Quarry Footprint	32.2	32.2	32.2	32.2
B. Total Active Disturbance	18.8	18.8	18.8	18.8
C. Land Being Prepared for Rehabilitation	0	0	0	0
D. Land Under Active Rehabilitation	13.4	13.4	13.4	13.4
E. Completed Rehabilitation	0	0	0	0

At the end of 2020 there was approximately 18.8 Ha of active disturbance and 13.4 Ha of active rehabilitation (see **Figure 4**). There is no rehabilitation proposed in 2021.

Rehabilitation monitoring of established rehabilitation has shown:

- Most of the rehabilitation has been from natural regeneration;
- Dominant species are paper bark, melaleuca, banksia, casuarina and brackern fern;
- Evidence of grass and leaf litter; and
- Some tree species greater than 15 metres high, shrub species greater than 5 m high and groundcover to 2 m.

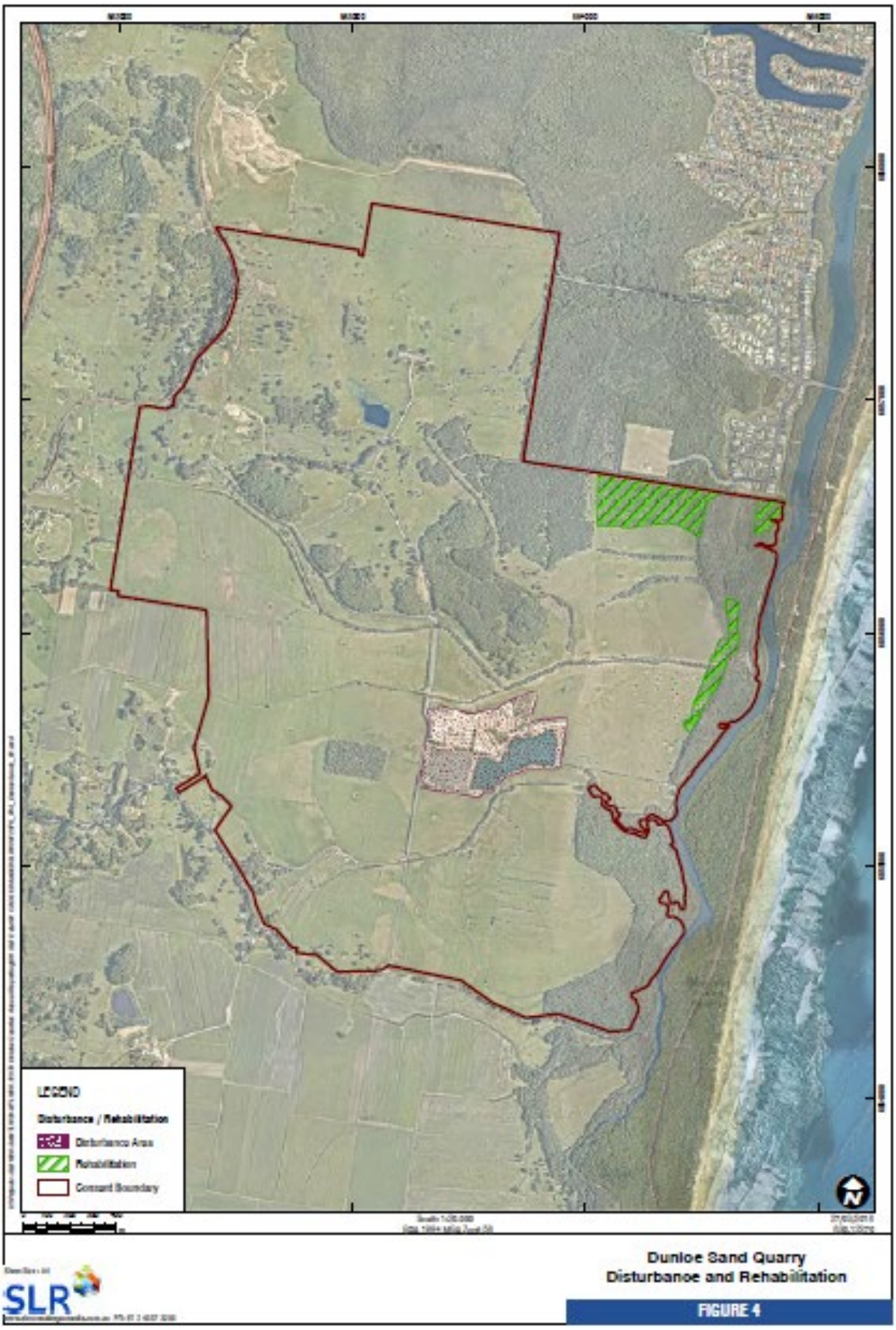

Figure 4: Rehabilitation and Disturbance

8.3 Actions for the Next Reporting Period

The DPIE 2015 *Annual Review Guidelines* require the Annual Review to outline the rehabilitation actions proposed during the next reporting period (1 January 2021 to 31 December 2021). These actions are detailed in **Table 42.**

Table 42: Rehabilitation and Closure Actions for the Next Reporting Period (2021)

Requirement	Site Comment
Describe the steps to be undertaken to progress agreement during next reporting period, where final rehabilitation outcomes have not yet been agreed between stakeholders.	No rehabilitation proposed for 2021.
Outline proposed rehabilitation trials, research projects and other initiatives to be undertaken during next reporting period.	Rehabilitation inspections/monitoring to continue as per the *Rehabilitation and Revegetation Management Plan* and the Dunloe Sand *Environmental Management Plan*.
Summary of rehabilitation activities proposed for next report period.	No specific rehabilitation proposed for 2021. The three rehabilitation zones will continue to be managed and worked on in accordance with the approved EMP including invasive species removal and monitoring.

9 COMMUNITY

9.1 Community Engagement Activities

The site implemented a Community Consultative Committee (CCC) when under the operation of Ramtech as part of the conditions of consent.

Due to Covid-19 social distancing requirements for this reporting period, CCC meetings were not held as face-to-face or online sessions. Instead, a report was generated in accordance with the usual CCC agenda structure and approved by all CCC members before being finalised. These CCC Agenda reports are publicly available on the Holcim Dunloe Sands website. The complaints register and contacts for community enquiries for site are also available on this webpage in accordance with the Project Approval requirements.

https://www.holcim.com.au/dunloe-sand-quarry-pottsville-nsw

Holcim has maintained community engagement measures, including:

- Maintenance of a website (containing publicly available documents);
- A telephone number, email and postal address (on the website) for community complaints and feedback;
- A copy of the Complaints Register is maintained on the company website; and
- All documents and items displayed on the website are regularly updated by Holcim staff.

9.2 Community Contributions

Holcim did not engage in any community activities during the Annual Review period.

9.3 Complaints

There were no community complaints for the site during 2020. This trend continues from 2018. Community complaints reports are published on the Holcim website quarterly.

10 INDEPENDENT AUDIT

The site undertook an expansion of Independent Environmental Audit (IEA) in 2016 in accordance with the timeframes of the Project Approval. All actions raised in the IEA have been undertaken in accordance with the recommendations made by Consultants Mark Rigby & Associates. All actions were closed out in 2016.

The next audit is due in June 2021.

11 INCIDENTS AND NON-COMPLIANCE

Table 43 summarises the incidents and non-compliances at the Dunloe Sand Quarry in 2020.

Table 43: Summary of Incidents and Non-Compliances

Date	Incident/Non-Compliance	Action/Comment
Overall report period	**Water Quality monitoring - Schedule 3 Condition 22** It is noted that there were some months where total algae count and total bio volume were not recorded. This is a non-compliance with the frequency outlined in the Blue – Green Algae Management (Component of the EMS and Soil and Water Management Plan). Non-compliance occurred in terms of the required frequency of sampling for quarterly vertical profile sampling for surface water in the extraction area. It is noted that vertical profile water quality monitoring was not undertaken in 2019 (Component of the Soil and Water Management Plan).	Holcim managed these incidents by consulting with environmental monitoring contractors. Holcim are committed to the continual improvement of surface water monitoring.

12 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Holcim staff will undertake the following works and improvement measures and projects in 2021 to ensure compliance with the consent and to ensure that effective environmental management controls are in place and operating in accordance with the requirements of the Consent. See **Table 44** for an outline of improvement measures and associated activities for 2021.

Table 44: Improvement Actions for 2021

Improvement Measure	Activities
Water Quality Monitoring	Ensure all water quality monitoring is completed in accordance with the EMP, with a focus on correct monitoring frequencies.
Dust Monitoring	Ensure dust monitoring is completed in accordance with the EMP.
Biodiversity	Weed spraying will continue at site during the next Annual Review period.
	Annual fauna box monitoring continues.
	Rehabilitation monitoring continues as per the *Rehabilitation and Revegetation Management Plan*.

13 REFERENCES

DPI Water (2017) Water Access Licence Usage

EPA (Ongoing) Environment Protection Licence) – 13077

GHD (2020) Environmental Management Strategy

GHD (2020) Environmental Monitoring Program

GHD (2019) Traffic Management Plan

Holcim (2018) CCC Minutes

Planit Consulting (2007) Environmental Assessment – Dunloe Park

RPS (2019) Aboriginal Cultural Heritage Assessment Report – Dunloe Sands Quarry, Pottsville, NSW

14 APPENDICES

APPENDIX 1

DUNLOE SAND QUARRY NOISE MONITORING

Noise Monitoring Assessment

Dunloe Quarry, Pottsville, NSW
Quarter 1 Ending March 2020.

Prepared for: Holcim (Australia) Pty Ltd
February 2020
MAC180611-07RP7

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Dunloe Quarry, Pottsville, NSW

Quarter 1 Ending March 2020

Prepared for: Holcim (Australia) Pty Ltd

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Document ID	Status	Date	Prepared By	Signed	Reviewed By	Signed
MAC180611-07RP7	Final	3 February 2020	Nicholas Shipman		Oliver Muller	

CONTENTS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for the quarterly period ending March 2020 for Dunloe Quarry (the 'quarry'), Pottsville, NSW.

The monitoring has been conducted in accordance with the Dunloe Project Approval (2008) and Noise Management Plan at four representative monitoring locations. This assessment represents the operations undertaken during Quarter 1, ending March 2020 and forms part of the annual noise monitoring program to address conditions of the project approval.

The assessment has been conducted in accordance with the following documents:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Dunloe Noise Management Plan (NMP), 2016; and
- Australian Standard AS 1055:2018- Acoustics - Description and measurement of environmental noise - General Procedures.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Noise Criteria

Schedule 3 Section 2 of the Project Approval outlines the applicable noise criteria for residential receivers surrounding the quarry site.

The noise criteria are applicable when the site undertakes quarrying operations within the permitted operating hours Monday to Friday 7am – 5pm, Saturday 7am – 12pm with no operations on Sunday.

Table 1 presents the noise criteria for each of the receivers as outlined in the Project Approval.

Table 1 Noise Criteria

Location	Day Criteria dB $LA_{eq(15min)}$ [2]
All privately-owned receivers [1]	48

Note 1: Receiver locations are shown in Figure 1.

Note 2: Criteria applicable between Monday to Friday 7am – 5pm, Saturday 7am – 12pm with no operations on Sunday as the Table 2 of the Project Approval.

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3 Methodology

3.1 Locality

The quarry is approximately 2.5km south west of Pottsville, NSW. Receivers surrounding the quarry are primarily rural/residential situated in coastal bushland with elevated and undulating topography. The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan shown in **Figure 1.**

3.2 Noise Monitoring Locations

Four monitoring locations have been selected as part of the NMA and are listed below:

- R1 is located at the property on Kellehers Road situated north of the quarry;
- R2 is located west of the quarry on the boundary of 574 Pottsville Road;
- R3 is located to the south-west of the quarry at the address of 122 Warwick Park Road; and
- R4 is located at 265 Warwick Park Road, south of the quarry.

3.3 Assessment Methodology

Attended noise surveys were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise and Dunloe Quarry's Project Approval. Measurements were carried out using a Svantek Type 1, 971 noise analyser on Thursday 30 January 2020. Acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

One measurement was conducted at each monitoring location during the daytime period. Measurements were of 15 minutes in duration and where possible, throughout each survey the operator quantified the contribution of each significant noise source.

Extraneous noise sources were excluded from the analysis to determine the $LA_{eq(15min)}$ quarry noise contribution for comparison against the relevant criteria. Where the quarry was inaudible, the contribution is estimated to be at least 10dB below the ambient noise level.

FIGURE 1

LOCALITY PLAN

REF: MAC180611-07

0 500m

KEY	
R1	RECEIVER LOCATION
	SITE LOCATION

MAC
Muller Acoustic Consulting

*Imagery Source : nearmaps

4 Results

4.1 Assessment Results - Location R1

The monitored noise level contributions and observed meteorological conditions for R1 are presented in **Table 2**.

Table 2 Operator-Attended Noise Survey Results – Location R1

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
30/01/2020	11:04	76	51	35	WD: N WS: 1m/s Rain: Nil	Insects <36 Local traffic 36-76 Birds 35-44 Aircraft 36-46 Quarry inaudible
Dunloe Quarry $L_{Aeq(15min)}$ Contribution						<30

4.2 Assessment Results - Location R2

The monitored noise level contributions and observed meteorological conditions for R2 are presented in **Table 3.**

Table 3 Operator-Attended Noise Survey Results – Location R2

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
30/01/2020	11:29	90	66	48	WD: N WS: 1m/s Rain: Nil	Local traffic 48-90 Distant traffic 48-53 Insects <48 Birds 48-51 Aircraft 46-50 Quarry inaudible
Dunloe Quarry $L_{Aeq(15min)}$ Contribution						<40

4.3 Assessment Results - Location R3

The monitored noise level contributions and observed meteorological conditions for R3 are presented in **Table 4.**

Table 4 Operator-Attended Noise Survey Results – Location R3

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
30/01/2020	11:50	66	56	47	WD: N WS: 1.5m/s Rain: Nil	Insects <46 Birds 46-54 Distant traffic 46-51 Local traffic 45-66 Quarry inaudible
Dunloe Quarry $L_{Aeq(15min)}$ Contribution						<40

4.4 Assessment Results - Location R4

The monitored noise level contributions and observed meteorological conditions for R4 are presented in **Table 5.**

Table 5 Operator-Attended Noise Survey Results – Location R4

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
30/01/2020	12:11	64	44	37	WD: N WS: 0.5m/s Rain: Nil	Insects 34-42 Aircraft 34-44 Birds 36-64 Quarry inaudible
Dunloe Quarry $L_{Aeq(15min)}$ Contribution						<30

5 Discussion

5.1 Discussion of Results - Location R1

Quarry noise emissions were inaudible during noise monitoring conducted on Thursday 30 January 2020 at location R1. Quarry noise contributions were estimated to satisfy the relevant daytime noise limit of 48dB $L_{Aeq(15min)}$. Extraneous noise sources include insects, local traffic, birds and aircraft during the monitoring period.

5.2 Discussion of Results - Location R2

Quarry noise emissions were inaudible during noise monitoring conducted on Thursday 30 January 2020 at location R2. Quarry noise contributions were estimated to satisfy the relevant daytime noise limit of 48dB $L_{Aeq(15min)}$. Extraneous noise sources include insects, birds, aircraft, local and distant traffic during the monitoring period.

5.3 Discussion of Results - Location R3

Quarry noise emissions were inaudible during noise monitoring conducted on Thursday 30 January 2020 at location R3. Quarry noise contributions were estimated to satisfy the relevant daytime noise limit of 48dB $L_{Aeq(15min)}$. Extraneous noise sources include insects, birds, local and distant traffic during the monitoring period.

5.4 Discussion of Results - Location R4

Quarry noise emissions were inaudible during noise monitoring conducted on Thursday 30 January 2020 at location R4. Quarry noise contributions were estimated to satisfy the relevant daytime noise limit of 48dB $L_{Aeq(15min)}$. Extraneous noise sources include insects, aircraft and birds during the monitoring period.

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6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Holcim (Australia) Pty Ltd at Dunloe Quarry, Pottsville, NSW. The assessment was completed to determine the quarry's compliance with the relevant criteria outlined in their Project Approval for relevant surrounding residential receivers for Quarter 1, ending March 2020.

Attended noise monitoring was undertaken on Thursday 30 January 2020 at representative monitoring locations, with quarry noise contributions compared against the relevant criteria. The assessment has identified that noise emissions generated by Dunloe Quarry complies with the relevant noise criteria specified in the Project Approval at all assessed residential receivers.

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Appendix A - Glossary of Terms

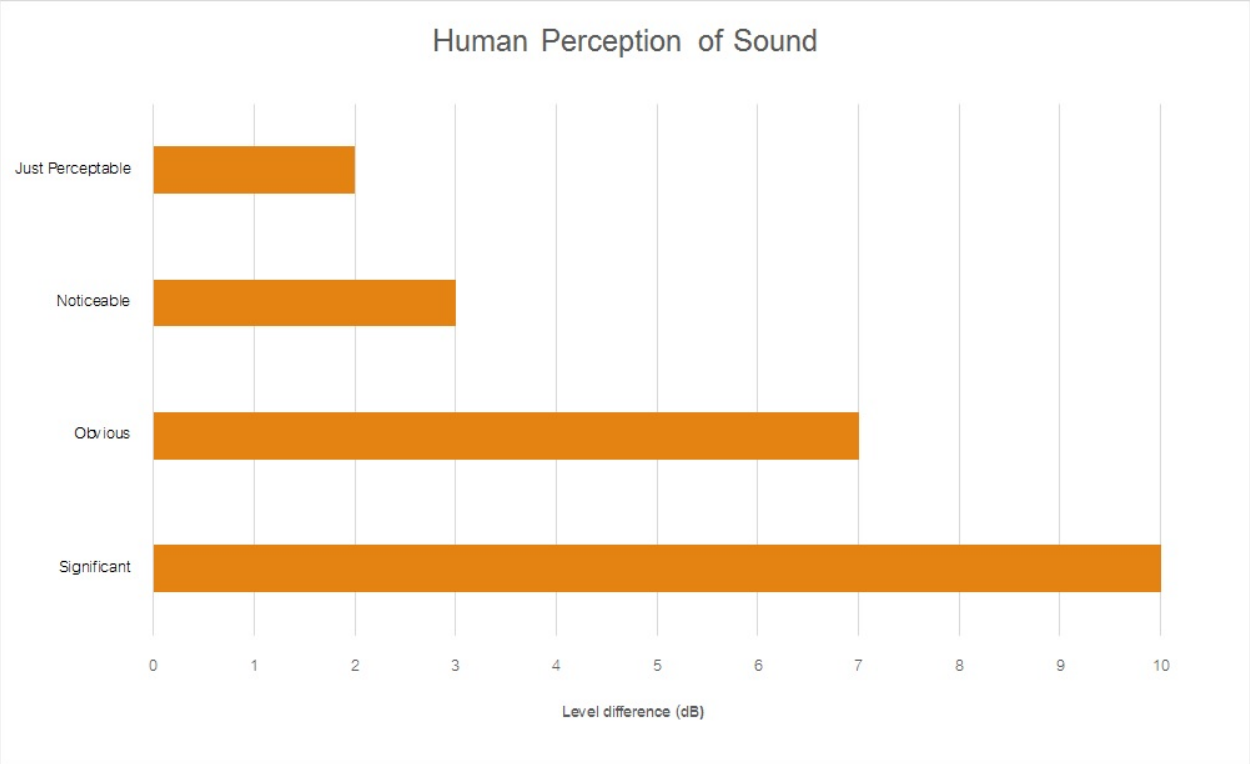
Table A1 provides a number of technical terms have been used in this report.

Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA	
Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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Noise Monitoring Assessment

Dunloe Quarry, Pottsville, NSW
Quarter 2 Ending June 2020.

Prepared for: Holcim (Australia) Pty Ltd
May 2020
MAC180611-07RP8

MAC
Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Dunloe Quarry, Pottsville, NSW

Quarter 2 Ending June 2020

Prepared for: Holcim (Australia) Pty Ltd

Prepared by: Muller Acoustic Consulting Pty Ltd
PO Box 262, Newcastle NSW 2300
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Document ID	Status	Date	Prepared By	Signed	Reviewed By	Signed
MAC180611-07RP8	Final	20 May 2020	Nicholas Shipman		Oliver Muller	

CONTENTS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for the quarterly period ending June 2020 for Dunloe Quarry (the 'quarry'), Pottsville, NSW.

The monitoring has been conducted in accordance with the Dunloe Project Approval (2008) and Noise Management Plan at four representative monitoring locations. This assessment represents the operations undertaken during Quarter 2, ending June 2020 and forms part of the annual noise monitoring program to address conditions of the project approval.

The assessment has been conducted in accordance with the following documents:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Dunloe Noise Management Plan (NMP), 2016; and
- Australian Standard AS 1055:2018- Acoustics - Description and measurement of environmental noise - General Procedures.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Noise Criteria

Schedule 3 Section 2 of the Project Approval outlines the applicable noise criteria for residential receivers surrounding the quarry site.

The noise criteria are applicable when the site undertakes quarrying operations within the permitted operating hours Monday to Friday 7am – 5pm, Saturday 7am – 12pm with no operations on Sunday.

Table 1 presents the noise criteria for each of the receivers as outlined in the Project Approval.

Table 1 Noise Criteria

Location	Day Criteria dB $LA_{eq(15min)}$ [2]
All privately-owned receivers [1]	48

Note 1: Receiver locations are shown in Figure 1.

Note 2: Criteria applicable between Monday to Friday 7am – 5pm, Saturday 7am – 12pm with no operations on Sunday as the Table 2 of the Project Approval.

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3 Methodology

3.1 Locality

The quarry is approximately 2.5km south west of Pottsville, NSW. Receivers surrounding the quarry are primarily rural/residential situated in coastal bushland with elevated and undulating topography. The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan shown in **Figure 1.**

3.2 Noise Monitoring Locations

Four monitoring locations have been selected as part of the NMA and are listed below:

- R1 is located at the property on Kellehers Road situated north of the quarry;
- R2 is located west of the quarry on the boundary of 574 Pottsville Road;
- R3 is located to the south-west of the quarry at the address of 122 Warwick Park Road; and
- R4 is located at 265 Warwick Park Road, south of the quarry.

3.3 Assessment Methodology

Attended noise surveys were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise and Dunloe Quarry's Project Approval. Measurements were carried out using a Svantek Type 1, 971 noise analyser on Wednesday 13 May 2020. Acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

One measurement was conducted at each monitoring location during the daytime period. Measurements were of 15 minutes in duration and where possible, throughout each survey the operator quantified the contribution of each significant noise source.

