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Dunmore Lakes Sand Project Annual Review

1 July 2019 – 30 June 2020

Document Control				
Ref	Prepared by	Approved by	Date	Distribution
v1.0	Ben Williams Environmental Coordinator Dunmore Operations	N/A	September 20	Initial draft for internal distribution for review
v1.1	Ben Williams Environmental Coordinator Dunmore Operations	David Bolton General Manager Quarries NSW/ACT	September 20	• Department of Planning, Industry and Environment • Environmental Protection Agency • Shellharbour City Council • Dunmore Quarry CCC • Online at https://www.boral.com.au/locations/boral-dunmore-operations

Name of operation	Boral Dunmore Lakes Sand Project
Name of operator	Boral Resources (NSW) Pty Ltd
Development consent	DA-195-8-2004
Name of holder of development consent	Boral Resources (NSW) Pty Ltd
Water licence number	WAL24477
Name of holder of water licence	Boral Resource (NSW) Pty Ltd
Annual Review start date	1 July 2019
Annual Review end date	30 June 2020

I, Shoanne Labowitch certify that this audit is a true and accurate record of the compliance statues of the Dunmore Lakes Sand Project for the period of the 2020 Financial Year and that I am authorised to make this statement on behalf of Boral Resources (NSW) Pty Ltd.

Note

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.

Name of authorised reporting officer	Shoanne Labowitch
Title of authorised reporting officer	Environment Manager NSW/ACT
Signature	*Shoanne Labowitch*
Date	30/09/20

Contents

Tables and Figures

List of Abbreviations

ANZECC	Australian and New Zealand Environment Conservation Council
AQMP	Air Quality Management Plan
AR	Annual review
AS	Australian Standard
BFMP	Bushfire Management Plan
BMP	Blast Management Plan
BOS	Biodiversity Offset Strategy
CCC	Community Consultative Committee
DA 195-8-2004	The development application for the Dunmore Lakes Sand Project operated by Boral Resources (NSW) Pty Ltd
DLSP	Dunmore Lakes Sand Project
DO	Dissolved Oxygen
DPIE	Department of Planning, Industry and Environment
EPA	Environmental Protection Authority
EPA&A Act	Environmental Planning and Assessment Act 1979
EPL 11147	Environmental Protection Licence for the Dunmore Lakes Sand Project operated by Boral Resource (NSW) Pty Ltd
FFMP	Flora and Fauna Management Plan
current reporting period	Financial Year 2020 (1 July 2019 – 30 June 2020)
GMMP	Groundwater Monitoring Management Plan
HVAS	High Volume Air Sampler
IEA	Independent Environmental Audit
LOR	Limit of Reporting
MOD	Modifications
ML	Megalitres
NATA	National Association of Testing Authorities
NMP	Noise Management Plan
NRAR	Natural Resource Access Regulator
NTU	Nephelometric Turbidity Units
PASS	Potential Acid Sulphate Soil
PIRMP	Pollution Incident Response Management Plan
PM_{10}	Particulate Matter (10 microns in diameter)
$PM_{2.5}$	Particulate Matter (2.5 microns in diameter)

POEO Act	Protection of the Environment Operations Act 1997
RMP	Rehabilitation Management Plan
S5.C9	Used to refer to a particular condition in DA-195-8-2004 (in this case Schedule 5, Condition 9).
TSP	Total Suspended Particulates
TSS	Total Suspended Solids
VENM	Virgin Excavated Natural Materials
WMP	Water Management Plan
WQO	Water Quality Objectives
µg/m^3	Micrograms per cubic metre

1. Purpose and Scope

In addition to determining the compliance of the development with the conditions of the consent, DA 195-8-2004 Schedule 5 Condition 9 (S5.C9) requires that the AR reports on specific components of the operation.

DA 195-8-2004 S5.C9 and all other relevant conditions required to be addressed as part of the AR are outlined in Table 1 with reference to the section of this report where each condition has been addressed. The timeframe for the annual review is the 2020 Financial Year which is 1 July 2019 – 30 June 2020.

Table 1 Consent Requirements for Annual Review

Condition	Condition Requirements	Where addressed in this report
5(9)	By the end of September each year, or other timing as may be agreed by the Secretary, the Applicant must review the environmental performance of the development to the satisfaction of the Secretary. This review must:	
	(a) Describe the development (including rehabilitation that was carried out in the previous financial year, and the development that is proposed to be carried out over the current financial year,	Section 4.8
	(b) Include a comprehensive review of the monitoring results and complaints records of the development over the previous financial year, which includes a comparison of these results against:	Section 4
	• The relevant statutory requirements, limits or performance measures/criteria;	
	• Requirements of any plan or program required under this consent;	
	• The monitoring results of previous years; and	
	• The relevant predictions in the documents listed in condition 2(a) of Schedule 2;	
	(c) Identify any non-compliances over the last year, and describe what actions were (or are being) taken to ensure compliance;	Section 1.1
	(d) Identify any trends in the monitoring data over the life