Extraneous noise sources were excluded from the analysis to determine the $LA_{eq(15min)}$ quarry noise contribution for comparison against the relevant criteria. Where the quarry was inaudible, the contribution is estimated to be at least 10dB below the ambient noise level.

FIGURE 1

LOCALITY PLAN

REF: MAC180611-07

0 500m

KEY	
R1	RECEIVER LOCATION
	SITE LOCATION

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*Imagery Source : nearmaps

4 Results

4.1 Assessment Results - Location R1

The monitored noise level contributions and observed meteorological conditions for R1 are presented in **Table 2**.

Table 2 Operator-Attended Noise Survey Results – Location R1

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
15/05/2020	13:38	53	37	32	WD: W WS: 0.1m/s Rain: Nil	Traffic 31-36 Insects <31 Birds 31-53 Aircraft 34-44 Quarry inaudible
Dunloe Quarry $L_{Aeq(15min)}$ Contribution						<30

4.2 Assessment Results - Location R2

The monitored noise level contributions and observed meteorological conditions for R2 are presented in **Table 3.**

Table 3 Operator-Attended Noise Survey Results – Location R2

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
15/05/2020	14:00	88	65	43	WD: W WS: 1m/s Rain: Nil	Traffic 39-88 Birds 39-46 Wind 38-46 Quarry inaudible
Dunloe Quarry $L_{Aeq(15min)}$ Contribution						<30

4.3 Assessment Results - Location R3

The monitored noise level contributions and observed meteorological conditions for R3 are presented in **Table 4.**

Table 4 Operator-Attended Noise Survey Results – Location R3

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
15/05/2020	14:21	66	44	33	WD: W WS: 1m/s Rain: Nil	Aircraft 36-51 Birds 36-56 Insects <32 Wind 32-38 Dog 32-42 Traffic 36-66 Quarry inaudible
Dunloe Quarry $L_{Aeq(15min)}$ Contribution						<30

4.4 Assessment Results - Location R4

The monitored noise level contributions and observed meteorological conditions for R4 are presented in **Table 5**.

Table 5 Operator-Attended Noise Survey Results – Location R4

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
15/05/2020	14:41	62	41	37	WD: W WS: 0.5m/s Rain: Nil	Birds 34-46 Traffic 32-38 Insects <34 Livestock 36-41 Wind <34 Quarry inaudible
Dunloe Quarry $L_{Aeq(15min)}$ Contribution						<30

5 Discussion

5.1 Discussion of Results - Location R1

Quarry noise emissions were inaudible during monitoring conducted on Wednesday 13 May 2020 at location R1. Quarry noise contributions were estimated to satisfy the relevant daytime noise limit of 48dB $L_{Aeq(15min)}$. Extraneous noise sources include traffic, insects, birds, and aircraft during the monitoring period.

5.2 Discussion of Results - Location R2

Quarry noise emissions were inaudible during monitoring conducted on Wednesday 13 May 2020 at location R2. Quarry noise contributions were estimated to satisfy the relevant daytime noise limit of 48dB $L_{Aeq(15min)}$. Extraneous noise sources include traffic, birds, and wind in trees during the monitoring period.

5.3 Discussion of Results - Location R3

Quarry noise emissions were inaudible during monitoring conducted on Wednesday 13 May 2020 at location R3. Quarry noise contributions were estimated to satisfy the relevant daytime noise limit of 48dB $L_{Aeq(15min)}$. Extraneous noise sources include aircraft, birds, insects, wind in trees and dogs barking during the monitoring period.

5.4 Discussion of Results - Location R4

Quarry noise emissions were inaudible during monitoring conducted on Wednesday 13 May 2020 at location R4. Quarry noise contributions were estimated to satisfy the relevant daytime noise limit of 48dB $L_{Aeq(15min)}$. Extraneous noise sources include birds, traffic, insects, livestock, and wind in trees during the monitoring period.

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6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Holcim (Australia) Pty Ltd at Dunloe Quarry, Pottsville, NSW. The assessment was completed to determine the quarry's compliance with the relevant criteria outlined in their Project Approval for relevant surrounding residential receivers for Quarter 2, ending June 2020.

Attended noise monitoring was undertaken on Wednesday 13 May 2020 at representative monitoring locations, with quarry noise contributions compared against the relevant criteria. The assessment has identified that noise emissions generated by Dunloe Quarry complies with the relevant noise criteria specified in the Project Approval at all assessed residential receivers.

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Appendix A - Glossary of Terms

Table A1 provides a number of technical terms have been used in this report.

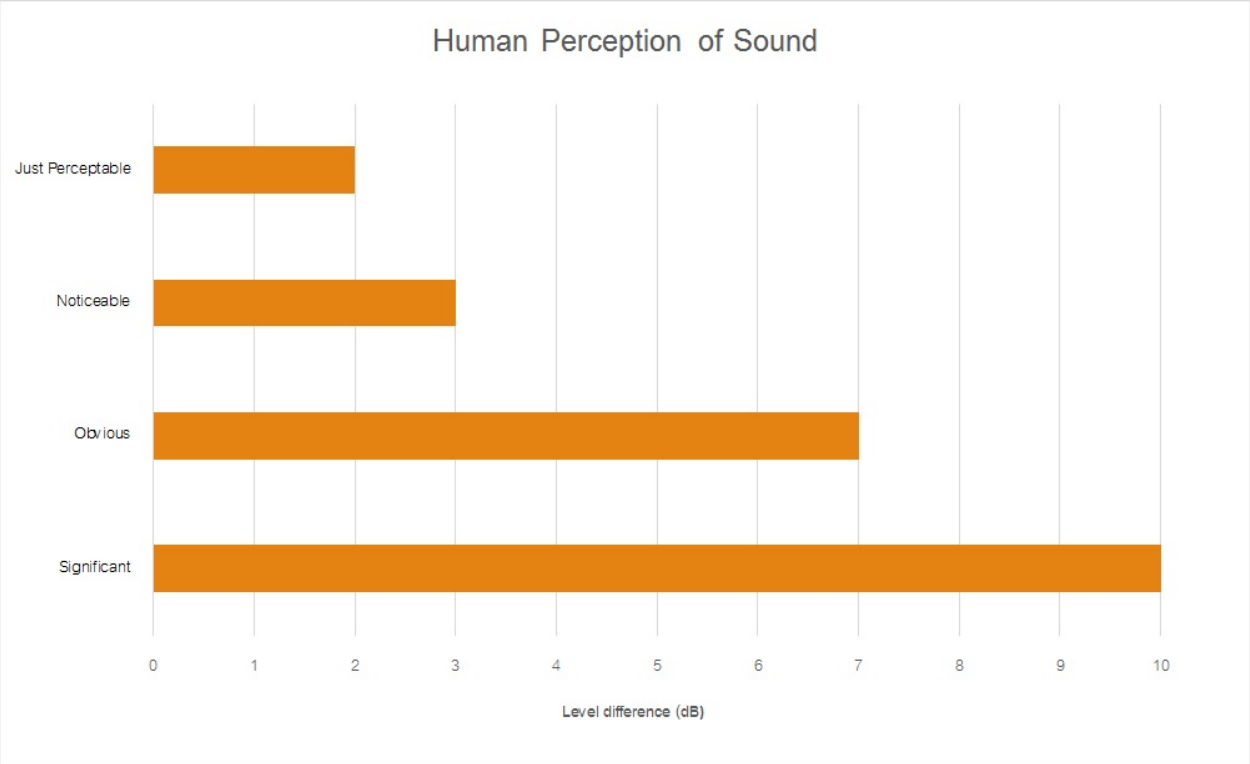
Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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Noise Monitoring Assessment

Dunloe Quarry, Pottsville, NSW
Quarter 3 Ending September 2020.

Prepared for: Holcim (Australia) Pty Ltd
September 2020
MAC180611-07RP9

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Dunloe Quarry, Pottsville, NSW

Quarter 3 Ending September 2020

Prepared for: Holcim (Australia) Pty Ltd

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Document ID	Status	Date	Prepared By	Signed	Reviewed By	Signed
MAC180611-07RP9	Final	18 September 2020	Nicholas Shipman		Oliver Muller	

CONTENTS

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1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has been commissioned by Holcim (Australia) Pty Ltd (Holcim) to complete a Noise Monitoring Assessment (NMA) for the quarterly period ending September 2020 for Dunloe Quarry (the 'quarry'), Pottsville, NSW.

The monitoring has been conducted in accordance with the Dunloe Project Approval 06_0030, Modification (2018) and Noise Management Plan (2020) at three representative monitoring locations. This assessment represents the operations undertaken during Quarter 3, ending September 2020 and forms part of the annual noise monitoring program to address conditions of the project approval.

The assessment has been conducted in accordance with the following documents:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- NSW Environment Protection Authority (EPA), Environmental Protection License (EPL), 13077, 2018;
- NSW Department of Planning, Project Approval 06_0030, Modification 2018;
- GHD, Dunloe Sand Quarry Noise Management Plan (NMP), 2020; and
- Australian Standard AS 1055:2018- Acoustics - Description and measurement of environmental noise - General Procedures.

A glossary of terms, definitions and abbreviations used in this report is provided in **Appendix A**.

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2 Noise Criteria

Table 4.1 of Dunloe Sand Quarry's NMP, (2020) outlines the updated applicable noise criteria for residential receivers surrounding the quarry site.

The noise criteria are applicable when the site undertakes quarrying operations within the permitted operating hours Monday to Friday 7am – 5pm, Saturday 7am – 12pm with no operations on Sunday.

Table 1 presents the noise criteria for each of the receivers as outlined in Table 4.1 of the NMP (2020).

Table 1 Noise Criteria

Location	Day Criteria dB $LA_{eq(15min)}$[2]
R6 and R7	42
R8	48
All privately-owned receivers[1]	41

Note 1: Receiver locations are shown in Figure 1.

Note 2: Criteria applicable between Monday to Friday 7am – 5pm, Saturday 7am – 12pm with no operations on Sunday as the Table 4.1 of the NMP (2020)

2.1 Environmental Protection License (EPL 13077)

Compliance with the noise criteria in the NMP would also result in compliance with the EPL noise limits (EPL 13077) which requires noise contribution from the quarry not to exceed 48dB $LA_{eq(15min)}$ at any residential receiver.

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3 Methodology

3.1 Locality

The quarry is approximately 2.5km south west of Pottsville, NSW. Receivers surrounding the quarry are primarily rural/residential situated in coastal bushland with elevated and undulating topography. The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan shown in **Figure 1.**

3.2 Noise Monitoring Locations

Three monitoring locations have been selected as part of the NMA and are listed below:

- R6 is located at 157 Warwick Park Road;
- R7 is located at 129 Warwick Park Road; and
- R8 is located at 679 Pottsville Road.

3.3 Assessment Methodology

Attended noise surveys were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise and Dunloe Quarry's Project Approval. Measurements were carried out using a Svantek Type 1, 971 noise analyser on Tuesday 8 September 2020. Acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

One measurement was conducted at each monitoring location during the daytime period. Measurements were of 15 minutes in duration and where possible, throughout each survey the operator quantified the contribution of each significant noise source.

Extraneous noise sources were excluded from the analysis to determine the $LA_{eq(15min)}$ quarry noise contribution for comparison against the relevant criteria. Where the quarry was inaudible, the contribution is estimated to be at least 10dB below the ambient noise level.

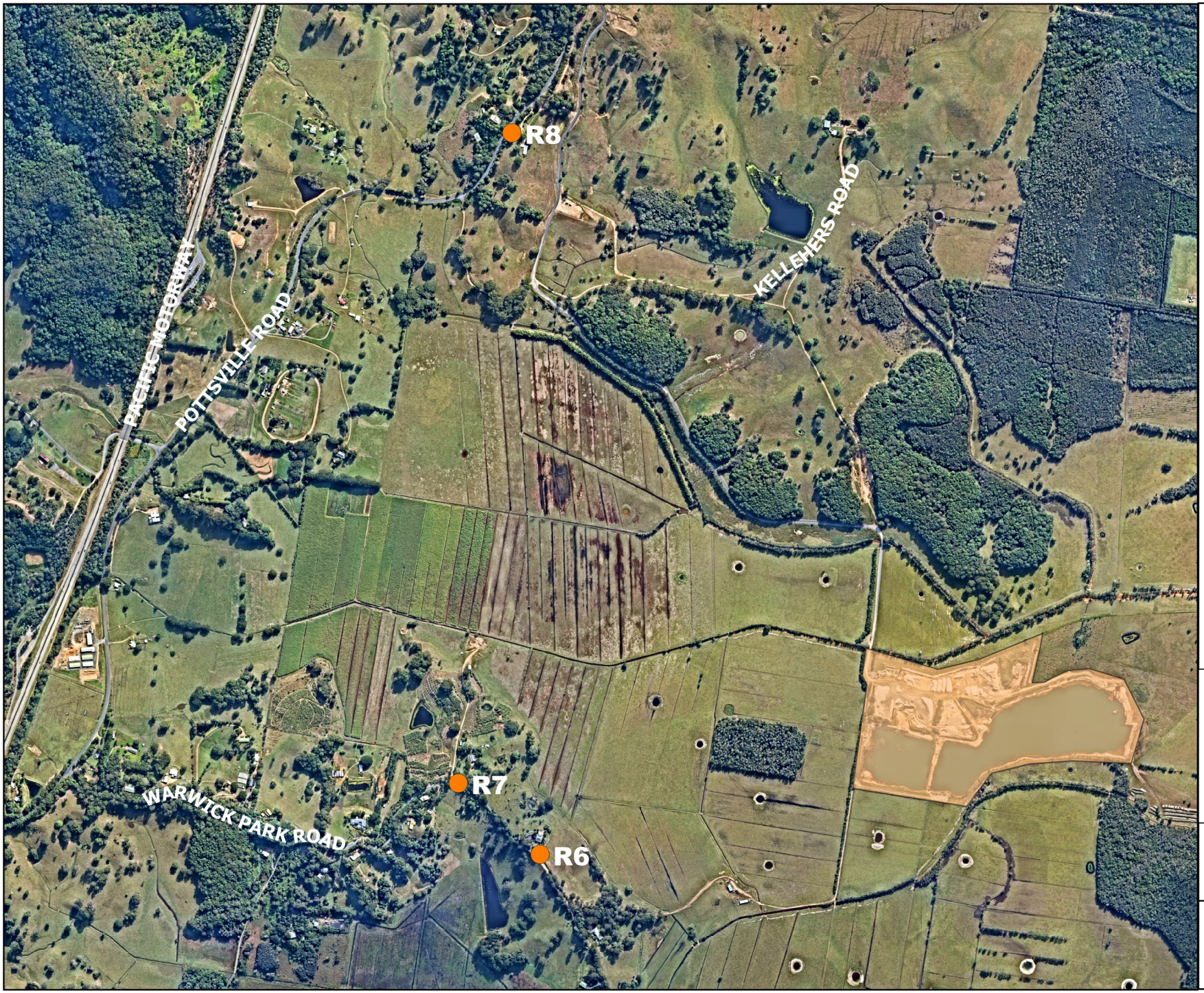

FIGURE 1

Site Locality

MAC180611-07

Holcim Dunloe Quarry

KEY

Receivers

Dunloe Quarry

0 100 200 300 400 500 m

N

MAC
Muller Acoustic Consulting

4 Results

4.1 Assessment Results - Location R6

The monitored noise level contributions and observed meteorological conditions for R6 are presented in **Table 2**.

Table 2 Operator-Attended Noise Survey Results – Location R6

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
08/09/2020	12:49	76	52	35	WD: S WS: 1.5m/s Rain: Nil	Birds 35-39 Wind 36-39 Traffic 35-76 Insects 33-36 Livestock 38-56 Local residential noise <37 Quarry inaudible
Dunloe Quarry $L_{Aeq(15min)}$ Contribution						<30

4.2 Assessment Results - Location R7

The monitored noise level contributions and observed meteorological conditions for R7 are presented in **Table 3.**

Table 3 Operator-Attended Noise Survey Results – Location R7

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
08/09/2020	13:09	59	41	36	WD: S WS: 1m/s Rain: Nil	Wind 34-40 Aircraft 34-38 Birds 39-59 Traffic 36-40 Quarry inaudible
Dunloe Quarry $L_{Aeq(15min)}$ Contribution						<30

4.3 Assessment Results - Location R8

The monitored noise level contributions and observed meteorological conditions for R8 are presented in **Table 4.**

Table 4 Operator-Attended Noise Survey Results – Location R8

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
08/09/2020	13:33	84	65	36	WD: S WS: 1.2m/s Rain: Nil	Traffic 32-84 Birds 32-44 Aircraft 32-36 Quarry inaudible
Dunloe Quarry $L_{Aeq(15min)}$ Contribution						<30

5 Discussion

5.1 Discussion of Results - Location R6

Quarry noise emissions were inaudible during monitoring conducted on Tuesday 8 September 2020 at location R6. The (in field) estimated quarry noise contributions satisfied the relevant daytime noise limit of 42dB $LA_{eq(15min)}$. Extraneous noise sources include birds, wind in trees, traffic insects, livestock, and local residential noise during the monitoring period.

5.2 Discussion of Results - Location R7

Quarry noise emissions were inaudible during monitoring conducted on Tuesday 8 September 2020 at location R7. The (in field) estimated quarry noise contributions satisfied the relevant daytime noise limit of 42dB $LA_{eq(15min)}$. Extraneous noise sources include wind in trees, aircraft, birds, and traffic during the monitoring period.

5.3 Discussion of Results - Location R8

Quarry noise emissions were inaudible during monitoring conducted on Tuesday 8 September 2020 at location R8. The (in field) estimated quarry noise contributions satisfied the relevant daytime noise limit of 48dB $LA_{eq(15min)}$. Extraneous noise sources include traffic, birds, and aircraft during the monitoring period.

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6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Holcim (Australia) Pty Ltd at Dunloe Quarry, Pottsville, NSW. The assessment was completed to determine the quarry's compliance with the relevant criteria outlined in the Dunloe Project Approval 06_0030, Modification (2018) at relevant surrounding residential receivers for Quarter 3, ending September 2020.

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Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
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Bedroom (night with windows closed)	20
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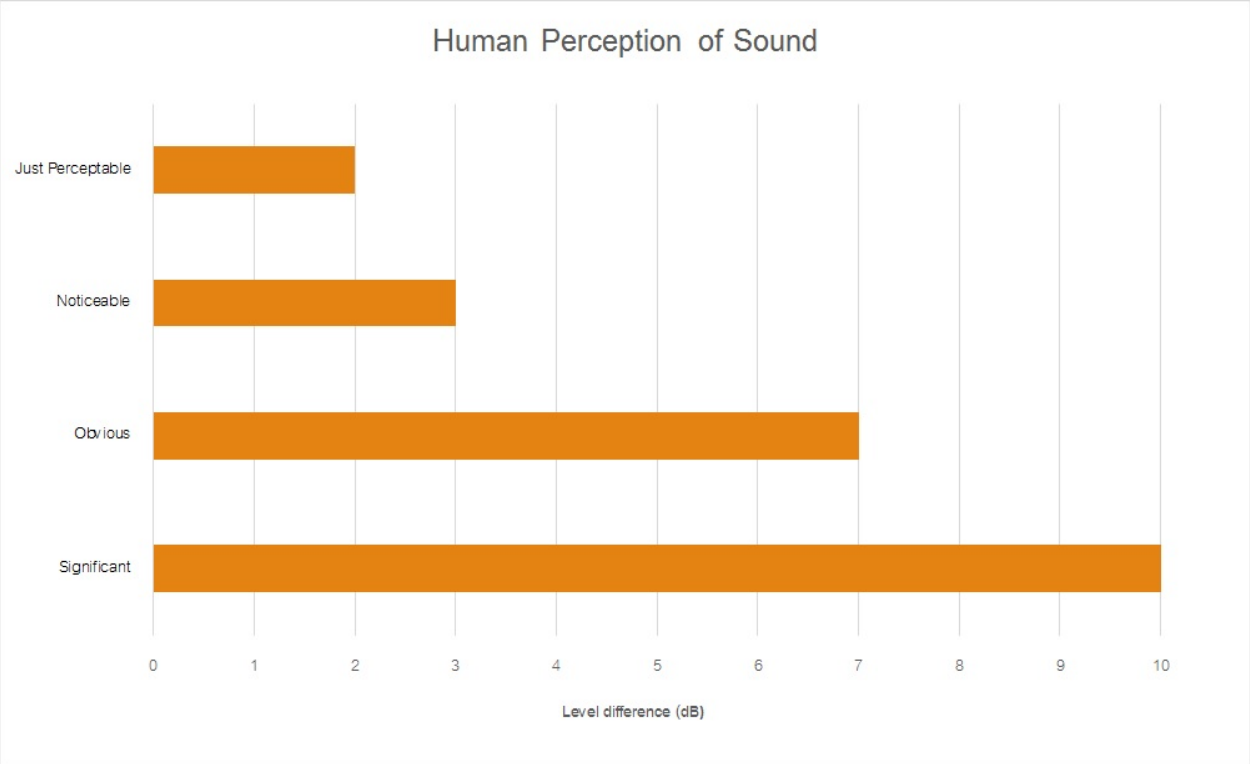
Figure A1 – Human Perception of Sound



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Noise Monitoring Assessment

Dunloe Quarry, Pottsville, NSW
Quarter 4 Ending December 2020

Prepared for: Holcim (Australia) Pty Ltd
December 2020
MAC180611-07RP10

Muller Acoustic Consulting

Document Information

Noise Monitoring Assessment

Dunloe Quarry, Pottsville, NSW

Quarter 4 Ending December 2020

Prepared for: Holcim (Australia) Pty Ltd

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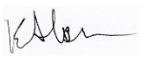
Document ID	Status	Date	Prepared By	Signed	Reviewed By	Signed
MAC180611-07RP10	Final	10 December 2020	Kristian Allen		Oliver Muller	

CONTENTS

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R6 and R7	42
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Compliance with the noise criteria in the NMP would also result in compliance with the EPL noise limits (EPL 13077) which requires noise contribution from the quarry not to exceed 48dB $LA_{eq(15min)}$ at any residential receiver.

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The quarry is approximately 2.5km south west of Pottsville, NSW. Receivers surrounding the quarry are primarily rural/residential situated in coastal bushland with elevated and undulating topography. The monitoring locations with respect to the quarry and assessed receivers are presented in the locality plan shown in **Figure 1.**

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- R8 is located at 679 Pottsville Road.

3.3 Assessment Methodology

Attended noise surveys were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise and Dunloe Quarry's Project Approval. Measurements were carried out using a Svantek Type 1, 971 noise analyser on Wednesday 25 Novemebr 2020. Acoustic instrumentation used carries current NATA calibration and complies with AS/NZS IEC 61672.1-2019-Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

One measurement was conducted at each monitoring location during the daytime period. Measurements were of 15 minutes in duration and where possible, throughout each survey the operator quantified the contribution of each significant noise source.

Extraneous noise sources were excluded from the analysis to determine the $LA_{eq(15min)}$ quarry noise contribution for comparison against the relevant criteria. Where the quarry was inaudible, the contribution is estimated to be at least 10dB below the ambient noise level.

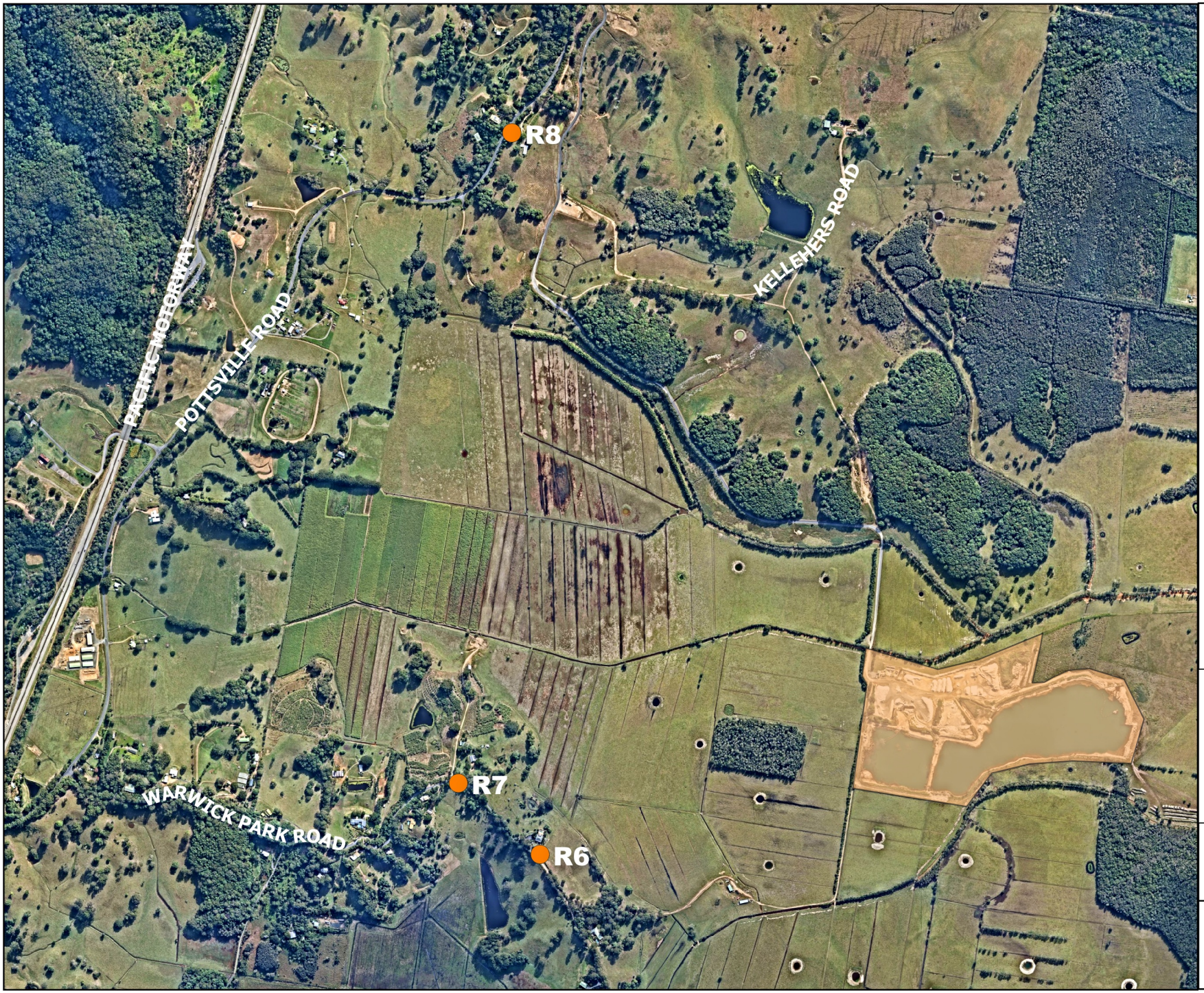

FIGURE 1

Site Locality

MAC180611-07

Holcim Dunloe Quarry

KEY

Receivers

Dunloe Quarry

0 100 200 300 400 500 m

N

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4 Results

4.1 Assessment Results - Location R6

The monitored noise level contributions and observed meteorological conditions for R6 are presented in **Table 2**.

Table 2 Operator-Attended Noise Survey Results – Location R6

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
25/11/2020	13:35	63	50	39	WD: SE WS: 1.5m/s Rain: Nil	Insects 36-59 Aircraft 39-48 Traffic 33-46 Birds 33-63 Wind <36 Quarry inaudible
Dunloe Quarry $L_{Aeq(15min)}$ Contribution						<35

4.2 Assessment Results - Location R7

The monitored noise level contributions and observed meteorological conditions for R7 are presented in **Table 3.**

Table 3 Operator-Attended Noise Survey Results – Location R7

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
25/11/2020	13:55	72	57	44	WD: SE WS: 1.0m/s Rain: Nil	Insects 40-65 Birds 37-58 Traffic 37-72 Aircraft 44-61 Quarry inaudible
Dunloe Quarry $L_{Aeq(15min)}$ Contribution						<35

4.3 Assessment Results - Location R8

The monitored noise level contributions and observed meteorological conditions for R8 are presented in **Table 4.**

Table 4 Operator-Attended Noise Survey Results – Location R8

Date	Time (hrs)	Descriptor (dBA re 20 µPa)			Meteorology	Description and SPL, dBA
		L_{Amax}	L_{Aeq}	L_{A90}		
25/11/2020	14:18	85	64	50	WD: SE WS: 1.0m/s Rain: Nil	Traffic 46-85 Insects <43 Birds 43-56 Aircraft 46-58 Quarry inaudible
Dunloe Quarry $L_{Aeq(15min)}$ Contribution						<40

5 Discussion

5.1 Discussion of Results - Location R6

Quarry noise emissions were inaudible during monitoring conducted on Wednesday 25 November 2020 at location R6. The (in field) estimated quarry noise contributions satisfied the relevant daytime noise limit of 42dB $LA_{eq(15min)}$. Extraneous noise sources include birds, wind in trees, traffic, insects and aircraft during the monitoring period.

5.2 Discussion of Results - Location R7

Quarry noise emissions were inaudible during monitoring conducted on Wednesday 25 November 2020 at location R7. The (in field) estimated quarry noise contributions satisfied the relevant daytime noise limit of 42dB $LA_{eq(15min)}$. Extraneous noise sources include insects, aircraft, birds and traffic during the monitoring period.

5.3 Discussion of Results - Location R8

Quarry noise emissions were inaudible during monitoring conducted on Wednesday 25 November 2020 at location R8. The (in field) estimated quarry noise contributions satisfied the relevant daytime noise limit of 48dB $LA_{eq(15min)}$. Extraneous noise sources include traffic, birds, insects and aircraft during the monitoring period.

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6 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Holcim (Australia) Pty Ltd at Dunloe Quarry, Pottsville, NSW. The assessment was completed to determine the quarry's compliance with the relevant criteria outlined in the Dunloe Project Approval 06_0030, Modification (2018) at relevant surrounding residential receivers for Quarter 4, ending December 2020.

Attended noise monitoring was undertaken on Wednesday 25 November 2020 at representative monitoring locations, with quarry noise contributions compared against the relevant criteria. The assessment has identified that noise emissions generated by Dunloe Quarry complies with the relevant noise criteria specified in the NMP (2020) and EPL at all assessed residential receivers.

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Appendix A - Glossary of Terms

Table A1 provides a number of technical terms have been used in this report.

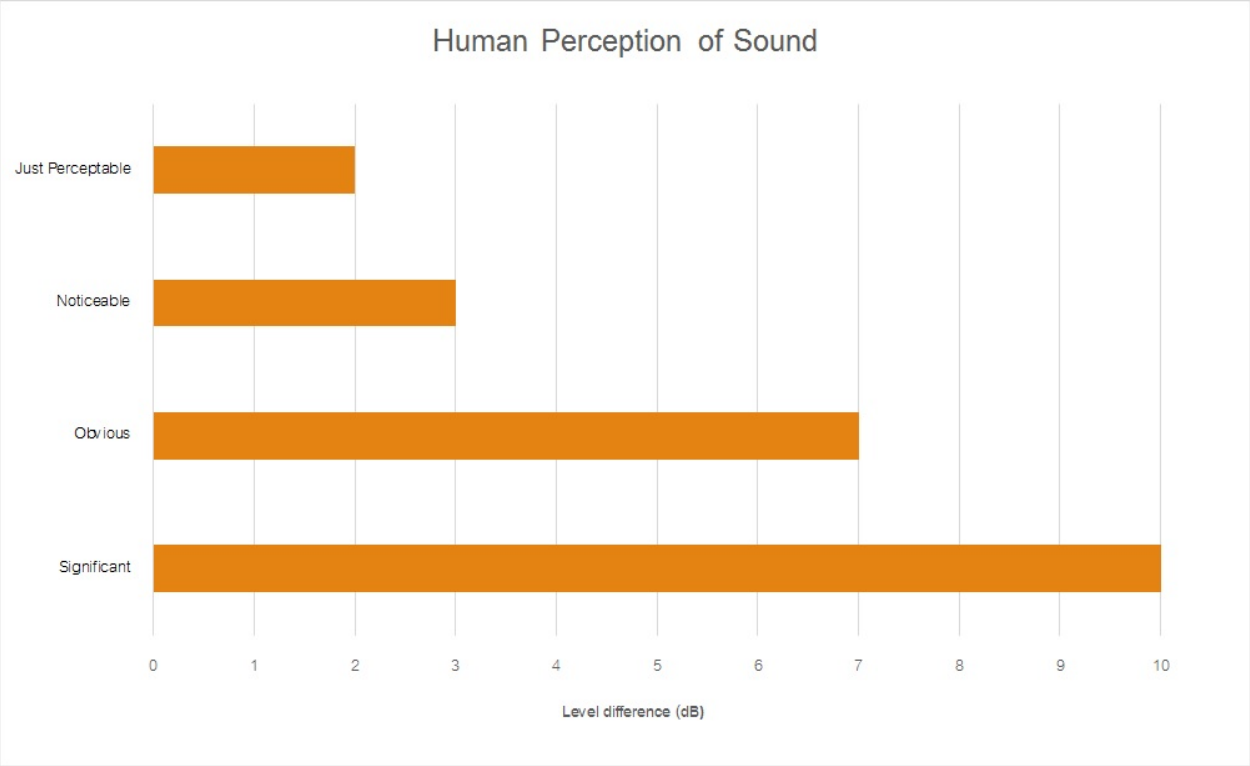
Table A1 Glossary of Terms	
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured LA90 statistical noise levels.
Adverse Weather	Weather effects that enhance noise (that is, wind and temperature inversions) that occur at a site for a significant period of time (that is, wind occurring more than 30% of the time in any assessment period in any season and/or temperature inversions occurring more than 30% of the nights in winter).
Ambient Noise	The noise associated with a given environment. Typically a composite of sounds from many sources located both near and far where no particular sound is dominant.
A Weighting	A standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.
dBA	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
dB(Z), dB(L)	Decibels Linear or decibels Z-weighted.
Hertz (Hz)	The measure of frequency of sound wave oscillations per second - 1 oscillation per second equals 1 hertz.
LA10	A noise level which is exceeded 10 % of the time. It is approximately equivalent to the average of maximum noise levels.
LA90	Commonly referred to as the background noise, this is the level exceeded 90 % of the time.
LAeq	The summation of noise over a selected period of time. It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period.
LAmax	The maximum root mean squared (rms) sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Level (RBL) is an overall single figure background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABL's.
Sound power level (LW)	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental location of the source and is independent of the surrounding environment. Or a measure of the energy emitted from a source as sound and is given by : = 10.log10 (W/Wo) Where : W is the sound power in watts and Wo is the sound reference power at 10-12 watts.

Table A2 provides a list of common noise sources and their typical sound level.

Table A2 Common Noise Sources and Their Typical Sound Pressure Levels (SPL), dBA

Source	Typical Sound Level
Threshold of pain	140
Jet engine	130
Hydraulic hammer	120
Chainsaw	110
Industrial workshop	100
Lawn-mower (operator position)	90
Heavy traffic (footpath)	80
Elevated speech	70
Typical conversation	60
Ambient suburban environment	40
Ambient rural environment	30
Bedroom (night with windows closed)	20
Threshold of hearing	0

Figure A1 – Human Perception of Sound



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APPENDIX 2

DUNLOE SAND QUARRY LONGTERM ENVIRONMENTAL MONITORING

Longterm Depositional Dust Monitoring at Dunloe Sands Quarry

Data located	Date	Location	D1	D2	D3	D4
			g/m2/month	g/m2/month	g/m2/month	g/m2/month
Appendix of 2015 AEMR	17/07/2015	Dunloe Sands	0.3	0.2	0.7	0.4
Appendix of 2015 AEMR	19/08/2015	Dunloe Sands	0.3	0.3	0.2	0.2
Appendix of 2015 AEMR	17/09/2015	Dunloe Sands	0.5	1.6	0.4	0.5
Appendix of 2015 AEMR	21/10/2015	Dunloe Sands	0.1	0.6	0.2	0.1
Appendix of 2015 AEMR	25/11/2015	Dunloe Sands	0.3	1.7	0.6	0.5
Appendix of 2015 AEMR	16/12/2015	Dunloe Sands	0.7	0.8	0.4	0.6
2016 AEMR	Jan-16	Dunloe Sands	0.3	0.4	0.5	0.6
2016 AEMR	Feb-16	Dunloe Sands	0.4	0.6	0.5	0.5
2016 AEMR	Mar-16	Dunloe Sands	0.2	4.7	0.3	0.5
2016 AEMR	Apr-16	Dunloe Sands	0.2	1.6	0.2	0.8
2016 AEMR	May-16	Dunloe Sands	0.3	1.2	0.3	1.6
2016 AEMR	Jun-16	Dunloe Sands	0.3	1.1	1.6	0.5
2016 AEMR	Jul-16	Dunloe Sands	0.13	0.52	0.41	0.39
2016 AEMR	Aug-16	Dunloe Sands	0.6	0.5	0.3	0.4
2016 AEMR	Sep-16	Dunloe Sands	0.8	0.5	0.4	0.3
2016 AEMR	Oct-16	Dunloe Sands	0.8	0.5	0.4	0.3
2016 AEMR	Nov-16	Dunloe Sands	0.4	1.9	0.3	0.4
2016 AEMR	Dec-16	Dunloe Sands	0.5	1.7	0.6	0.5
2017 Q1 Env Mon report	30/01/2017	Dunloe Sands	0.3	0.2	0.5	0.3
2017 Q1 Env Mon report	27/02/2017	Dunloe Sands	0.3	0.2	0.2	0.3
2017 Enviro Monitoring	22/03/2017	Dunloe Sands	0.2	0.1	2.4	0.3
2017 Enviro Monitoring	19/04/2017	Dunloe Sands	0.2	0.9	1	0.3
2017 Enviro Monitoring	17/05/2017	Dunloe Sands	0.8	0.8	1.4	0.7
2017 Enviro Monitoring	14/06/2017	Dunloe Sands	0.2	0.2	0.2	0.2
2017 Enviro Monitoring	12/07/2017	Dunloe Sands	0.3	0.1	0.2	0.3
2017 Enviro Monitoring	9/08/2017	Dunloe Sands	0.1	0.1	0.2	0.5
2017 Enviro Monitoring	6/09/2017	Dunloe Sands	0.5	0.2	0.5	0.5
2017 Enviro Monitoring	4/10/2017	Dunloe Sands	0.7	0.6	2.4	0.9
2017 Enviro Monitoring	1/11/2017	Dunloe Sands	0.5	0.3	0.8	0.5
2017 Enviro Monitoring	29/11/2017	Dunloe Sands	0.1	0.2	0.3	0.1
2017 Enviro Monitoring	28/12/2017	Dunloe Sands	0.4	0.3	0.2	0.2
2018 Enviro Monitoring	24/01/2018	Dunloe Sands	0.1	0.1	0.1	0.1
2018 Enviro Monitoring	21/02/2018	Dunloe Sands	2.7	0.7	1.6	0.6
2018 Enviro Monitoring	21/03/2018	Dunloe Sands	0.4	4.9c	11.8c	7.1c
2018 Enviro Monitoring	18/04/2018	Dunloe Sands	0.4	0.1	0.3	0.2
2018 Enviro Monitoring	16/05/2018	Dunloe Sands	0.2	0.4	0.6	0.3
2018 Enviro Monitoring	13/06/2018	Dunloe Sands	0.3	0.2	5.2c	0.4
2018 Enviro Monitoring	11/07/2018	Dunloe Sands	0.5	0.4	0.5	0.2
2018 Enviro Monitoring	8/08/2018	Dunloe Sands	0.4	0.5	0.3	0.2
2018 Enviro Monitoring	5/09/2018	Dunloe Sands	NS	NS	NS	NS
2018 Enviro Monitoring	5/10/2018	Dunloe Sands	0.1	0.4	0.3	0.7
2018 Enviro Monitoring	6/11/2018	Dunloe Sands	0.1	0.1	1.5	0.7
2018 Enviro Monitoring	7/12/2018	Dunloe Sands	1	0.2	1.6	0.3
2019 Enviro Monitoring	8/01/2019	Dunloe Sands	0.5	0.6	0.5	0.3
2019 Enviro Monitoring	5/02/2019	Dunloe Sands	0.2	0.2	0.2	0.2
2019 Enviro Monitoring	8/03/2019	Dunloe Sands	1.1	1	1.2	0.9
2019 Enviro Monitoring	5/04/2019	Dunloe Sands	0.5	0.2	0.2	0.9
2019 Enviro Monitoring	7/05/2019	Dunloe Sands	0.1	0.4	0.2	1.2
2019 Enviro Monitoring	4/06/2019	Dunloe Sands	0.2	0.4	0.7	0.2
2019 Enviro Monitoring	4/07/2019	Dunloe Sands	0.3	0.3	0.2	1.1
2019 Enviro Monitoring	29/08/2019	Dunloe Sands	0.5	0.5	0.4	1.8
2019 Enviro Monitoring	26/09/2019	Dunloe Sands	0.7	0.6	0.5	1.5
2019 Enviro Monitoring	24/10/2019	Dunloe Sands	1.2	0.7	0.5	1.4
2019 Enviro Monitoring	22/11/2019	Dunloe Sands	0.8	0.5	0.8	0.5
2019 Enviro Monitoring	20/12/2019	Dunloe Sands	1.8	1.8	1.6	1
2020 Enviro Monitoring Portal	17/01/2020	Dunloe Sands	2.3	2.5	1.3	NS
2020 Enviro Monitoring Portal	14/02/2020	Dunloe Sands	0.3	NS	NS	NS
2020 Enviro Monitoring Portal	18/03/2020	Dunloe Sands	0.4	6.1*	0.5*	5.4*

2020 Enviro Monitoring Portal	16/04/2020	Dunloe Sands	1	0.6	0.5	0.6
2020 Enviro Monitoring Portal	14/05/2020	Dunloe Sands	2	3.6	0.3	0.6
2020 Enviro Monitoring Portal	11/06/2020	Dunloe Sands	0.1	0.9	0.3	2.5*
2020 Enviro Monitoring Portal	9/07/2020	Dunloe Sands	0.1	2.1	0.2	4
2020 Enviro Monitoring Portal	10/08/2020	Dunloe Sands	1.4	0.7	0.2	3
2020 Enviro Monitoring Portal	10/09/2020	Dunloe Sands	0.5	0.6	0.7	0.8
2020 Enviro Monitoring Portal	8/10/2020	Dunloe Sands	0.5	0.4	1	7.7
2020 Enviro Monitoring Portal	9/11/2020	Dunloe Sands	1.1	1.6	0.4	3
2020 Enviro Monitoring Portal	10/12/2020	Dunloe Sands	1	NS	0.4	3.8
		Minimum	**0.1**	**0.1**	**0.1**	**0.1**
		Maximum	**2.7**	**4.7**	**2.4**	**7.7**
		Average	**0.55**	**0.77**	**0.61**	**0.86**

Longterm Surrounding Surface Water Quality Monitoring at Dunloe Sands Quarry

Data located	Date	Location	pH	EC	DO (membrane electrode)	Turbidity	TSS	Total Phosphorus-P	Total-N	Calcium	Magnesium	Potassium	Sulfur as Sulfate	Arsenic (Total)	Iron (Total)	Manganese (Total)
			pH	µScm-1	mg/L	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
2011/2012 AEMR	Dec-11	SW3	6	253	8.4		8	0.03	0.05							
2011/2012 AEMR	Mar-12	SW3	5.4	227	5.5		11	0.02	0.96							
2011/2012 AEMR	Jun-12	SW3	6	314	7.8	36	12	0.05	0.7	8.2						
2011/2012 AEMR	27/09/2012	SW3	6.7	17676	7.6	10	5.2	0.03	0.52							
2012/2013 AEMR	Dec-12	SW3	6.7	25765	6		14	0.04	0.7							
2012/2013 AEMR	Mar-13	SW3	6.7	3489	6.8		8.4	0.03	0.53							
2012/2013 AEMR	Jun-13	SW3	6	692	7.2		48									
2012/2013 AEMR	Sep-13	SW3	7	17686	7.3		14	0.02	0.38							
2013/2014 AEMR	12/12/2013	SW3	7.1	25681	5.8		13	0.02	0.34							
2013/2014 AEMR	Mar-14	SW3	3.7	1753	2.9		42	0.05	1.54							
2013/2014 AEMR	31/03/2014	SW3	3.7	1753	2.9	77	42	0.05	1.54							
2013/2014 AEMR	25/06/2014	SW3	5.7	19911	8.9	14	9	<0.02	0.76							
2013/2014 AEMR	Aug-14	SW3	7.9	41455	8.4		5.8	<0.02	0.2							
2013/2014 AEMR	29/09/2014	SW3	7.9	41455	8.4	6.2	5.8	<0.02	0.2	123	16	7	505	<0.005	11	106
Appendix of 2015 AEMR	15/12/2014	SW3	7.7	30732	7.9	9.9	35	0.03	0.36							
Appendix of 2015 AEMR	26/03/2015	SW3	3.7	1834	4.8	54	23	0.04	1.32							
Appendix of 2015 AEMR	24/04/2015	SW3	6.5	12467	7.2	7.8	4.0	0.15	0.46							
Appendix of 2015 AEMR	17/09/2015	SW3	6.7	15704	7.3	33	20	0.02	0.45							
Appendix of 2015 AEMR	11/12/2015	SW3	6.5	15038	6.8	13	24	<0.02	0.41							
Appendix of 2016 AEMR	24/03/2016	SW3	3.8	2548	3.6	54	24	0.06	1.16							
Appendix of 2016 AEMR	30/06/2016	SW3	5.5	1501.6	6.8	31	25	0.03	0.87							
Appendix of 2016 AEMR	29/09/2016	SW3	6.7	38914	6.1		5.6	0.02	0.23							
Appendix of 2016 AEMR	20/12/2016	SW3	7.4	36425	7.1		6.2	<0.02	0.31							
AEMR 2019	8/03/2019	SW3	6.92	41	2.97	0	5									
AEMR 2019	4/06/2019	SW3	6.84	30600	7.8	14	6									
AEMR 2019	29/08/2019	SW3	6.36	6310	9.9	17.5	10									
AEMR 2019	22/11/2019	SW3	6.79	43000	108	5.6	6									
2020 Annual Review	18/03/2020	SW3	5.02	778	2	43										
2020 Annual Review	11/06/2020	SW3	4.05	4600	4.4	0					98	27		0.002		0.79
2020 Annual Review	10/09/2020	SW3	4.22	2240	6.01	104	170	0.03	1.8							
2020 Annual Review	9/11/2020	SW3	3.74	4150	5.97	0	24	0.02	0.6							
Number of Samples			**31**	**31**	**31**	**20**	**29**	**19**	**24**	**2**	**2**	**2**	**1**	**1**	**1**	**2**
Minimum			**3.7**	**41**	**2**	**0**	**4**	**0.02**	**0.05**	**8.2**	**16**	**7**	**505**	**0.002**	**11**	**0.79**
Maximum			**7.9**	**43000**	**108**	**104**	**170**	**0.15**	**1.8**	**123**	**98**	**27**	**505**	**0.002**	**11**	**106**
Average			**5.97**	**14354.60**	**9.63**	**26.50**	**21.59**	**0.04**	**0.68**	**65.60**	**57.00**	**17.00**	**505.00**	**0.00**	**11.00**	**53.40**
2011/2012 AEMR	Dec-11	SW4	6.4	1504	5.3		12	0.03	0.63							
2011/2012 AEMR	Mar-12	SW4	6	458	6.8		6.7	0.03	0.81							
2011/2012 AEMR	Jun-12	SW4	6.2	805	8.6	26	7.7	0.04	0.78	10						
2011/2012 AEMR	27/09/2012	SW4	7	23790	7	5.1	10	<0.02	0.27							
2012/2013 AEMR	Dec-12	SW4	7	30543	5.7		9.4	<0.02	0.39							
2012/2013 AEMR	Mar-13	SW4	7.6	29821	7		9.6	0.02	0.54							
2012/2013 AEMR	Jun-13	SW4	5.9	890	7.4		16									
2012/2013 AEMR	Sep-13	SW4	6.8	16825	7.2		8.8	0.02	0.41							
2013/2014 AEMR	12/12/2013	SW4	6.7	17021	5.5		15	0.03	0.51							
2013/2014 AEMR	Mar-14	SW4	3.8	1354	2.5		41	0.04	1.43							
2013/2014 AEMR	31/03/2014	SW4	3.8	1354	2.5	76	41	0.04	1.43							
2013/2014 AEMR	25/06/2014	SW4	6.5	25363	8.4	12	8	<0.02	0.5							
2013/2014 AEMR	Aug-14	SW4	7.1	22190	8.4		6	<0.02	0.31							
2013/2014 AEMR	29/09/2014	SW4	7.1	22190	8.4	9.8	6	<0.02	0.31							
Appendix of 2015 AEMR	15/12/2014	SW4	8	29257	10	11	33	0.05	0.86							
Appendix of 2015 AEMR	26/03/2015	SW4	3.7	1426	4.7	48	24	0.1	1.15							
Appendix of 2015 AEMR	24/04/2015	SW4	6.4	12416	7.4	22	18	0.02	0.45							
Appendix of 2015 AEMR	17/09/2015	SW4	6.7	8008	7.3	19	11	0.02	0.48							
Appendix of 2015 AEMR	11/12/2015	SW4	7.7	39859	7.5	4.2	9.5	0.02	0.24							
Appendix of 2016 AEMR	24/03/2016	SW4	3.8	2721	5.5	54	25	0.06	1.15							
Appendix of 2016 AEMR	30/06/2016	SW4	6.5	3468.2	8.4	14	10	0.02	0.7							
Appendix of 2016 AEMR	29/09/2016	SW4	6.9	37551	9.6		66	0.02	0.34							
Appendix of 2016 AEMR	20/12/2016	SW4	6.9	17005	6.9		8.5	0.03	0.49							
AEMR 2019	8/03/2019	SW4	7.59	51	4.67	0	5									
AEMR 2019	4/06/2019	SW4	6.99	40700	9	2.3	6									
AEMR 2019	29/08/2019	SW4	6.9	7140	8.5	6.6	8									
AEMR 2019	22/11/2019	SW4	7.23	45300	103	2.6	5									
2020 Annual Review	18/03/2020	SW4	5.02	778	24.35	43										
2020 Annual Review	10/09/2020	SW4	5.42	3430	2200	5.4	14	0.01	1.1							

Longterm Surrounding Surface Water Quality Monitoring at Dunloe Sands Quarry

2020 Annual Review	8/10/2020	SW4	7.33	16900	5.59	13.3	13	0.02	1							
2020 Annual Review	9/11/2020	SW4	5.6	5860	5.3	0	27	0.01	0.7							
		Number of Samples	**31**	**31**	**31**	**20**	**30**	**20**	**25**	**1**						
		Minimum	**3.7**	**51**	**2.5**	**0**	**5**	**0.01**	**0.24**	**10**						
		Maximum	**8**	**45300**	**2200**	**76**	**66**	**0.1**	**1.43**	**10**						

Longterm Surrounding Surface Water Quality Monitoring at Dunloe Sands Quarry

		Average	**6.34**	**15031.55**	**81.24**	**18.72**	**16.01**	**0.03**	**0.68**	**10.00**						
2011/2012 AEMR	Dec-11	SW9	6.4	657	7.8		13	0.03	0.53							
2011/2012 AEMR	Mar-12	SW9	6.1	704	6.5		36	0.09	1.31							
2011/2012 AEMR	Jun-12	SW9	6.1	575	5.4	25	10	0.04	0.6	32						
2011/2012 AEMR	27/09/2012	SW9	7.3	13557	9.4	4.8	13	0.02	0.53							
2012/2013 AEMR	Dec-12	SW9	6.8	17219	6.9		9.4	0.04	0.76							
2012/2013 AEMR	Mar-13	SW9	6.7	3708	7.3		6.8	0.03	0.43							
2012/2013 AEMR	Jun-13	SW9	4.9	305	6.5		27									
2012/2013 AEMR	Sep-13	SW9	7	2753	9.9		29	0.13	1.34							
2013/2014 AEMR	12/12/2013	SW9	6.8	10096	5.2		20	0.05	0.81							
2013/2014 AEMR	Mar-14	SW9	4.6	1431	2.1		40	0.13	1.64							
2013/2014 AEMR	31/03/2014	SW9	4.6	1431	2.1	30	40	0.13	1.64							
2013/2014 AEMR	25/06/2014	SW9	6.6	18376	7.9	60	16	0.05	0.67							
2013/2014 AEMR	Aug-14	SW9	7.1	10705	9.3		20	0.03	0.6							
2013/2014 AEMR	29/09/2014	SW9	7.1	10705	9.3	36	20	0.03	0.6							
Appendix of 2015 AEMR	15/12/2014	SW9	8	26966	10	33	37	0.05	1.52							
Appendix of 2015 AEMR	26/03/2015	SW9	4.2	763	5.2	16	5.8	0.02	1.04							
Appendix of 2015 AEMR	24/04/2015	SW9	6.2	4344	6.8	29	14	0.03	0.86							
Appendix of 2015 AEMR	17/09/2015	SW9	6.6	7381	6.8	34	14	0.03	0.83							
Appendix of 2015 AEMR	11/12/2015	SW9	7.1	5694	5.2	22	28	0.05	0.81							
Appendix of 2016 AEMR	24/03/2016	SW9	6.1	4157	6.5	13	10	0.04	0.88							
Appendix of 2016 AEMR	30/06/2016	SW9	6.6	2577.4	7.6	19	6.3	0.02	0.78							
Appendix of 2016 AEMR	29/09/2016	SW9	6.8	35815	7.4		35	<0.02	0.26							
Appendix of 2016 AEMR	20/12/2016	SW9	6.9	21421	6.9		6.4	0.04	0.82							
AEMR 2019	8/03/2019	SW9	7.46	49	3.6	0	5									
AEMR 2019	4/06/2019	SW9	6.93	38	8	3	5									
AEMR 2019	29/08/2019	SW9	6.82	7240	8.7	3.4	5									
AEMR 2019	22/11/2019	SW9	7.07	44300	71.1	2.1	10									
2020 Annual Review	24/09/2020	SW9	7.09	12500	6.75	18.1	16	0.01	0.2							
2020 Annual Review	9/11/2020	SW9	7.31	15700	6.32	0	58	0.01	0.2							
		Number of Samples	**29**	**29**	**29**	**18**	**29**	**23**	**24**	**1**						
		Minimum	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**						
		Maximum	**8**	**44300**	**71.1**	**60**	**58**	**0.13**	**1.64**	**32**						
		Average	**6.53**	**9695.43**	**9.05**	**19.36**	**19.16**	**0.05**	**0.82**	**32.00**						
2011/2012 AEMR	Dec-11	SW10	6.2	492	7.5		23	0.04	0.54							
2011/2012 AEMR	Mar-12	SW10	5.7	546	4.3		31	0.03	0.73							
2011/2012 AEMR	Jun-12	SW10	6.4	805	6.7	45	22	0.07	0.86	35						
2011/2012 AEMR	27/09/2012	SW10	7.4	12749	9.4	7.7	14	0.04	0.84							
2012/2013 AEMR	Dec-12	SW10	6.7	19403	6.9		7.4	0.03	0.71							
2012/2013 AEMR	Mar-13	SW10	6.8	1025	5.6		16	0.05	0.77							
2012/2013 AEMR	Jun-13	SW10	4.8	302	5.7		30									
2012/2013 AEMR	Sep-13	SW10	7.8	2870	15		45	0.29	2.15							
2013/2014 AEMR	12/12/2013	SW10	6.8	15775	5		10	0.03	0.56							
2013/2014 AEMR	Mar-14	SW10	4.6	1454	2.2		40	0.13	1.63							
2013/2014 AEMR	31/03/2014	SW10	4.6	1454	2.2	32	40	0.13	1.63							
2013/2014 AEMR	25/06/2014	SW10	6.5	17312	7.6	37	15	0.04	0.72							
2013/2014 AEMR	Aug-14	SW10	7.2	9164	11		30	0.11	1.06							
2013/2014 AEMR	29/09/2014	SW10	7.2	9164	11	46	30	0.11	1.06							
Appendix of 2015 AEMR	15/12/2014	SW10	7.6	26936	12	33	44	0.07	1.38							
Appendix of 2015 AEMR	26/03/2015	SW10	4.2	779	5.6	14	8.0	0.06	1.08							
Appendix of 2015 AEMR	24/04/2015	SW10	6.2	4381	6.5	25	15	0.03	0.87							
Appendix of 2015 AEMR	17/09/2015	SW10	6.5	6756	7	37	21	0.04	0.98							
Appendix of 2015 AEMR	11/12/2015	SW10	6.8	17660	5.7	5.4	9	<0.02	0.33							
Appendix of 2016 AEMR	24/03/2016	SW10	5.3	2967	7.1	7.4	4.8	0.04	0.77							
Appendix of 2016 AEMR	30/06/2016	SW10	6.7	4893.3	7.1	7.1	4.8	0.02	0.61							
Appendix of 2016 AEMR	29/09/2016	SW10	6.9	35928	6.9		36	0.02	0.58							
Appendix of 2016 AEMR	20/12/2016	SW10	6.9	7210	7.8		10	0.04	0.81							
AEMR 2019	8/03/2019	SW10	6.93	42	4.29	20	8									
AEMR 2019	4/06/2019	SW10	5.76	18800	4.8	16.4	15									
AEMR 2019	29/08/2019	SW10	6.6	3010	9.2	19.6	8									
AEMR 2019	22/11/2019	SW10	7.02	38700	54.8	10.5	9									
2020 Annual Review	18/03/2020	SW10	4.79	646	3.22	2.2										
2020 Annual Review	11/06/2020	SW10	3.37	2970	2.52	91.5					60	15		0.001		0.69
2020 Annual Review	10/09/2020	SW10	3.78	1460	3.71	149	30	0.01	0.8							
2020 Annual Review	9/11/2020	SW10	5.95	7240	3.38	53.7	46	0.01	0.2							
		Number of Samples	**31**	**31**	**31**	**20**	**29**	**23**	**24**	**1**	**1**	**1**	**0**	**1**	**0**	**1**
		Minimum	**3.37**	**42**	**2.2**	**2.2**	**4.8**	**0.01**	**0.2**	**35**	**60**	**15**	**0**	**0.001**	**0**	**0.69**
		Maximum	**7.8**	**38700**	**54.8**	**149**	**46**	**0.29**	**2.15**	**35**	**60**	**15**	**0**	**0.001**	**0**	**0.69**

Longterm Surrounding Surface Water Quality Monitoring at Dunloe Sands Quarry

Average	6.13	8803.01	8.12	32.98	21.45	0.06	0.90	35.00	60.00	15.00		0.00		0.69

Longterm Pond Water Quality Monitoring at Dunloe Sands Quarry

Data located	Date	Location	pH	EC	DO (membrane electrode)	*Redox Potential	Alkalinity as CaCO3	Bicarbonate as CaCO3	Chloride	Turbidity	TDS	TSS	Chlorophyll 'a'	Oil and Grease	Total Phosphorus-P	Total-N	Ammonia	Calcium	Magnesium	Sodium	Potassium	Sulfur as Sulfate	Aluminium (Total)	Arsenic (Total)	Iron (Total)	Manganese (Total)
			pH	µScm-1	mg/L	mV	mg/L	mg/L	mg/L	NTU	mg/L	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
2011/2012 AEMR	30/05/2012	Lake	5.8	133	8.9					190		84		<2	0.09	0.66										
2011/2012 AEMR	27/06/2012	Lake	6	143	9.4		3	2	8	34		23		4	0.04	0.38		13	1.5	6.3	<5	41	1.21	<0.005	1.01	0.03
2011/2012 AEMR	26/07/2012	Lake	7	164	9.4					18		15		<2	0.02	33										
2011/2012 AEMR	27/08/2012	Lake	5.7	188	9.3	168				100		70		2	0.04	0.44										
2011/2012 AEMR	27/09/2012	Lake 1	4.6	214	8.2		<1	<1	10	7.8		11		<2	0.02			22	1.9	9	<5	65	0.47	<0.005	0.41	0.05
2011/2012 AEMR	29/10/2012	Lake	4.2	246	8.5					2.9		4		<2	<0.02	0.09										
2012/2013 AEMR	25/11/2013	Lake	5.9	478	7					18		26		<2	0.04	0.33										
2013/2014 AEMR	12/12/2013	Lake	4.7	568	7.7	160	2	1	22	33		54		<2	0.06	0.48		75	8.6	15	5	244	8.92	<0.005	3.49	0.64
2013/2014 AEMR	30/01/2014	Lake	4.4	650	7.9					31		41		<2	0.03	0.37										
2013/2014 AEMR	24/02/2014	Lake	4.4	780	7.7					40		45		<2	0.04	0.25										
2013/2014 AEMR	31/03/2014	Lake	4.9	800	7.5					70		63		<2	0.04	0.55										
2013/2014 AEMR	28/04/2014	Lake	4.4	874						33		30		<2	0.03	0.17										
2013/2014 AEMR	28/05/2014	Lake	4.1	895	9.2					42		30		<2	<0.02	0.27										
2013/2014 AEMR	25/06/2014	Lake	3.8	916	9.4		<1	<1	35	72		53		<2	0.08	0.37		109	16	23	6	413	26	<0.005	12	1.05
2013/2014 AEMR	30/07/2014	Lake	4.3	917						79		44		<2	0.02	0.44										
2013/2014 AEMR	29/08/2014	Lake	4.5	960						138		187		5	0.05	0.81										
2013/2014 AEMR	29/09/2014	Lake	3.8	971	8		<1	<1		68		58			0.03	0.58										
Appendix of 2015 AEMR	28/11/2014	Lake	4	998	8.3					70		101		<2	0.07	0.5										
Appendix of 2015 AEMR	15/12/2014	Lake	4.4	1005	8		NP	<1	40	119		167		<2	0.14	0.31		159	18	29	7	394	33	0.008	11	1.23
Appendix of 2015 AEMR	22/01/2015	Lake 1	4.4	1029	7.4	204				78		96		<2	0.05	0.32										
Appendix of 2015 AEMR	25/02/2015	Lake 1	4.2	960	7					85		89		<2	0.08	0.6										
Appendix of 2015 AEMR	26/03/2015	Lake 1	4.1	853	7.5		NP	NP	38	34		55		<2	0.25	0.42		92	12	22	6	369	24.2	0.003	5.61	1.03
Appendix of 2015 AEMR	24/04/2015	Lake	4.3	963	8.5					59		95		<2	0.1	0.73										
Appendix of 2015 AEMR	28/05/2015	Lake	4.4	927	9					52		85		<2	0.22	0.44										
Appendix of 2015 AEMR	17/09/2015	Lake	4.5	928	8.9		NP		35	56		61	6	<2	0.1	0.43	0.08	117	13	25	8	361	19.3	0.003	6.7	0.953
Appendix of 2015 AEMR	21/10/2015	Lake	4.4	955	7.8					56		100		<2	0.08	0.28										
Appendix of 2015 AEMR	25/11/2015	Lake	3.7	996	7.7					5.1		4		<2	0.03	0.16										
Appendix of 2015 AEMR	11/12/2015	Lake 1	4.2	956	6.8		<1	<1	45	20		39		<2	0.39	0.57		111	13	29	9	429	14.3	0.004	2.54	0.896
Appendix of 2016 AEMR	25/01/2016	Pond	3.9	1002	7.3					7.9				6												
Appendix of 2016 AEMR	24/02/2016	Pond	4	1021	7.4					6.1				2												
Appendix of 2016 AEMR	24/03/2016	Pond	3.9	1060	7.9					7.2				2	0.07	0.12		112.71	14.14	43.28	9.32	382.38	10.93	0.002	1.24	0.88
Appendix of 2016 AEMR	29/04/2016	Pond	4.4	1037	8.6					7.7				2												
Appendix of 2016 AEMR	24/05/2016	Pond	4.9	1029	8.4									4												
Appendix of 2016 AEMR	30/06/2016	Pond	4.7	518.9	9.8					4			16	2	0.02	0.31	<0.02	57.45	7.218	24.38	5.39	185.14	4.51	0.002	0.41	0.56
Appendix of 2016 AEMR	21/07/2016	Pond	4.5	546.4	9.3					1.2				0												
Appendix of 2016 AEMR	31/08/2016	Pond	4	618	9.1					2				2												
Appendix of 2016 AEMR	29/09/2016	Pond	4.1	651	8.7					2.6			10	2			<0.02		7.9	27	6	220	2.83	0.002	0.41	0.39
Appendix of 2016 AEMR	27/10/2016	Pond	4	684	8.4					7.2				2												
Appendix of 2016 AEMR	29/11/2016	Pond	3.8	714	8					1.7				2												
Appendix of 2016 AEMR	20/12/2016	Pond	3.5	742	7.3					2.8			2	2	<0.02	0.19	0.03		9.3	29	7	251	4.01	0.001	0.71	0.48
2017 Q1 Env Mon report	30/01/2017	Pond	3.6	758	7.2					2.6				<2												
2017 Q1 Env Mon report	27/02/2017	Pond	3.5	858	7.7					2.4				<2												
2017 Env Monitoring	22/03/2017	Pond	3.4	979	8.2		<5		67	2.2				<5.0	<0.05	0.01	0.013		10	46	7	260	5.6	<0.001	1.7	0.57
2017 Env Monitoring	19/04/2017	Pond	6.5	84	7.6					400				<5.0												
2017 Env Monitoring	17/05/2017	Pond	5.9	101	8.1					230				<5.0												
2017 Env Monitoring	14/06/2017	Pond	4.8	115	9.5		<5		8	100				<5.0	0.07	0.07	0.03		2	7	2	25	0.17	<0.001	0.04	0.12
2017 Env Monitoring	12/07/2017	Pond	4.3	153	9.2					5.5				<5.0												
2017 Env Monitoring	9/08/2017	Pond	4.2	171	9.9					3.4				<5.0												
2017 Env Monitoring	6/09/2017	Pond	4.2	183	6.6		<5		11	3.2				<5.0	<0.05	0.3	<0.005		2	8	2	47	0.35	<0.001	0.085	0.18
2017 Env Monitoring	4/10/2017	Pond	4.3	229	8.6					1.6				<5.0												
2017 Env Monitoring	1/11/2017	Pond	4.1	271	8					2.9				<5.0												
2017 Env Monitoring	29/11/2017	Pond	4.3	303	7.6					4				<5.0												
2017 Env Monitoring	28/12/2017	Pond	4.1	339	7.8		<5		16	1				<5.0	<0.05	<0.1	<0.005		3.7	11	3	84	0.6	<0.001	0.12	0.23
2018 Env Monitoring	24/01/2018	Dam 1	4.02	361	8.3					2.1			<1	<5												
2018 Env Monitoring	21/02/2018	Dam 1	3.96	367	8.74					2.1			<1	<5												
2018 Env Monitoring	21/03/2018	Dam 1	4.05	395	8.61		<5		21	2.42			<1	<5	<0.05	<0.1	<0.005		5	14	3.6	99	0.88	<0.001	0.088	0.25
2018 Env Monitoring	18/04/2018	Dam 1	4.6	373	8.18					4.64			1	<5												
2018 Env Monitoring	16/05/2018	Dam 1	4.12	346	8.38					2.27			<1	<5												
2018 Env Monitoring	13/06/2018	Dam 1	4.21	366	9.18		<5		21	2.87			<1	<5	<0.05	<0.1	<0.005		4.9	14	3.6	110	0.62	<0.001	0.1	0.25
2018 Env Monitoring	11/07/2018	Dam 1	4.13	324	9.69					4.17			<1	<5												
2018 Env Monitoring	8/08/2018	Dam 1	4.08	384	9.38					5.3			<1	<5												
2018 Env Monitoring	5/09/2018	Dam 1	6.73	382	99.2	138				21			<1		0.02		0.04									
2018 Env Monitoring	5/10/2018	Dam 1																								
2018 Env Monitoring	6/11/2018	Dam 1	4.25	560	104	3520				0.2		<5														
2018 Env Monitoring	7/12/2018	Dam 1	4.42	540	99.8	350	1		86	1.4			<1	<5	0.18		0.01		9	45	4	135	0.72	<0.002	0.07	0.243
2019 Env Monitoring	8/01/2019	Dredge Pond Dam 1	4.45	613	103					0.7				NR												
2019 Env Monitoring	5/02/2019	Dredge Pond Dam 1	4.41	680	7.44					0				5												
2019 Env Monitoring	8/03/2019	Dredge Pond Dam 1	4.12	625	5.63			1	81	0			2	5					10	47	5	164	0.84	0.001	0.23	0.278
2019 Env Monitoring	5/04/2019	Dredge Pond Dam 1	4.24	603	8.1					3.4				5												
2019 Env Monitoring	7/05/2019	Dredge Pond Dam 1	4.18	127	1.2					50.8				5												
2019 Env Monitoring	4/06/2019	Dredge Pond Dam 1	4.06	547	9.3			1	74	1.8			1	5					10	44	5	170	0.76	0.001	0.21	0.235
2019 Env Monitoring	4/07/2019	Dredge Pond Dam 1	4.15	436	12.8					1.8				5												
2019 Env Monitoring	29/08/2019	Dredge Pond Dam 1	4.35	120	11.4			1	66	1.9			1	NR					9	37	4	174	0.68	0.001	0.2	0.259
2019 Env Monitoring	26/09/2019	Dredge Pond Dam 1	5.54	620	8					8				5												
2019 Env Monitoring	24/10/2019	Dredge Pond Dam 1	4.42	663	60.3					NR				5												
2019 Env Monitoring	22/11/2019	Dredge Pond Dam 1	3.95	722	116			1	95	1.1			1	5					11	53	5	171	0.92	0.003	0.55	0.26
2019 Env Monitoring	20/12/2019	Dredge Pond Dam 1	5.13	783	85.4					12.7				5												
2020 Annual Review	18/03/2020	Dredge Pond	6.52	621	5.85					0.5	397000 c			10												

Longterm Pond Water Quality Monitoring at Dunloe Sands Quarry

Data located	Date	Location	pH	EC	DO (membrane electrode)	*Redox Potential	Alkalinity as CaCO3	Bicarbonate as CaCO3	Chloride	Turbidity	TDS	TSS	Chlorophyll 'a'	Oil and Grease	Total Phosphorus-P	Total-N	Ammonia	Calcium	Magnesium	Sodium	Potassium	Sulfur as Sulfate	Aluminium (Total)	Arsenic (Total)	Iron (Total)	Manganese (Total)
			pH	µScm-1	mg/L	mV	mg/L	mg/L	mg/L	NTU	mg/L	mg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
2020 Annual Review	16/04/2020	Dredge Pond	4.72	635	3.79					1.2	407000 c			10												
2020 Annual Review	14/05/2020	Dredge Pond	3.87	620	8.57					6.9	397			10												
2020 Annual Review	11/06/2020	Dredge Pond	3.69	611	8.38					0	391															
2020 Annual Review	9/07/2020	Dredge Pond	3.87	676	6.89					1.6	433															
2020 Annual Review	10/08/2020	Dredge Pond	4.06	291	7.43					61.5	189			5												
2020 Annual Review	8/09/2020	Dredge Pond	3.88	661	3.88					4	423000 c			5												
2020 Annual Review	8/10/2020	Dredge Pond	3.88	661	3.88					4	423000 c															
2020 Annual Review	9/11/2020	Dredge Pond	3.86	710	6.48				88	0	454000 c		5	5					10	44	5	146	1.8	0.001	0.54	0.29
2020 Annual Review	24/11/2020	Dredge Pond																								
2020 Annual Review	10/12/2020	Dredge Pond	3.83	245	8.63					40.9	155			5												
		Minimum	**3.4**	**84**	**1.2**	**138**	**1**	**1**	**8**	**0**	**155**	**4**	**1**	**0**	**0.02**	**0.01**	**0.01**	**13**	**1.5**	**6.3**	**2**	**25**	**0.17**	**0.001**	**0.04**	**0.03**
		Maximum	**7**	**1060**	**116**	**3520**	**3**	**2**	**95**	**400**	**433**	**187**	**16**	**10**	**0.39**	**33**	**0.08**	**159**	**18**	**53**	**9.32**	**429**	**33**	**0.008**	**12**	**1.23**
		Average	**4.42**	**596.54**	**15.39**	**756.67**	**2.00**	**1.17**	**43.35**	**31.80**	**313.00**	**61.79**	**4.50**	**4.34**	**0.08**	**1.36**	**0.03**	**86.82**	**8.71**	**27.17**	**5.36**	**205.81**	**6.82**	**0.00**	**2.06**	**0.47**
2019 Env Monitoring	8/01/2019	Silt Pond Dam 2	8.21	578	111.28					2.76				NR												
2019 Env Monitoring	5/02/2019	Silt Pond Dam 2	6.76	653	7.74					0				5												
2019 Env Monitoring	8/03/2019	Silt Pond Dam 2	9.85	612	5.97			8	71	0			3	5					10	43	4	158	0.03	0.001	0.05	0.076
2019 Env Monitoring	5/04/2019	Silt Pond Dam 2	6.8	587	8.2					15				5												
2019 Env Monitoring	7/05/2019	Silt Pond Dam 2	3.94	592	0.5					0.6				5												
2019 Env Monitoring	4/06/2019	Silt Pond Dam 2	6.08	501	9.6			5	72	8.8			1	5					10	42	4	164	0.01	0.001	0.05	0.164
2019 Env Monitoring	4/07/2019	Silt Pond Dam 2	6.7	420	9.5					7.6				8												
2019 Env Monitoring	29/08/2019	Silt Pond Dam 2	6.91	148	10			11	65	14.1			2	NR					9	36	4	164	0.02	0.001	0.05	0.203
2019 Env Monitoring	26/09/2019	Silt Pond Dam 2	6.81	130	9.3					15.5				5												
2019 Env Monitoring	24/10/2019	Silt Pond Dam 2	7.3	652	84.5					NR				5												
2019 Env Monitoring	22/11/2019	Silt Pond Dam 2	NRR	NRR	NRR			22	80	NRR			8	5					11	46	5	164	0.58	0.003	0.05	0.126
2019 Env Monitoring	20/12/2019	Silt Pond Dam 2	6.99	719	110					57.3				5												
2020 Annual Review	14/02/2020	Silt Pond	6.56	633	8.9					4			7	5	0.01				10	44	5	146	0.03	0.001	0.05	0.172
2020 Annual Review	18/03/2020	Silt Pond	5.84	592	5.27					48.2	379000 c			10												
2020 Annual Review	16/04/2020	Silt Pond	5.55	606	5.5					1.3	388000 c			10												
2020 Annual Review	14/05/2020	Silt Pond	4.54	606	7.63					12.3	388			10												
2020 Annual Review	11/06/2020	Silt Pond	5.17	565	9.09					0	362															
2020 Annual Review	9/07/2020	Silt Pond	5.91	643	7.79					17.6	412															
2020 Annual Review	10/08/2020	Silt Pond	4.79	641	7.46					79.6	410			5												
2020 Annual Review	8/09/2020	Silt Pond	4.56	676	6.18					9.4	433000 c			5												
2020 Annual Review	8/10/2020	Silt Pond	4.56	676	6.18					9.4	433000 c															
2020 Annual Review	9/11/2020	Silt Pond	4.34	707	4.94					0	452		5	5					10	45	4.4	210	0.79	0.001	0.08	0.33
2020 Annual Review	24/11/2020	Silt Pond																								
2020 Annual Review	10/12/2020	Silt Pond	5.76	753	4.42					739	482			5												
		Minimum	**3.94**	**130**	**0.5**	**0**	**0**	**5**	**65**	**0**	**362**	**0**	**1**	**5**	**0.01**	**0**	**0**	**0**	**9**	**36**	**4**	**146**	**0.01**	**0.001**	**0.05**	**0.076**
		Maximum	**9.85**	**753**	**111.28**	**0**	**0**	**22**	**80**	**739**	**482**	**0**	**8**	**10**	**0.01**	**0**	**0**	**0**	**11**	**46**	**5**	**210**	**0.79**	**0.003**	**0.08**	**0.33**
		Average	**6.09**	**576.82**	**20.00**			**11.50**	**72.00**	**49.64**	**417.67**		**4.33**	**6.00**	**0.01**				**10.00**	**42.67**	**4.40**	**167.67**	**0.24**	**0.00**	**0.06**	**0.18**

Longterm Pond Water Layer Monitoring at Dunloe Sands Quarry

Data located	Date	Location	pH	EC	DO (membrane electrode)	*Redox Potential	Turbidity	TSS	Total Phosphorus-P	Total-N
			pH	µScm-1	mg/L	mV	NTU	mg/L	mg/L	mg/L
2011/2012 AEMR	27/06/2012	Lake 2m	6.1	144	9.4	257				
2011/2012 AEMR	27/09/2012	Lake 2m	4.6	214	8.2		2.2	4.5	0.02	
Appendix of 2015 AEMR	26/03/2015	Lake 2m	4.0	859	7.6	280				
Appendix of 2015 AEMR	17/09/2015	Lake 2m	4.5	915	8.8	185				
Appendix of 2015 AEMR	11/12/2015	Lake 2m	4.2	952	7.2		19	44	0.13	0.13
Appendix of 2016 AEMR	24/03/2016	Lake 2m	4.3	1011	8					
Appendix of 2016 AEMR	30/06/2016	Lake 2m	4.8	527.6	9.9					
Appendix of 2016 AEMR	29/09/2016	Lake 2m	4.1	647	8.8					
Appendix of 2016 AEMR	20/12/2016	Lake 2m	3.5	742	7.4					
		No of Samples	**9**	**9**	**9**	**3**	**2**	**2**	**2**	**1**
		Minimum	**3.5**	**144**	**7.2**	**185**	**2.2**	**4.5**	**0.02**	**0.13**
		Maximum	**6.1**	**1011**	**9.9**	**280**	**19**	**44**	**0.13**	**0.13**
		Average	**4.46**	**667.96**	**8.37**	**240.67**	**10.60**	**24.25**	**0.08**	**0.13**
2011/2012 AEMR	27/06/2012	Lake 3m	6.1	144	9.5	267				
2011/2012 AEMR	27/09/2012	Lake 3m	4.6	214	8.2		14	30	0.03	
Appendix of 2015 AEMR	26/03/2015	Lake 3m	4.0	859	7.5	297				
Appendix of 2015 AEMR	17/09/2015	Lake 3m	4.5	915	8.7	200				
Appendix of 2015 AEMR	11/12/2015	Lake 3m	4.2	949	7.2		19	96	0.07	0.07
Appendix of 2016 AEMR	24/03/2016	Lake 3m	4.4	1014	8.1					
Appendix of 2016 AEMR	30/06/2016	Lake 3m	4.9	510.8	9.8					
Appendix of 2016 AEMR	29/09/2016	Lake 3m	4.1	650	8.8					
Appendix of 2016 AEMR	20/12/2016	Lake 3m	3.6	742	7.7					
		No of Samples	**9**	**9**	**9**	**3**	**2**	**2**	**2**	**1**
		Minimum	**3.6**	**144**	**7.2**	**200**	**14**	**30**	**0.03**	**0.07**
		Maximum	**6.1**	**1014**	**9.8**	**297**	**19**	**96**	**0.07**	**0.07**
		Average	**4.49**	**666.42**	**8.39**	**254.67**	**16.50**	**63.00**	**0.05**	**0.07**
2011/2012 AEMR	27/06/2012	Lake 4m	6.2	144	9.6	264				
2011/2012 AEMR	27/09/2012	Lake 4m	4.6	213	8.2		5.8	9.2	0.02	
Appendix of 2015 AEMR	26/03/2015	Lake 4m	4.0	860	7.5	312				
Appendix of 2015 AEMR	17/09/2015	Lake 4m	4.5	915	8.7	200				
Appendix of 2015 AEMR	11/12/2015	Lake 4m	4.2	952	7.5		16	102	0.06	0.06
Appendix of 2016 AEMR	24/03/2016	Lake 4m	4.3	1.11	7.9					
Appendix of 2016 AEMR	30/06/2016	Lake 4m	4.8	517.4	9.9					
Appendix of 2016 AEMR	29/09/2016	Lake 4m	4	648	8.8					
Appendix of 2016 AEMR	20/12/2016	Lake 4m	3.6	742	7.7					
		No of Samples	**9**	**9**	**9**	**3**	**2**	**2**	**2**	**1**
		Minimum	**3.6**	**1.11**	**7.5**	**200**	**5.8**	**9.2**	**0.02**	**0.06**
		Maximum	**6.2**	**952**	**9.9**	**312**	**16**	**102**	**0.06**	**0.06**
		Average	**4.47**	**554.72**	**8.42**	**258.67**	**10.90**	**55.60**	**0.04**	**0.06**
2011/2012 AEMR	27/06/2012	Lake 5m	6.5	144	9.5	261				
Appendix of 2015 AEMR	26/03/2015	Lake 5m	4.0	864	7.5	316				
Appendix of 2015 AEMR	17/09/2015	Lake 5m	4.4	913	8.7	210				
Appendix of 2015 AEMR	11/12/2015	Lake 5m	4.1	954	7.7		12	22	0.06	0.06
Appendix of 2016 AEMR	24/03/2016	Lake 5m	4.7	1019	8.1					
Appendix of 2016 AEMR	30/06/2016	Lake 5m	4.8	515.5	9.9					
Appendix of 2016 AEMR	29/09/2016	Lake 5m	4	647	8.8					
Appendix of 2016 AEMR	20/12/2016	Lake 5m	3.6	742	7.6					
		No of Samples	**8**	**8**	**8**	**3**	**1**	**1**	**1**	**1**
		Minimum	**3.6**	**144**	**7.5**	**210**	**12**	**22**	**0.06**	**0.06**
		Maximum	**6.5**	**1019**	**9.9**	**316**	**12**	**22**	**0.06**	**0.06**
		Average	**4.51**	**724.81**	**8.48**	**262.33**	**12.00**	**22.00**	**0.06**	**0.06**
Appendix of 2016 AEMR	30/06/2016	Lake 6m	5.2	516.6	9.9					
Appendix of 2016 AEMR	29/09/2016	Lake 6m	4.5	627	8.4					
Appendix of 2016 AEMR	20/12/2016	Lake 6m	3.6	740	7.4					
		No of Samples	**3**	**3**	**3**					
		Minimum	**3.6**	**516.6**	**7.4**					
		Maximum	**5.2**	**740**	**9.9**					
		Average	**4.43**	**627.87**	**8.57**					

Longterm Algae Monitoring at Dunloe Sands Quarry

Data located	Date	Location	Cyanophyta (Blue Green Algae)	Chlorophyta (Total Algae Count)	Diatoms (Bacillariophyta)	Dinophyta (Dinoflagellates)	Euglenophyta (Euglenoids)	M. Aeruginosa	Total Biovolume
			cells/mL	cells/mL	cells/mL	cells/mL	cells/mL	cells/mL	mm3/L
2011/2012 AEMR	30/11/2011	Extraction Pond	240						
2011/2012 AEMR	22/12/2012	Extraction Pond	800						
2011/2012 AEMR	2/02/2012	Extraction Pond	<100						
2011/2012 AEMR	20/02/2012	Extraction Pond	700						
2011/2012 AEMR	28/02/2012	Extraction Pond	14375						
2011/2012 AEMR	27/03/2012	Extraction Pond	1200						
2011/2012 AEMR	30/05/2012	Extraction Pond	<100						
2011/2012 AEMR	27/06/2012	Extraction Pond	130	0.01					
2011/2012 AEMR	26/07/2012	Extraction Pond	16360	2520					
2011/2012 AEMR	27/08/2012	Extraction Pond	24640	3720					
2011/2012 AEMR	27/09/2012	Extraction Pond	68000	35000					
2011/2012 AEMR	29/10/2012	Extraction Pond	<100	7900					
2012/2013 AEMR	28/11/2012	Extraction Pond	<100	80670					
2012/2013 AEMR	24/12/2012	Extraction Pond	<100						
2012/2013 AEMR	17/01/2013	Extraction Pond	<100						
2012/2013 AEMR	1/02/2013	Extraction Pond	<100						
2012/2013 AEMR	15/02/2013	Extraction Pond	<100						
2012/2013 AEMR	8/03/2013	Extraction Pond	<100	215					
2012/2013 AEMR	30/05/2013	Extraction Pond	<100	880					
2012/2013 AEMR	30/06/2013	Extraction Pond	<100						
2012/2013 AEMR	30/07/2013	Extraction Pond	<100	34000					
2012/2013 AEMR	28/08/2013	Extraction Pond	<100	205					
2012/2013 AEMR	30/09/2013	Extraction Pond	<100						
2012/2013 AEMR	25/10/2013	Extraction Pond	<100	17430					
2013/2014 AEMR	25/11/2013	Extraction Pond				480			
2013/2014 AEMR	12/12/2013	Extraction Pond	1150	39500					
2013/2014 AEMR	19/12/2013	Extraction Pond		22000					
2013/2014 AEMR	9/01/2014	Extraction Pond		123000					
2013/2014 AEMR	29/01/2014	Extraction Pond		34000					
2013/2014 AEMR	31/03/2014	Extraction Pond			295				
2013/2014 AEMR	28/04/2014	Extraction Pond		7700	45				
2013/2014 AEMR	29/05/2014	Extraction Pond	ND	7600					
2013/2014 AEMR	26/06/2014	Extraction Pond	ND	52000					
2013/2014 AEMR	31/07/2014	Extraction Pond	ND	28000					
2013/2014 AEMR	28/10/2014	Extraction Pond	ND	168000					
Appendix of 2015 AEMR	28/11/2014	Extraction Pond	ND	123000	260	60			
Appendix of 2015 AEMR	16/12/2014	Extraction Pond	ND	106500	220	35			
Appendix of 2015 AEMR	22/01/2015	Extraction Pond	ND	37000					
Appendix of 2015 AEMR	26/02/2015	Extraction Pond	ND						
Appendix of 2015 AEMR	26/03/2015	Extraction Pond	ND	8750					
Appendix of 2015 AEMR	24/04/2015	Extraction Pond	ND	8000					
Appendix of 2015 AEMR	29/05/2015	Extraction Pond	ND	76000	4200				
Appendix of 2015 AEMR	29/06/2015	Extraction Pond	ND	211000	6300				
Appendix of 2015 AEMR	21/10/2015	Extraction Pond	ND	18330	65	35	155		
Appendix of 2015 AEMR	26/11/2015	Extraction Pond	ND	4850		5			
Appendix of 2015 AEMR	11/12/2015	Extraction Pond	ND	11900	30	10			
2016 AEMR	25/01/2016	Extraction Pond	ND	34000					
2016 AEMR	8/02/2016	Extraction Pond	ND	0					
2016 AEMR	24/02/2016	Extraction Pond	ND	3700					
2016 AEMR	10/03/2016	Extraction Pond	ND	1575					
2016 AEMR	24/03/2016	Extraction Pond	ND	7600					
2016 AEMR	7/04/2016	Extraction Pond	ND	9700					
2016 AEMR	29/04/2016	Extraction Pond	ND	11800					
2016 AEMR	24/05/2016	Extraction Pond	ND	5700					
2016 AEMR	30/06/2016	Extraction Pond	ND	28930					
2016 AEMR	31/08/2016	Extraction Pond	840	61500					
2016 AEMR	30/09/2016	Extraction Pond	ND	920					
2016 AEMR	4/10/2016	Extraction Pond	ND	920					
2016 AEMR	28/10/2016	Extraction Pond	ND	29000					
2016 AEMR	21/12/2016	Extraction Pond	ND	10830					
2017 Q1 Env Mon report	30/01/2017	Extraction Pond	ND	1480					
2017 Q1 Env Mon report	27/02/2017	Extraction Pond	ND	640					
2017 Env Monitoring	22/03/2017	Extraction Pond	ND	175					
2017 Env Monitoring	19/04/2017	Extraction Pond	ND	600					
2017 Env Monitoring	17/05/2017	Extraction Pond	ND	2820					
2017 Env Monitoring	14/06/2017	Extraction Pond	ND	1830					
2017 Env Monitoring	12/07/2017	Extraction Pond	ND	5260					
2017 Env Monitoring	9/08/2017	Extraction Pond	ND	41500					
2017 Env Monitoring	6/09/2017	Extraction Pond	ND	99800					
2017 Env Monitoring	4/10/2017	Extraction Pond	ND	128000					
2017 Env Monitoring	1/11/2017	Extraction Pond	ND	38600					
2017 Env Monitoring	29/11/2017	Extraction Pond	ND	8150					
2017 Env Monitoring	28/12/2017	Extraction Pond	ND	1890					
2018 Env Monitoring	24/01/2018	Extraction Pond	<5	350					
2018 Env Monitoring	21/02/2018	Extraction Pond	<5	100					
2018 Env Monitoring	21/03/2018	Extraction Pond	<5	3,960					
2018 Env Monitoring	18/04/2018	Extraction Pond	<5	4,580					
2018 Env Monitoring	16/05/2018	Extraction Pond	<5	250					
2018 Env Monitoring	13/06/2018	Extraction Pond	<5	5,820					
2018 Env Monitoring	11/07/2018	Extraction Pond	<5	16,100					
2018 Env Monitoring	8/08/2018	Extraction Pond	<5	13,800					
2018 Env Monitoring	5/09/2018	Extraction Pond	ND	ND					
2018 Env Monitoring	5/10/2018	Extraction Pond	<5	ND					
2018 Env Monitoring	6/11/2018	Extraction Pond	ND	ND					
2018 Env Monitoring	7/12/2018	Extraction Pond	ND	ND					
2019 Env Monitoring	8/03/2019	Point 1 Silt Pond (Dam 2)	<0.001	<5					
2019 Env Monitoring	4/06/2019	Point 1 Silt Pond (Dam 2)	<0.001	500					
2019 Env Monitoring	29/08/2019	Point 1 Silt Pond (Dam 2)	<0.001	525					
2019 Env Monitoring	22/11/2019	Point 1 Silt Pond (Dam 2)	2.13	10800					
2019 Env Monitoring	8/03/2019	Point 2 Dredge Pond (Dam 1)	<0.001	<5					
2019 Env Monitoring	4/06/2019	Point 2 Dredge Pond (Dam 1)	<0.001	550					
2019 Env Monitoring	29/08/2019	Point 2 Dredge Pond (Dam 1)	0.002	30900					
2019 Env Monitoring	22/11/2019	Point 2 Dredge Pond (Dam 1)	0.002	900					
2020 Annual Review	14/02/2020	Silt Pond (Dam 2)						5	0.001
2020 Annual Review	18/03/2020	Dredge Pond (Dam 1)						735	1.0199
2020 Annual Review	18/03/2020	Silt Pond (Dam 2)						727	1.032
2020 Annual Review	16/04/2020	Dredge Pond (Dam 1)						430	0.0166
2020 Annual Review	16/04/2020	Silt Pond (Dam 2)						0	0
2020 Annual Review	14/05/2020	Dredge Pond (Dam 1)						90	0.0043
2020 Annual Review	14/05/2020	Silt Pond (Dam 2)						270	0.115
2020 Annual Review	11/06/2020	Dredge Pond (Dam 1)						0	0
2020 Annual Review	11/06/2020	Silt Pond (Dam 2)						0	0
2020 Annual Review	9/07/2020	Dredge Pond (Dam 1)						0	0
2020 Annual Review	9/07/2020	Silt Pond (Dam 2)						110	0.0011
2020 Annual Review	10/08/2020	Dredge Pond (Dam 1)						210	0.0153
2020 Annual Review	10/08/2020	Silt Pond (Dam 2)						170	0.0151
2020 Annual Review	8/09/2020	Dredge Pond (Dam 1)						326	0.00171
2020 Annual Review	8/09/2020	Silt Pond (Dam 2)						2252	0.0089
2020 Annual Review	8/10/2020	Dredge Pond (Dam 1)						0	0
2020 Annual Review	8/10/2020	Silt Pond (Dam 2)						148	0.00186
2020 Annual Review	9/11/2020	Dredge Pond (Dam 1)						1	0.01
2020 Annual Review	9/11/2020	Silt Pond (Dam 2)						1	0.01
2020 Annual Review	24/11/2020	Dredge Pond (Dam 1)						1	0.01
2020 Annual Review	24/11/2020	Silt Pond (Dam 2)						1	0.01
2020 Annual Review	10/12/2020	Dredge Pond (Dam 1)						1	0.01
2020 Annual Review	10/12/2020	Silt Pond (Dam 2)						1	0.01
		Minimum	**0.002**	**0**	**30**	**5**	**155**	**0**	**0**
		Maximum	**68000**	**211000**	**6300**	**480**	**155**	**2252**	**1.032**
		Average	**9174.1**	**26700.4**	**1426.9**	**104.2**	**155.0**	**238.2**	**0.1**

Longterm Groundwater Quality Monitoring at Dunloe Sands Quarry

Data located	Date	Location	pH	EC	DO (membrane electrode)	*Redox Potential	Alkalinity as CaCO3	Bicarbonate as CaCO3	Chloride	Total Phosphorus-P	Total-N	Ammonia	Calcium	Magnesium	Sodium	Potassium	Sulfur as Sulfate	Aluminium (Total)	Arsenic (Total)	Iron (Total)	Manganese (Total)
			pH	µScm-1	mg/L	mV	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
2011/2012 AEMR	Dec-11	DPL1							13				0.2	0.4	4	<5	3.5		<0.005	1.34	<0.01
2011/2012 AEMR	Mar-12	DPL1							17				0.2	0.4	5.4	<5	4.8		<0.005	1.32	<0.01
2011/2012 AEMR	30/05/2012	DPL1	4.2	98	3.3	435															
2011/2012 AEMR	Jun-12	DPL1	4.2	105	3.8	405	<1	<1	20				0.6	0.6	11	<5	5.3		<0.005	2.49	<0.01
2011/2012 AEMR	26/07/2012	DPL1	4.3	87	5.1	374															
2011/2012 AEMR	27/08/2012	DPL1	4.2	98	2.1	365															
2011/2012 AEMR	27/09/2012	DPL1	4.2	94	2.6	305	<1	<1	15				0.5	0.3	8.4	<5	6.7		<0.005	3.25	<0.01
2011/2012 AEMR	29/10/2012	DPL1	4.6	96	5.8	208															
2012/2013 AEMR	Dec-12	DPL1							36				1	0.7	6.3	<5	4.9		<0.005	4.32	<0.01
2012/2013 AEMR	Mar-13	DPL1							12				0.2	0.1	9.2	<5	7.3		<0.005	1.68	<0.01
2012/2013 AEMR	Jun-13	DPL1							19				0.1	<0.1	0.1	<5	5.9		<0.005	1.5	<0.01
2012/2013 AEMR	Sep-13	DPL1							16				0.4	0.2	7.5	<5			<0.005	5.82	<0.01
2013/2014 AEMR	12/12/2013	DPL1	4.8	86	3.5	91	3	2	20				0.4	0.2	0.2	<5	6.2		<0.005	3.83	0.02
2013/2014 AEMR	29/01/2014	DPL1	4	279	5.7	264															
2013/2014 AEMR	24/02/2014	DPL1	4.6	76	3.8	242															
2013/2014 AEMR	31/03/2014	DPL1	4.9	72	6.3	136	3	2	15				0.6	0.1	0.1	<5	3.5		<0.005	2.44	<0.01
2013/2014 AEMR	24/04/2014	DPL1	4	75		204															
2013/2014 AEMR	28/05/2014	DPL1	4.2	95		307															
2013/2014 AEMR	25/06/2014	DPL1	4.1	98	2	350	<1	<1	16				0.5	0.3	9.7	<5	6.4		<0.005	0.76	<0.01
2013/2014 AEMR	30/07/2014	DPL1	4.1	112	3.9	174	<1	<1	19				0.4	0.2	11	<5	7.7	0.77	<0.005	0.62	<0.01
2013/2014 AEMR	29/08/2014	DPL1	4.4	97	4.3	185	NP	NP	20				0.2	<0.1	9.6	<5	4.3		<0.005	3.93	<0.01
2013/2014 AEMR	29/09/2014	DPL1	4	108	3.5	177															
Appendix of 2015 AEMR	28/11/2014	DPL1	4.7	81	3.3	110															
Appendix of 2015 AEMR	15/12/2014	DPL1	4.6	94	1.5	160	NP	<1	15				1.6	0.4	10	<5	6.1	0.32	<0.005	2.55	0.02
Appendix of 2015 AEMR	22/01/2015	DPL1	4.8	80	3.8	110															
Appendix of 2015 AEMR	25/02/2015	DPL1	4.2	110	1.1	160															
Appendix of 2015 AEMR	26/03/2015	DPL1	4	109	4	245	NP	NP													
Appendix of 2015 AEMR	24/04/2015	DPL1	4.1	131	2.7	253															
Appendix of 2015 AEMR	28/05/2015	DPL1	3.8	164	2	256															
Appendix of 2015 AEMR	17/09/2015	DPL1	4.1	135	3.9	195	NP		18			<0.02	0.7	0.8	12	<5	10	0.64	<0.001	0.95	0.017
Appendix of 2015 AEMR	21/10/2015	DPL1	4.3	116	2.9	217															
Appendix of 2015 AEMR	25/11/2015	DPL1	4.2	102	6.1	170															
Appendix of 2015 AEMR	11/12/2015	DPL1	4.6	86	2.4	232	1	1	14				0.3	0.2	11	<5	10	0.32	<0.001	3.21	0.009
Appendix of 2016 AEMR	25/01/2016	DPL1	4.7	95	1.6	165															
Appendix of 2016 AEMR	24/02/2016	DPL1	4.8	98	5.7	138															
Appendix of 2016 AEMR	24/03/2016	DPL1	4.6	104	3.8	268	2	2	17				0.37	0.23	10.21	<5	9.403	0.727	0.001	4.224	0.007
Appendix of 2016 AEMR	29/04/2016	DPL1	4.3	96	6.4	388															
Appendix of 2016 AEMR	24/05/2016	DPL1	4.2	106	2.7	255															
Appendix of 2016 AEMR	30/06/2016	DPL1	4.9	101.1	3.6	283							3.503	0.353	10.561	<5	9.636	0.471	0.001	2.508	0.14
Appendix of 2016 AEMR	21/07/2016	DPL1	3.9	142.2	6.8	384															
Appendix of 2016 AEMR	31/08/2016	DPL1	4	140	6.5	321															
Appendix of 2016 AEMR	29/09/2016	DPL1	3.9	151	2.5	366															
Appendix of 2016 AEMR	27/10/2016	DPL1	4	151	2.5	366															
Appendix of 2016 AEMR	29/11/2016	DPL1	4.7	116	1.9	108															
Appendix of 2016 AEMR	20/12/2016	DPL1	4.7	131	5.2	307.1															
Q1 2017 Env mon report	30/01/2017	DPL1	4.2	121																	
Q1 2017 Env mon report	27/02/2017	DPL1	4.6	103																	
2017 Env Monitoring	22/03/2017	DPL1	4.4	116			<5		18	0.09	1.1	0.056		<0.5	12	1	12	0.48	<0.001	4.8	0.018
2017 Env Monitoring	19/04/2017	DPL1	4.2	180																	
2017 Env Monitoring	17/05/2017	DPL1	4.4	135																	
2017 Env Monitoring	14/06/2017	DPL1	4.3	197			<5		22	<0.05	0.5	0.039		1	14	1	39	1.6	<0.001	13	0.039
2017 Env Monitoring	12/07/2017	DPL1	4.1	137																	
2017 Env Monitoring	9/08/2017	DPL1	4.3	123																	
2017 Env Monitoring	6/09/2017	DPL1	4	124			<5		18	<0.05	1.2	0.031		<0.5	11	1	10	0.73	<0.001	3.4	0.017
2017 Env Monitoring	4/10/2017	DPL1	4.3	123																	
2017 Env Monitoring	1/11/2017	DPL1	4.4	121																	
2017 Env Monitoring	29/11/2017	DPL1	4.5	129																	
2017 Env Monitoring	28/12/2017	DPL1	4.5	130			<5		21	<0.05	0.4	0.071		0.6	12	2.1	44	0.53	<0.001	5	0.02
2018 Env Monitoring	24/01/2018	DPL1	4.49	138.4																	
2018 Env Monitoring	21/02/2018	DPL1	4.46	120.5																	
2018 Env Monitoring	21/03/2018	DPL1	4.35	159			<5		21	0.06	0.2	0.062		0.8	13	1.5	44	0.76	<0.001	5.5	0.028
2018 Env Monitoring	18/04/2018	DPL1	4.49	153																	
2018 Env Monitoring	16/05/2018	DPL1	4.4	146.3																	
2018 Env Monitoring	13/06/2018	DPL1	4.33	167.1			<5		19	<0.05	0.4	0.057		0.7	14	1.4	28	0.76	<0.001	6.2	0.024
2018 Env Monitoring	11/07/2018	DPL1	4.31	146.3																	
2018 Env Monitoring	8/08/2018	DPL1	3.91	204																	
2018 Env Monitoring	5/09/2018	DPL1	4.12	114	4.52		<1		18			0.07		<1	22	1	26	1.08	<0.001	0.05	0.001
2018 Env Monitoring	5/10/2018	DPL1	4.53	143	7																
2018 Env Monitoring	6/11/2018	DPL1	4.51	142	4.8																
2018 Env Monitoring	7/12/2018	DPL1	4.49	120	4.8	44.3	<1		17			0.06		1	11	<1	36	0.88	0.001	10.7	0.003
2019 Env Monitoring	8/01/2019	DPL1	4.4	178.36	3.52	-2.5															
2019 Env Monitoring	5/02/2019	DPL1	4.48	142.5	0.26	-64.1															
2019 Env Monitoring	8/03/2019	DPL1	4.12	224	0.11	1.6		<1					4	2	13	1	68	2.58	<0.001	19.5	0.05
2019 Env Monitoring	5/04/2019	DPL1	4.14	122	0.2	NR		<1						1					<0.001		0.038
2019 Env Monitoring	7/05/2019	DPL1	6.6	3570	0.3	0.1		<1											<0.001		0.033
2019 Env Monitoring	4/06/2019	DPL1	4.14	126	0.5	31.9		<1					2	1	11	1	38	1.27	<0.001	10.9	0.034
2019 Env Monitoring	4/07/2019	DPL1	6.6	3570	0.3	0.1															
2019 Env Monitoring	1/08/2019	DPL1	4.32	94	8.1	54.1		<1					2	<1	10	<1	20	1.1	<0.001	8.63	0.033
2019 Env Monitoring	26/09/2019	DPL1	5.01	38	9.6	-29.4		<1													0.034
2019 Env Monitoring	24/10/2019	DPL1	5.01	138	1.8	<0.1		<1													
2019 Env Monitoring	22/11/2019	DPL1	4.59	94	15.6	71.1		<1					2	<1	11	<1	31	0.98	<0.001	8.34	0.034

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2019 Env Monitoring	20/12/2019	DPL1	4.86	84	15.5	110														
2020 Env Monitoring	17/01/2020	DPL1	4.57	132	2.5															
2020 Env Monitoring	14/02/2020	DPL1																		
2020 Env Monitoring	18/03/2020	DPL1	5.39	188	0.04	63		19.9	71		0.19	0.21		3.1	16	2.5	38	0.049	0.025		0.1
2020 Env Monitoring	16/04/2020	DPL1	4.43	196	0.11	162														
2020 Env Monitoring	14/05/2020	DPL1	5.77	198	0	-13														
2020 Env Monitoring	11/06/2020	DPL1	5.59	191	0.62	83		25	27				10	3.9	20	3	44	0.05	0.017		0.11
2020 Env Monitoring	9/07/2020	DPL1	5.84	204	4.7	187														
2020 Env Monitoring	10/08/2020	DPL1	4.91	187	2.74	283														
2020 Env Monitoring	24/09/2020	DPL1	5.3	190	0			20	28			0.26	9.5	5	16	5	42	0.05	0.005		
2020 Env Monitoring	8/10/2020	DPL1	5.96	213	0	98														
2020 Env Monitoring	9/11/2020	DPL1	7.78	209	2.7			260	120			1.13	22	8.1	53	5	84	0.05	0.007		0.14
2020 Env Monitoring	10/12/2020	DPL1	6.63	451	0.09	-14														
No of Samples			**87**	**87**	**64**	**58**	**4**	**8**	**29**	**2**	**7**	**11**	**25**	**28**	**34**	**13**	**33**	**22**	**7**	**30**	**24**
Minimum			**3.8**	**38**	**0**	**-64.1**	**1**	**1**	**12**	**0.06**	**0.19**	**0.031**	**0.1**	**0.1**	**0.1**	**1**	**3.5**	**0.049**	**0.001**	**0.05**	**0.001**
Maximum			**7.78**	**3570**	**15.6**	**435**	**3**	**260**	**120**	**0.09**	**1.2**	**1.13**	**22**	**8.1**	**53**	**5**	**84**	**2.58**	**0.025**	**19.5**	**0.14**
Average			**4.57**	**213.19**	**3.58**	**185.26**	**2.25**	**41.49**	**24.21**	**0.08**	**0.57**	**0.19**	**2.53**	**1.20**	**11.63**	**2.04**	**21.69**	**0.74**	**0.01**	**4.76**	**0.04**
2011/2012 AEMR	Dec-11	DPL3							2300				72	119	842	72	136		<0.005	0.74	0.53
2011/2012 AEMR	Mar-12	DPL3							2400				66	109	1081	<5	126		<0.005	1.25	0.51
2011/2012 AEMR	30/05/2012	DPL3	6.6	7074	2.3	317															
2011/2012 AEMR	Jun-12	DPL3	6.7	7057	6.6	315	150	94	2220				70	112	1119	48	143		<0.005	1.94	0.53
2011/2012 AEMR	26/07/2012	DPL3	6.6	7093	3.6	284															
2011/2012 AEMR	27/08/2012	DPL3	6.7	7343	1.8	193															
2011/2012 AEMR	27/09/2012	DPL3	6.4	7130	2.4	249	120	75	2280				63	100	1060	50	147		<0.005	2.11	0.51
2011/2012 AEMR	29/10/2012	DPL3	6.3	7177	4.8	146															
2012/2013 AEMR	Dec-12	DPL3							2270				68	103	946	61	132		<0.005	2.46	0.52
2012/2013 AEMR	Mar-13	DPL3							2280				74	115	1296	48	149		<0.005	1.78	0.58
2012/2013 AEMR	Jun-13	DPL3							2310				66	105	66	44	169		<0.005	1.63	0.52
2012/2013 AEMR	Sep-13	DPL3							2280				60	93	1003	38			<0.005	3.05	0.52
2013/2014 AEMR	12/12/2013	DPL3	6.2	7140	2.4	116	120	73	2340				66	104	104	43	168		<0.005	3.16	0.57
2013/2014 AEMR	29/01/2014	DPL3	6.3	6964	4.4	201															
2013/2014 AEMR	24/02/2014	DPL3	6.3	6677	3.6	245															
2013/2014 AEMR	31/03/2014	DPL3	6.4	7234	4.2	118	120	74	120				63	109	109	43	175		<0.005	2.86	0.56
2013/2014 AEMR	24/04/2014	DPL3	6.5	7448		136															
2013/2014 AEMR	28/05/2014	DPL3	6.6	7484		318															
2013/2014 AEMR	25/06/2014	DPL3	6.6	7370	5.9	260	110	70	2290				82	125	1320	44	180		<0.005	6.47	0.93
2013/2014 AEMR	30/07/2014	DPL3	6.6	7431	4.9	122	110	66	2420				74	114	1200	46	177	0.03	<0.005	3.97	0.58
2013/2014 AEMR	29/08/2014	DPL3	6.5	7643	3.9	184	110	68	2370				71	110	1140	43	168		<0.005	4.22	0.56
2013/2014 AEMR	29/09/2014	DPL3	6.1	7558	3	188															
Appendix of 2015 AEMR	28/11/2014	DPL3	6.1	7491	4.2	100															
Appendix of 2015 AEMR	15/12/2014	DPL3	6.2	7280	2.6	130	130	77	2370				82	118	1240	48	146	0.04	<0.005	3.53	0.59
Appendix of 2015 AEMR	22/01/2015	DPL3	6.1	7473	2.2	136															
Appendix of 2015 AEMR	25/02/2015	DPL3	6.4	7478	3.2	150															
Appendix of 2015 AEMR	26/03/2015	DPL3	6.1	7542	2.9	195	130	128													
Appendix of 2015 AEMR	24/04/2015	DPL3	6.6	7540	4.8	246															
Appendix of 2015 AEMR	28/05/2015	DPL3	6.5	7483	5.2	182															
Appendix of 2015 AEMR	17/09/2015	DPL3	6.4	7422	3.7	150	120		2380			0.04	68	102	1220	41	152	0.22	<0.001	3.09	0.641
Appendix of 2015 AEMR	21/10/2015	DPL3	6.2	7310	2.4	157															
Appendix of 2015 AEMR	25/11/2015	DPL3	6.2	7562	6.9	205															
Appendix of 2015 AEMR	11/12/2015	DPL3	6.3	7321	2.6	182	120	120	2370				68	108	1220	40	181	0.13	0.001	2.99	6.23
Appendix of 2016 AEMR	25/01/2016	DPL3	6.1	7395	2.8	147															
Appendix of 2016 AEMR	24/02/2016	DPL3	6.2	7372	5.7	58															
Appendix of 2016 AEMR	24/03/2016	DPL3	6.4	7406	3.5	155	123	123	2650				78.03	117.11	1284.98	44.19	176.114	0.07	0.001	2.183	0.625
Appendix of 2016 AEMR	29/04/2016	DPL3	6.4	7417	6.4	196															
Appendix of 2016 AEMR	24/05/2016	DPL3	6.5	7394	5.4	180															
Appendix of 2016 AEMR	30/06/2016	DPL3	6.6	7250.2	6.4	180															
Appendix of 2016 AEMR	21/07/2016	DPL3	6.5	6868.2	6.6	262															
Appendix of 2016 AEMR	31/08/2016	DPL3	6.5	7281	5.8	170	121		2650				78	121	1350	46	170		0.001	3.33	0.541
Appendix of 2016 AEMR	29/09/2016	DPL3	6.1	7313	2.5	221															
Appendix of 2016 AEMR	27/10/2016	DPL3	6.1	7313	399	1738															
Appendix of 2016 AEMR	29/11/2016	DPL3	6.1	7376	1.8	67															
Appendix of 2016 AEMR	20/12/2016	DPL3	6	7673	4	315.9	121		2700				75	114	1.28	43	182		0.001	2.4	0.541
Q1 2017 Env mon report	30/01/2017	DPL3	6.1	7119																	
Q1 2017 Env mon report	27/02/2017	DPL3	6.1	7013																	
2017 Env Monitoring	22/03/2017	DPL3	5.9	7570			130		2300	0.1	4.1	2.9		130	1500	54	230	0.04	<0.001	15	0.67
2017 Env Monitoring	19/04/2017	DPL3	5.9	7660																	
2017 Env Monitoring	17/05/2017	DPL3	5.9	7410																	
2017 Env Monitoring	14/06/2017	DPL3																			
2017 Env Monitoring	12/07/2017	DPL3	6.2	7060																	
2017 Env Monitoring	9/08/2017	DPL3	6.2	7490																	
2017 Env Monitoring	6/09/2017	DPL3	6.1	7490			140		2000	<0.05	3	2		120	1600	55	140	0.04	<0.001	2.8	0.6
2017 Env Monitoring	4/10/2017	DPL3	6	7530																	
2017 Env Monitoring	1/11/2017	DPL3	5.9	7970																	
2017 Env Monitoring	29/11/2017	DPL3	5.9	7680																	
2017 Env Monitoring	28/12/2017	DPL3	6	7570			130		2400	0.05	3.8	2.8		130	1700	53	190	0.09	<0.001	13	0.62
2018 Env Monitoring	24/01/2018	DPL3	5.94	7640																	
2018 Env Monitoring	21/02/2018	DPL3	5.94	7240																	
2018 Env Monitoring	21/03/2018	DPL3	5.87	8230			140		2500	<0.05	3.7	2.9		150	1400	53	200	0.09	<0.001	9.9	0.64
2018 Env Monitoring	18/04/2018	DPL3	5.94	7580																	
2018 Env Monitoring	16/05/2018	DPL3	5.97	7670																	
2018 Env Monitoring	13/06/2018	DPL3	6.02	7930			130		2300	<0.05	4.1	2.7		120	1500	56	180	0.08	<0.001	11	0.61
2018 Env Monitoring	11/07/2018	DPL3	6.18	7280																	
2018 Env Monitoring	8/08/2018	DPL3	6.1	7880																	
2018 Env Monitoring	5/09/2018	DPL3	5.38	3760	69.8	211	134		2760			2.46		137	1380	49	191	0.66	0.002	24	0.715
2018 Env Monitoring	5/10/2018	DPL3	5.87	7540	7.8																
2018 Env Monitoring	6/11/2018	DPL3	5.81	7580																	
2018 Env Monitoring	7/12/2018	DPL3	5.82	7520	3.4		151		2470			2.29		118	130	45	158	0.32	<0.001	12.9	0.658

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2019 Env Monitoring	8/01/2019	DPL3	5.84	7562.2	10.2	-25.8															
2019 Env Monitoring	5/02/2019	DPL3	5.76	8597.1	0.38	-88.9															
2019 Env Monitoring	8/03/2019	DPL3	3.88	680	0.27	39.3		120	3500				134	193	1720	56		0.07	<0.01	15.8	0.988
2019 Env Monitoring	5/04/2019	DPL3	5.83	8790	0.3	NR															
2019 Env Monitoring	7/05/2019	DPL3	4.08	568	8.5	278															
2019 Env Monitoring	4/06/2019	DPL3	5.72	9200	0.4	56.8		133	2810				92	142	1400	47		0.18	<0.001	12.2	0.789
2019 Env Monitoring	4/07/2019	DPL3	4.08	568	8.5	278															
2019 Env Monitoring	1/08/2019	DPL3	5.99	7560	7.6	2.9		138	2610				84	130	1240	41		0.46	<0.001	14	0.797
2019 Env Monitoring	26/09/2019	DPL3	6.4	8790	4.3	106															
2019 Env Monitoring	24/10/2019	DPL3	6.16	8580	16	48															

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2019 Env Monitoring	22/11/2019	DPL3	6.03	9480	19.9	<0.1		115	3840				150	236	1910	64		0.21	<0.001	17.6	1.11
2019 Env Monitoring	20/12/2019	DPL3	6.26	10400	40.4	<0.1															
2020 Env Monitoring	17/01/2020	DPL3	6.47	8880	6.8																
2020 Env Monitoring	14/02/2020	DPL3																			
2020 Env Monitoring	18/03/2020	DPL3	5.64	7660	0.98	-33		160	2800			2.2		160	1600	56	220	0.08	0.0009	12	0.8
2020 Env Monitoring	16/04/2020	DPL3	6.08	7170	0.89	-38															
2020 Env Monitoring	14/05/2020	DPL3	5.79	6800	0.23	-67															
2020 Env Monitoring	11/06/2020	DPL3	5.9	6800	1.02	-62		220	2400				85	120	1300	43	210	0.09	0.001	12	0.68
2020 Env Monitoring	9/07/2020	DPL3	5.73	7590	1.46	-38															
2020 Env Monitoring	10/08/2020	DPL3	6.33	7620	0.97	13															
2020 Env Monitoring	10/09/2020	DPL3	6.26	7550	1.62	-109		150	2300			2.2	79	120	1200	42	180	0.08	0.001	10	
2020 Env Monitoring	10/09/2020	DPL3	6.26	7550	1.62			150	2300			2.2	79	120	1200	42	180	0.08	0.001	10	
2020 Env Monitoring	8/10/2020	DPL3	7.64	7200	1.74	-70															
2020 Env Monitoring	9/11/2020	DPL3	5.97	7930	0.03			180	10000			2.64	79	100	1200	42	210	0.09	0.001	12	0.66
2020 Env Monitoring	10/12/2020	DPL3	5.64	8920	6.09	-130															
No of Samples			**87**	**87**	**64**	**58**	**21**	**20**	**35**	**2**	**5**	**12**	**27**	**35**	**35**	**34**	**30**	**21**	**10**	**35**	**33**
Minimum			**3.88**	**568**	**0.03**	**-130**	**110**	**66**	**120**	**0.05**	**3**	**0.04**	**60**	**93**	**1.28**	**38**	**126**	**0.03**	**0.0009**	**0.74**	**0.51**
Maximum			**7.64**	**10400**	**399**	**1738**	**151**	**220**	**10000**	**0.1**	**4.1**	**2.9**	**150**	**236**	**1910**	**72**	**230**	**0.66**	**0.002**	**24**	**6.23**
Average			**6.10**	**7306.21**	**11.96**	**160.11**	**126.67**	**116.70**	**2636.86**	**0.08**	**3.74**	**2.28**	**78.74**	**123.55**	**1130.92**	**48.24**	**172.20**	**0.15**	**0.00**	**7.35**	**0.82**
2011/2012 AEMR	Dec-11	DPL5																			
2011/2012 AEMR	Mar-12	DPL5							14				0.5	1	9.1	<5	5.9		<0.005	2.51	<0.01
2011/2012 AEMR	30/05/2012	DPL5	4.7	92	4.6	386															
2011/2012 AEMR	Jun-12	DPL5	4.8	81	6.6	347	2	1	17				0.6	1.3	9.2	<5	4.3		<0.005	1.01	<0.01
2011/2012 AEMR	26/07/2012	DPL5	4.7	92	3.7	313															
2011/2012 AEMR	27/08/2012	DPL5	4.6	103	3.4	292															
2011/2012 AEMR	27/09/2012	DPL5	4.5	102	2.6	266	<1	<1	19				0.7	1.4	10	<5	8.5		<0.005	0.89	<0.01
2011/2012 AEMR	29/10/2012	DPL5	4.4	108	2.2	288															
2012/2013 AEMR	Dec-12	DPL5							18				0.6	1.2	5.9	<5	3.5		<0.005	2.16	<0.01
2012/2013 AEMR	Mar-13	DPL5							12				0.5	1.3	8.2	<5	4		<0.005	0.09	<0.01
2012/2013 AEMR	Jun-13	DPL5							30				0.7	1.9	0.7	<5	8.2		<0.005	0.31	<0.01
2012/2013 AEMR	Sep-13	DPL5							640				13	40	243	9			<0.005	15	0.14
2013/2014 AEMR	12/12/2013	DPL5	4.8	334	2.3	106	3	2	89				2.3	7.2	7.2	<5	15		<0.005	4.81	0.04
2013/2014 AEMR	29/01/2014	DPL5	4.9	314	4.2	161															
2013/2014 AEMR	24/02/2014	DPL5	4.1	337	4.1	255															
2013/2014 AEMR	31/03/2014	DPL5	5	359	3.3	107	2	1	110				2.4	6.3	6.3	<5	12		<0.005	3.52	<0.01
2013/2014 AEMR	24/04/2014	DPL5	4.7	110		84															
2013/2014 AEMR	28/05/2014	DPL5	4	239		313															
2013/2014 AEMR	25/06/2014	DPL5	3.6	566	2.1	375	<1	<1	140				4.2	9.9	64	<5	9.8		<0.005	1.73	0.05
2013/2014 AEMR	30/07/2014	DPL5	3.7	639	4.6	238	<1	<1	140				13	11	69	<5	47	3.96	<0.005	2	0.11
2013/2014 AEMR	29/08/2014	DPL5	3.9	678	2.7	215	NP	NP	170				4.9	12	75	<5	16		<0.005	11	0.03
2013/2014 AEMR	29/09/2014	DPL5	3.8	942	1.8	247															
Appendix of 2015 AEMR	28/11/2014	DPL5	4.9	706	2.7	105															
Appendix of 2015 AEMR	15/12/2014	DPL5	5.2	801	2	115	5	3	220				6.2	15	110	<5	11	0.3	<0.005	14	0.08
Appendix of 2015 AEMR	22/01/2015	DPL5	5	811	3.8	160															
Appendix of 2015 AEMR	25/02/2015	DPL5	4	433	6.2	178															
Appendix of 2015 AEMR	26/03/2015	DPL5	4.8	1066	3.9	144	2	2													
Appendix of 2015 AEMR	24/04/2015	DPL5	3.7	963	4.8	257															
Appendix of 2015 AEMR	28/05/2015	DPL5	3.8	611	2.5	325															
Appendix of 2015 AEMR	17/09/2015	DPL5	3.9	844	2.4	205	NP		220			0.18	5.5	9.6	113	<5	23	0.67	<0.001	1.4	0.055
Appendix of 2015 AEMR	21/10/2015	DPL5	4.3	676	5.4	189															
Appendix of 2015 AEMR	25/11/2015	DPL5	5.2	390	6	135															
Appendix of 2015 AEMR	11/12/2015	DPL5	5.4	310	2.3	151	7	7	80				2.2	3.9	41	<5	12	0.13	<0.001	7.21	0.027
Appendix of 2016 AEMR	25/01/2016	DPL5	5.6	376	3.1	113															
Appendix of 2016 AEMR	24/02/2016	DPL5	5.6	335	2.9	76															
Appendix of 2016 AEMR	24/03/2016	DPL5	5.3	412	2.4	186	6	6	112				2.99	3.88	42.05	<5	13.372	0.148	<0.001	4.597	0.022
Appendix of 2016 AEMR	29/04/2016	DPL5	4.6	285	6.2	259															
Appendix of 2016 AEMR	24/05/2016	DPL5	4.5	300	4.7	195															
Appendix of 2016 AEMR	30/06/2016	DPL5	4.3	385.7	2.9	271															
Appendix of 2016 AEMR	21/07/2016	DPL5	4.4	321.5	5.2	297															
Appendix of 2016 AEMR	31/08/2016	DPL5	4.4	348	4.4	230	<1		89				2.2	2.8	57	<5	28		0.001	11.2	0.012
Appendix of 2016 AEMR	29/09/2016	DPL5	4.4	399	2.5	285															
Appendix of 2016 AEMR	27/10/2016	DPL5	4.4	399	2.5	285															
Appendix of 2016 AEMR	29/11/2016	DPL5	5.4	5.4	1.6	74															
Appendix of 2016 AEMR	20/12/2016	DPL5	5.2	298	3.3	244.5	5		50				2.3	2.8	47	<5	21		0.001	4.55	0.012
Q1 2017 Env mon report	30/01/2017	DPL5	5.2	260																	
Q1 2017 Env mon report	27/02/2017	DPL5	5.5	244																	
2017 Env Monitoring	22/03/2017	DPL5	5.1	300			<5		63	0.1	1	0.1		2	55	1	22	0.2	<0.001	1.5	0.009
2017 Env Monitoring	19/04/2017	DPL5	5.1	203																	
2017 Env Monitoring	17/05/2017	DPL5	5.1	226																	
2017 Env Monitoring	14/06/2017	DPL5																			
2017 Env Monitoring	12/07/2017	DPL5	5.2	189																	
2017 Env Monitoring	9/08/2017	DPL5	5.1	200																	
2017 Env Monitoring	6/09/2017	DPL5	5.2	179			8		26	<0.05	1.3	0.055		<0.5	35	0.7	18	0.54	<0.001	0.23	<0.005
2017 Env Monitoring	4/10/2017	DPL5	5.3	188																	
2017 Env Monitoring	1/11/2017	DPL5	5.3	197																	
2017 Env Monitoring	29/11/2017	DPL5	5	480																	
2017 Env Monitoring	28/12/2017	DPL5	4.5	2200			<5		640	<0.05	0.6	0.24		41	450	6.8	79	2.4	<0.001	7.2	0.11
2018 Env Monitoring	24/01/2018	DPL5	4.42	2470																	
2018 Env Monitoring	21/02/2018	DPL5	4.53	1392																	
2018 Env Monitoring	21/03/2018	DPL5	4.58	1461			11		370	<0.05	0.4	0.14		25	230	5.1	59	1.2	<0.001	4.2	0.066
2018 Env Monitoring	18/04/2018	DPL5	4.88	266																	
2018 Env Monitoring	16/05/2018	DPL5	4.78	486																	
2018 Env Monitoring	13/06/2018	DPL5	4.69	406			<5		96	<0.05	0.4	0.098		4.8	66	2.1	15	0.28	<0.001	2.1	0.019
2018 Env Monitoring	11/07/2018	DPL5	4.73	623																	
2018 Env Monitoring	8/08/2018	DPL5	4.61	252																	
2018 Env Monitoring	5/09/2018	DPL5	4.67	1880			4		112			0.12		7	58	2	14	0.36	<0.001	3.11	0.0029
2018 Env Monitoring	5/10/2018	DPL5	4.96	201																	
2018 Env Monitoring	6/11/2018	DPL5	4.99	296																	
2018 Env Monitoring	7/12/2018	DPL5	4.84	437		-112.6	2		156			0.16		8	80	2	20	0.31	<0.001	3.66	0.039
2019 Env Monitoring	8/01/2019	DPL5	5.13	259.66	12.15	-36.9															

Longterm Groundwater Quality Monitoring at Dunloe Sands Quarry																					
2019 Env Monitoring	5/02/2019	DPL5	4.62	1140.4	0.43	-40.9															
2019 Env Monitoring	8/03/2019	DPL5	9.89	3168	48	-82.4		4	100				2	5	16	2		0.23	<0.001		0.02
2019 Env Monitoring	5/04/2019	DPL5	4.63	1280	0.3	NR															
2019 Env Monitoring	7/05/2019	DPL5	6.41	5623	9.5	121															
2019 Env Monitoring	4/06/2019	DPL5	4.43	2310	0.6	2.4		<1	657				1	41	337	7		1.81	<0.001		0.127
2019 Env Monitoring	4/07/2019	DPL5	6.41	563	9.5	121															
2019 Env Monitoring	1/08/2019	DPL5	4.5	1780	10	46		<1	940				15	56	462	10		2.23	<0.001		0.212
2019 Env Monitoring	26/09/2019	DPL5	4.35	657	5.3	-14.4															
2019 Env Monitoring	24/10/2019	DPL5	4.63	2380	10.8	61															

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2019 Env Monitoring	22/11/2019	DPL5	4.63	2200	11.6	66.1		<1	888				14	55	54	10		1.74	<0.01		0.16
2019 Env Monitoring	20/12/2019	DPL5	5.71	22	43.1	59.7															
2020 Env Monitoring	17/01/2020	DPL5	4.5	2040	8.4																
2020 Env Monitoring	14/02/2020	DPL5																			
2020 Env Monitoring	18/03/2020	DPL5	4.65	4140	0.84	-89			1500			0.37		96	830	26	180	3.8	0.0009		0.54
2020 Env Monitoring	16/04/2020	DPL5	7.92	1770	1.03	63															
2020 Env Monitoring	14/05/2020	DPL5	4.15	1210	0.3	147															
2020 Env Monitoring	11/06/2020	DPL5	4.29	847	1.01	333			280				7.7	17	160	4.8	56	0.57	0.001		0.081
2020 Env Monitoring	9/07/2020	DPL5	4.3	642	0	380															
2020 Env Monitoring	24/09/2020	DPL5	5.68	149	0				25			0.03	5	5	19	5	5	0.17	0.001		
2020 Env Monitoring	8/10/2020	DPL5	6.54	123	0.31	184															
2020 Env Monitoring	9/11/2020	DPL5	6.24	285	0				110			1.79	21	9	46	1.8	20	0.18	0.001		0.011
2020 Env Monitoring	10/12/2020	DPL5	6.62	4.83	0	-216															
No of Samples			**85**	**85**	**59**	**58**	**12**	**8**	**33**	**1**	**5**	**11**	**25**	**32**	**33**	**16**	**28**	**20**	**6**	**25**	**24**
Minimum			**3.6**	**4.83**	**0**	**-216**	**2**	**1**	**12**	**0.1**	**0.4**	**0.03**	**0.5**	**1**	**0.7**	**0.7**	**3.5**	**0.13**	**0.0009**	**0.09**	**0.0029**
Maximum			**9.89**	**5623**	**48**	**386**	**11**	**7**	**1500**	**0.1**	**1.3**	**1.79**	**21**	**96**	**830**	**26**	**180**	**3.96**	**0.001**	**15**	**0.54**
Average			**4.91**	**755.31**	**5.17**	**163.18**	**4.75**	**3.25**	**246.45**	**0.10**	**0.74**	**0.30**	**5.22**	**15.76**	**115.63**	**5.96**	**26.09**	**1.06**	**0.00**	**4.40**	**0.08**
2011/2012 AEMR	Dec-11	DPL6							14				2.7	3.6	4.9	<5	37		<0.005	9.48	0.02
2011/2012 AEMR	Mar-12	DPL6							14				3.3	4.5	8.4	<5	42		<0.005	17	0.02
2011/2012 AEMR	30/05/2012	DPL6	3.8	302	1	464															
2011/2012 AEMR	Jun-12	DPL6	4	324	2.8	345	<1	<1	14				7.3	12	10	<5	104		<0.005	17	0.11
2011/2012 AEMR	26/07/2012	DPL6	4.6	331	3.3	14															
2011/2012 AEMR	27/08/2012	DPL6	4.4	419	2	84															
2011/2012 AEMR	27/09/2012	DPL6	4.3	363	2.2	279	<1	<1	15				11	14	12	<5	130		<0.005	24	0.16
2011/2012 AEMR	29/10/2012	DPL6	4.4	425	4.9	127															
2012/2013 AEMR	Dec-12	DPL6							15				4.7	4.7	13	<5	63		<0.005	15	0.07
2012/2013 AEMR	Mar-13	DPL6							14				3.6	2.5	11	<5	34		<0.005	20	0.07
2012/2013 AEMR	Jun-13	DPL6							18				3.1	2.1	3.1	<5	40		<0.005	15	0.04
2012/2013 AEMR	Sep-13	DPL6							16				2.4	1.6	11	<5			<0.005	10	0.04
2013/2014 AEMR	12/12/2013	DPL6	5.2	162	4.4	42	10	6	20				4.5	1.5	1.5	<5	30		<0.005	10	0.06
2013/2014 AEMR	29/01/2014	DPL6	4.2	210	5.3	269															
2013/2014 AEMR	24/02/2014	DPL6	4.2	228	4.5	268															
2013/2014 AEMR	31/03/2014	DPL6	4.8	165	2.5	130	3	2	22				5.6	1.8	1.8	<5	34		<0.005	10.5	0.06
2013/2014 AEMR	24/04/2014	DPL6	5	156		162															
2013/2014 AEMR	28/05/2014	DPL6	3.8	198		343															
2013/2014 AEMR	25/06/2014	DPL6	3.2	497	6.1	440	<1	<1	17				7	4.5	16	<5	119		<0.005	13	0.2
2013/2014 AEMR	29/08/2014	DPL6	4.1	1764	4.9	191	NP	NP	40				45	23	16	9	958		<0.005	388	2.01
2013/2014 AEMR	29/09/2014	DPL6	3.5	1699	<1	302															
Appendix of 2015 AEMR	28/11/2014	DPL6	4.5	1622	2.6	90															
Appendix of 2015 AEMR	15/12/2014	DPL6	3.5	1700	<0.1	290	NP	<1	<3				134	26	24	10	768	10	<0.005	322	1.91
Appendix of 2015 AEMR	22/01/2015	DPL6	4.1	1216	3.4	230															
Appendix of 2015 AEMR	25/02/2015	DPL6	3.7	951	1.6	213															
Appendix of 2015 AEMR	26/03/2015	DPL6	4.2	1600	5.1	177	NP	NP													
Appendix of 2015 AEMR	24/04/2015	DPL6	4.0	1558	2.5	226															
Appendix of 2015 AEMR	28/05/2015	DPL6	3.9	2153	5.3	279															
Appendix of 2015 AEMR	17/09/2015	DPL6	3.8	2219	2	220	NP		100			1.13	22	24	16	9	1490	147	<0.001	580	3.65
Appendix of 2015 AEMR	21/10/2015	DPL6	3.6	2189	2	284															
Appendix of 2015 AEMR	25/11/2015	DPL6	3.3	2264	1.7	226															
Appendix of 2015 AEMR	11/12/2015	DPL6	3.4	2164	0.9	342	<1	<1	40				50	23	18	10	1520	104	0.011	291	3
Appendix of 2016 AEMR	25/01/2016	DPL6	4.5	2056	1.1	52															
Appendix of 2016 AEMR	24/02/2016	DPL6	4.4	2056	2.3	78															
Appendix of 2016 AEMR	24/03/2016	DPL6	4.1	2031	1.5	183	<1	<1	23				55.48	23.88	17.76	10.27	1382.076	94.142	0.026	428	3.75
Appendix of 2016 AEMR	29/04/2016	DPL6	3.9	1997	1.9	183															
Appendix of 2016 AEMR	24/05/2016	DPL6	3.8	1974	2.8	199															
Appendix of 2016 AEMR	30/06/2016	DPL6	4.2	1810.2	3.3	275															
Appendix of 2016 AEMR	21/07/2016	DPL6	3.5	1731.9	1.3	338															
Appendix of 2016 AEMR	31/08/2016	DPL6	3.7	1783	3.8	262	<1		790				24	22	14	<5	1100		0.001	241	1.96
Appendix of 2016 AEMR	29/09/2016	DPL6	3.8	1738	1.9	189															
Appendix of 2016 AEMR	27/10/2016	DPL6	3.8	1738	1.9	189															
Appendix of 2016 AEMR	29/11/2016	DPL6	3.8	3.8	2.3	182															
Appendix of 2016 AEMR	20/12/2016	DPL6	3.7	1752	2.1	274.7	<1		<1				21	33	16	9	1080		0.001	259	1.96
Q1 2017 Env mon report	30/01/2017	DPL6	3.6	1745																	
Q1 2017 Env mon report	27/02/2017	DPL6	3.8	1653																	
2017 Env Monitoring	22/03/2017	DPL6	3.8	1710			<5		17	0.3	2.5	0.54		21	14	10	1200	59	0.004	370	1.9
2017 Env Monitoring	19/04/2017	DPL6	3.9	1540																	
2017 Env Monitoring	17/05/2017	DPL6	3.8	1580																	
2017 Env Monitoring	14/06/2017	DPL6	3.7	1380			<5		17	0.2	1.6	0.59		17	14	11	990	43	0.003	300	1.4
2017 Env Monitoring	12/07/2017	DPL6	3.9	1100																	
2017 Env Monitoring	9/08/2017	DPL6	3.9	1050																	
2017 Env Monitoring	6/09/2017	DPL6	3.7	977			<5		16	<0.05	1.6	0.51		11	12	8	370	17	0.002	180	0.93
2017 Env Monitoring	4/10/2017	DPL6	3.9	1030																	
2017 Env Monitoring	1/11/2017	DPL6	3.9	1000																	
2017 Env Monitoring	29/11/2017	DPL6	3.9	919																	
2017 Env Monitoring	28/12/2017	DPL6	3.9	822			<5		18	0.1	1.6	0.41		8.8	11	8	540	12	0.001	150	0.67
2018 Env Monitoring	24/01/2018	DPL6	3.88	866																	
2018 Env Monitoring	21/02/2018	DPL6	3.84	822																	
2018 Env Monitoring	21/03/2018	DPL6	3.94	655			<5		20	11	1.3	0.3		7.1	11	7.3	410	8.2	0.001	120	0.45
2018 Env Monitoring	18/04/2018	DPL6	4.03	472																	
2018 Env Monitoring	16/05/2018	DPL6	3.98	469																	
2018 Env Monitoring	13/06/2018	DPL6	3.89	533			<5		25	11	1.4	0.52		5.2	11	6.5	320	6.7	<0.001	74	0.4
2018 Env Monitoring	11/07/2018	DPL6	3.92	463																	
2018 Env Monitoring	8/08/2018	DPL6	3.93	517																	
2018 Env Monitoring	5/09/2018	DPL6	3.82	600	6.82	14.5	<1		20	11		0.25		7	11	6	205	9.31	0.001		0.498
2018 Env Monitoring	5/10/2018	DPL6	3.99	641	8.8																
2018 Env Monitoring	6/11/2018	DPL6	4.02	634	14.1																
2018 Env Monitoring	7/12/2018	DPL6	4.01	618	3.2		<1		17	11		0.28		8	11	6	328	12.1	0.001	123	0.659
2019 Env Monitoring	8/01/2019	DPL6	4.07	607.54	10.04	39.9															
2019 Env Monitoring	5/02/2019	DPL6	4.07	653.15	0.25	-45.9															
2019 Env Monitoring	8/03/2019	DPL6	5.78	10190	0.19	-39.5		<1	18				11	8	11	6	293	9.51	<0.01	99.8	0.576
2019 Env Monitoring	5/04/2019	DPL6	3.98	655	0.3	NR															

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2019 Env Monitoring	7/05/2019	DPL6	5.69	8160	0.6	0.1														
2019 Env Monitoring	4/06/2019	DPL6	3.9	611	0.4	25.6		<1	16				10	8	11	6	288	9.92	0.001	108	0.54
2019 Env Monitoring	4/07/2019	DPL6	5.69	8160	0.6	0.1															
2019 Env Monitoring	1/08/2019	DPL6	3.93	473	2.8	53.8		<1	17				8	6	10	4	231	8.03	<0.001	92.6	0.538
2019 Env Monitoring	26/09/2019	DPL6	3.93	109	0.8	-19.9															
2019 Env Monitoring	24/10/2019	DPL6	4.94	393	24.3	<0.1															
2019 Env Monitoring	22/11/2019	DPL6	3.96	463	2.5	36.9		<1	16				7	6	12	6	187	3.21	<0.01	45	0.225
2019 Env Monitoring	20/12/2019	DPL6	4.84	262	35.9	80.6															
2020 Env Monitoring	17/01/2020	DPL6	4.7	249	7.7																
2020 Env Monitoring	14/02/2020	DPL6	4.09										4	4	9	5	127	4.35	0.001	54.8	0.275
2020 Env Monitoring	18/03/2020	DPL6	4.99	227	1.42	-39		19.9				0.98		2.1	7	3.6	73	0.8	0.0009	39	0.16
2020 Env Monitoring	16/04/2020	DPL6	5.11	2250	1.52	-26															
2020 Env Monitoring	14/05/2020	DPL6	4.74	207	0.34	-21															
2020 Env Monitoring	11/06/2020	DPL6	4.29	253	0	32		20					2.6	2.2	7.9	4.5	53	1.6	0.001	22	0.15
2020 Env Monitoring	9/07/2020	DPL6	4.46	302	0	54															
2020 Env Monitoring	10/08/2020	DPL6	4.31	520	0	-13															
2020 Env Monitoring	24/09/2020	DPL6	7.14	504	0.46			20				2.4	5	5	28	7.2	160	0.56	0.001	73	
2020 Env Monitoring	8/10/2020	DPL6	4.37	507	0	27															
2020 Env Monitoring	9/11/2020	DPL6	6.68	490	0.95			20				1.6	3.9	5.2	23	5	140	3.1	0.001	61	0.31
2020 Env Monitoring	10/12/2020	DPL6	6.18	498	1.34	-41															
No of Samples			**87**	**86**	**61**	**57**	**2**	**6**	**28**	**7**	**6**	**12**	**26**	**35**	**35**	**23**	**34**	**21**	**17**	**34**	**34**

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Minimum			**3.2**	**3.8**	**0**	**-45.9**	**3**	**2**	**14**	**0.1**	**1.3**	**0.25**	**2.4**	**1.5**	**1.5**	**3.6**	**30**	**0.56**	**0.0009**	**9.48**	**0.02**
Maximum			**7.14**	**10190**	**35.9**	**464**	**10**	**20**	**790**	**11**	**2.5**	**2.4**	**134**	**33**	**28**	**11**	**1520**	**147**	**0.026**	**580**	**3.75**
Average			**4.20**	**1256.86**	**3.65**	**150.19**	**6.50**	**14.65**	**49.61**	**6.37**	**1.67**	**0.79**	**17.62**	**10.27**	**12.24**	**7.28**	**436.65**	**26.83**	**0.00**	**134.77**	**0.85**
2011/2012 AEMR	Dec-11	DPL7							680				**16**	**24**	451	36	207		<0.005	0.34	0.04
2011/2012 AEMR	Mar-12	DPL7							710				**16**	**24**	649	28	210		<0.005	0.28	0.03
2011/2012 AEMR	30/05/2012	DPL7	7.4	3451	3.6	241															
2011/2012 AEMR	Jun-12	DPL7	7.5	3446	5	249	550	336	700				17	36	561	30	214		<0.005	0.32	0.05
2011/2012 AEMR	26/07/2012	DPL7	7.4	3434	3.4	-15															
2011/2012 AEMR	27/08/2012	DPL7	7.6	3492	2.5	24															
2011/2012 AEMR	27/09/2012	DPL7	7.4	3385	2.1	154	430	256	730				15	32	530	28	226		<0.005	1.11	0.02
2011/2012 AEMR	29/10/2012	DPL7	7.2	3416	1.7	52															
2012/2013 AEMR	Dec-12	DPL7							730				16	34	673	29	203		<0.005	0.56	0.02
2012/2013 AEMR	Mar-13	DPL7							750				18	38	610	27	223		<0.005	0.72	0.05
2012/2013 AEMR	Jun-13	DPL7							740				16	36	16	25	274		<0.005	1.56	0.03
2012/2013 AEMR	Sep-13	DPL7							750				16	34	543	23			<0.005	1.2	0.05
2013/2014 AEMR	12/12/2013	DPL7	7.2	3341	4.1	52	390	238	750				18	38	38	26	249		<0.005	1.33	0.08
2013/2014 AEMR	29/01/2014	DPL7	7.3	3243	3.9	154															
2013/2014 AEMR	24/02/2014	DPL7	7.2	3151	2.4	231															
2013/2014 AEMR	31/03/2014	DPL7	7.2	3358	2.8	-2	410	250	720				19	39	39	26	253		<0.005	1.52	0.04
2013/2014 AEMR	24/04/2014	DPL7	7.5	3452		116															
2013/2014 AEMR	28/05/2014	DPL7	7.3	3468		297															
2013/2014 AEMR	25/06/2014	DPL7	4.6	69	2.3	320	1	<1	15				0.3	0.2	9.9	<5	4.2		<0.005	0.85	<0.01
2013/2014 AEMR	30/07/2014	DPL7	7.5	3414	3.5	126	390	240	760				19	41	656	27	261	0.41	<0.005	1.42	0.02
2013/2014 AEMR	29/08/2014	DPL7	7.5	3477	2.8	128	400	245	740				17	37	611	25	236		<0.005	1.88	0.01
2013/2014 AEMR	29/09/2014	DPL7	7.2	3436	4.9	173															
Appendix of 2015 AEMR	28/11/2014	DPL7	7.1	3416	4.9	75															
Appendix of 2015 AEMR	15/12/2014	DPL7	7.2	3340	2.3	100	400	243	780				22	43	685	29	211	0.34	<0.005	1.62	0.06
Appendix of 2015 AEMR	22/01/2015	DPL7	7.1	3404	2.6	77															
Appendix of 2015 AEMR	25/02/2015	DPL7	7.4	3396	4.5	30															
Appendix of 2015 AEMR	26/03/2015	DPL7	7.1	3446	3.1	78	420	423	780				18	38	651	26	250	0.51	<0.001	2.62	0.077
Appendix of 2015 AEMR	24/04/2015	DPL7	7.5	3438	5.5	53															
Appendix of 2015 AEMR	28/05/2015	DPL7	7.5	3417	6	161															
Appendix of 2015 AEMR	17/09/2015	DPL7	7.3	3323	2.8	110	380		760			0.06	18	39	644	25	250	0.62	<0.001	2.53	0.025
Appendix of 2015 AEMR	21/10/2015	DPL7	7.2	3330	3.5	144															
Appendix of 2015 AEMR	25/11/2015	DPL7	7.2	3500	5.8	100															
Appendix of 2015 AEMR	11/12/2015	DPL7	7.2	3371	2.7	214	380	380	770				17	37	644	24	272	0.04	0.0002	2.44	0.084
Appendix of 2016 AEMR	25/01/2016	DPL7	7.1	3344	1.8	-36.00															
Appendix of 2016 AEMR	24/02/2016	DPL7	7.2	3444	5.5	-60.00															
Appendix of 2016 AEMR	24/03/2016	DPL7	7.2	3399	4.1	-9.00	363	363	738				18.21	38.01	637.38	26.08	260.218	0.356	<0.001	1.772	0.084
Appendix of 2016 AEMR	29/04/2016	DPL7	7.4	3374	6.4	26.00															
Appendix of 2016 AEMR	24/05/2016	DPL7	7.4	3382	5.5	-57.00															
Appendix of 2016 AEMR	30/06/2016	DPL7	7.4	3404.7	5.7	98.00															
Appendix of 2016 AEMR	21/07/2016	DPL7	7.5	3159	6.5	-31.00															
Appendix of 2016 AEMR	31/08/2016	DPL7	7.3	3364	3.7	-22.00	369		760				24	35	604	24	217		0.001	2.07	0.082
Appendix of 2016 AEMR	29/09/2016	DPL7	7.2	3558	2.4	44.00															
Appendix of 2016 AEMR	27/10/2016	DPL7	7.2	3558	2.4	44.00															
Appendix of 2016 AEMR	29/11/2016	DPL7	7.1	7.1	2.4	20.00															
Appendix of 2016 AEMR	20/12/2016	DPL7	6.9	3527	4.5	229.3	372		372				18	38	648	25	263		0.001	1.85	0.082
Q1 2017 Env mon report	30/01/2017	DPL7	6.9	3471																	
Q1 2017 Env mon report	27/02/2017	DPL7	7.1	3174																	
2017 Env Monitoring	22/03/2017	DPL7	7	3430			350		360	0.1	2.1	0.19		36	830	29	710	0.33	<0.001	1.8	0.076
2017 Env Monitoring	19/04/2017	DPL7																			
2017 Env Monitoring	17/05/2017	DPL7	6.9	3440																	
2017 Env Monitoring	14/06/2017	DPL7																			
2017 Env Monitoring	12/07/2017	DPL7	7	3360																	
2017 Env Monitoring	9/08/2017	DPL7	7	3480																	
2017 Env Monitoring	6/09/2017	DPL7	7	3380			390		640	0.1	2.9	0.67		38	940	31	350	0.33	<0.001	1.3	0.065
2017 Env Monitoring	4/10/2017	DPL7	7	3450																	
2017 Env Monitoring	1/11/2017	DPL7	6.9	3440																	
2017 Env Monitoring	29/11/2017	DPL7	6.8	344																	
2017 Env Monitoring	28/12/2017	DPL7	6.9	3410			380		720	0.1	3.6	2.4		38	930	30	250	0.33	<0.001	1.4	0.063
2018 Env Monitoring	24/01/2018	DPL7	6.84	3450																	
2018 Env Monitoring	21/02/2018	DPL7	6.83	3310																	
2018 Env Monitoring	21/03/2018	DPL7	6.78	3650			400		710	0.2	3.7	2.3		41	750	30	250	0.37	<0.001	1.3	0.065
2018 Env Monitoring	18/04/2018	DPL7	6.88	3500																	
2018 Env Monitoring	16/05/2018	DPL7	6.89	3480																	
2018 Env Monitoring	13/06/2018	DPL7	6.89	3570			380		680	0.1	3.9	2.3		37	840	31	260	0.35	<0.001	1.6	0.072
2018 Env Monitoring	11/07/2018	DPL7	7.08	3220																	
2018 Env Monitoring	8/08/2018	DPL7	7.01	3510																	
2018 Env Monitoring	5/09/2018	DPL7	3.9	2680	57.6	391	393		783			2.06		40	651	26	232	0.49	<0.001		0.074
2018 Env Monitoring	5/10/2018	DPL7	6.88	3340	7.5																
2018 Env Monitoring	6/11/2018	DPL7	6.73	3530	4																
2018 Env Monitoring	7/12/2018	DPL7	6.76	3310	2.3	-112.6	395		749			2.08		39	635	25	278	0.5	<0.001	1.7	0.659
2019 Env Monitoring	8/01/2019	DPL7	6.75	3329.4	14.2	-90.7															
2019 Env Monitoring	5/02/2019	DPL7	6.74	3571.4	0.18	-1620															
2019 Env Monitoring	8/03/2019	DPL7	5.09	367	0.22	3.2		415					755	39	675	25	267	0.44	<0.01	1.63	0.072
2019 Env Monitoring	5/04/2019	DPL7	6.74	3460	0.6	NR															
2019 Env Monitoring	7/05/2019	DPL7	4.4	2320	0.7	0.1															
2019 Env Monitoring	4/06/2019	DPL7	6.68	3480	0.4	0.1		380					671	40	656	25	316	0.34	<0.001	1.57	0.078
2019 Env Monitoring	4/07/2019	DPL7	4.4	2320	0.7	0.1															
2019 Env Monitoring	1/08/2019	DPL7	6.88	3220	7.2	<0.1		393					639	38	607	22	265	0.51	<0.001	1.8	0.082
2019 Env Monitoring	26/09/2019	DPL7	7.35	3420	2.2	195															
2019 Env Monitoring	24/10/2019	DPL7	7.51	3590	1.3	0.1															
2019 Env Monitoring	22/11/2019	DPL7	6.71	3570	5.7	<0.1		388					803	39	637	24	264	0.48	<0.001	1.48	0.074
2019 Env Monitoring	20/12/2019	DPL7	6.82	3820	3.1	<0.1															
2020 Env Monitoring	17/01/2020	DPL7	7.25	3500	4.1																
2020 Env Monitoring	16/01/2020	DPL7																			
2020 Env Monitoring	14/02/2020	DPL7																			
2020 Env Monitoring	18/03/2020	DPL7	6.83	3110	0	-155		470	840			1.9		44	730	28	270	0.41	0.0009	1.5	0.077

Longterm Groundwater Quality Monitoring at Dunloe Sands Quarry																				
2020 Env Monitoring	16/04/2020	DPL7	6.36	3070	1.58	8														
2020 Env Monitoring	14/05/2020	DPL7	6.82	2960	0	-63														
2020 Env Monitoring	11/06/2020	DPL7	6.78	2890	0	-46		790	700				18	37	600	23	280	0.5	0.002	0.5	0.05
2020 Env Monitoring	9/07/2020	DPL7	7.2	3190	0.5	-69														
2020 Env Monitoring	10/08/2020	DPL7	4.75	276	0	113														
2020 Env Monitoring	10/08/2020	DPL7	7.12	3290	0.59	-182100														
2020 Env Monitoring	24/09/2020	DPL7	6.99	3220	0			6100	650			2.1	16	33	550	23	290	0.29	0.001	1.4	
2020 Env Monitoring	8/10/2020	DPL7	7.27	3250	0	-94														
2020 Env Monitoring	9/11/2020	DPL7	7.49	3370	0			490	700			0.71	18	33	590	24	260	0.37	0.001	1.4	0.067
2020 Env Monitoring	10/12/2020	DPL7	6.79	3150	0	-228														
No of Samples			**86**	**86**	**65**	**58**	**21**	**18**	**31**	**5**	**5**	**11**	**27**	**35**	**35**	**34**	**34**	**21**	**7**	**34**	**33**
Minimum			**3.9**	**7.1**	**0**	**-182100**	**1**	**238**	**15**	**0.1**	**2.1**	**0.06**	**0.3**	**0.2**	**9.9**	**22**	**4.2**	**0.04**	**0.0002**	**0.28**	**0.01**
Maximum			**7.6**	**3820**	**57.6**	**391**	**550**	**6100**	**840**	**0.2**	**3.9**	**2.4**	**803**	**44**	**940**	**36**	**710**	**0.62**	**0.002**	**2.62**	**0.659**
Average			**6.92**	**3169.86**	**3.91**	**-3106.54**	**378.24**	**688.89**	**686.03**	**0.12**	**3.24**	**1.52**	**120.69**	**35.81**	**586.32**	**26.62**	**259.57**	**0.40**	**0.00**	**1.42**	**0.08**

Longterm Groundwater Depth Monitoring at Dunloe Sands Quarry

Date	DPL1	DPL3	DPL5	DPL6	DPL7
Nov-13	0.61	0.57	0.67	0.59	0.61
Apr-14	0.61	0.58	0.68	0.61	0.62
Nov-14	1.30	1.90	1.20	1.40	1.90
Dec-14	1.20	1.80	1.20	1.40	1.80
Jan-15	1.10	1.40	0.90	1.20	1.40
Feb-15	0.30	1.00	0.20	0.80	1.50
Mar-15	0.70	1.00	0.40	1.00	1.20
Apr-15	0.90	1.00	0.80	1.20	1.40
May-15	1.10	1.70	0.80	1.40	1.20
Jun-15	1.40	1.40	0.80	1.20	1.30
Jul-15	1.00	1.50	1.10	1.10	1.00
Aug-15	1.30	1.50	0.90	1.10	1.60
Sep-15	1.30	1.80	1.30	1.20	1.70
Oct-15	1.40	1.70	1.10	1.20	1.80
Nov-15	1.20	1.40	1.20	1.30	1.70
Dec-15	1.10	1.20	0.90	1.20	1.60
22/03/2017	1.58	1.28	1.38	1.95	1.20
19/04/2017	1.53	1.46	1.51	1.26	
17/05/2017	1.64	1.44	1.54	1.51	1.51
14/06/2017	0.89			1.08	
12/07/2017	1.69	1.52	1.60	1.54	1.47
9/08/2017	1.83	1.60	1.68	1.77	1.69
6/09/2017	1.90	1.61	1.67	1.85	1.80
4/10/2017	1.91	1.54	1.61	1.81	1.69
1/11/2017	1.92	1.64	1.72	1.81	1.72
29/11/2017	1.93	1.65	1.74	1.81	1.77
28/12/2017	1.94	1.66	1.74	1.97	1.78
24/01/2018	2.03	1.70	1.77	1.88	1.9
21/02/2018	1.94	1.52	1.62	1.87	1.89
21/03/2018	1.68	1.38	1.49	1.62	1.4
18/04/2018	1.6	1.33	1.41	1.52	1.24
16/05/2018	1.62	1.23	1.36	1.65	1.37
13/06/2018	1.74	1.42	1.56	1.78	1.55
11/07/2018	1.78	1.48	1.56	1.71	1.62
8/08/2018	1.98	1.72	1.80	1.78	1.78
5/09/2018		1.36	1.74	1.6	1.78
5/10/2018	1.73	1.39	1.39	1.73	1.64
6/11/2018	1.74	1.74	1.54	1.62	1.52
7/12/2018		1.39	1.46	1.58	1.34
8/01/2019	1.75	1.63	1.60	1.91	1.8
5/02/2019	1.99	1.64	1.71	2.1	1.93
8/03/2019	1.97	1.83	1.88	1.51	1.59
5/04/2019	1.58	1.35	1.39	1.48	1.56
7/05/2019	NA	NA	NA	NA	NA
4/06/2019	1.75	1.35	1.75	1.64	1.6
4/07/2019	1.68	1.26	1.42	1.49	1.31
1/08/2019	1.85	1.49	1.59	1.58	1.61
26/09/2010	2.45	2.74	2.77	1.64	2.75
24/10/2019	NR	NR	NR	NR	NR
22/11/2019	2.03	2.02	1.81	2.01	1.99
20/12/2019	2.13	1.79	1.83	1.68	2.01
17/01/2020	2.03				
18/03/2020	0.7	1.2	1.25	1	1.15
16/04/2020	1.7	1.4	1.50	1.4	1.4

14/05/2020	1.9	1.7	1.8	1.8	1.7
11/06/2020	1.8	1.5	1.65	1.55	1.7
9/07/2020	2.05	1.7	1.65	1.65	1.8
10/08/2020	1.05	1.5		1.6	1.55
10/09/2020					
24/09/2020	1.94	1.75	1.75	1.43	1.66
8/10/2020	2.07	1.79	1.7	1.72	1.82
9/11/2020	2.15	1.68	1.64	1.71	1.71
10/12/2020	2.25	1.87	1.76	2.3	1.97
Minimum	**0.3**	**0.57**	**0.2**	**0.59**	**0.61**
Maximum	**2.45**	**2.74**	**2.77**	**2.3**	**2.75**
Average	**1.59**	**1.51**	**1.43**	**1.52**	**1.59**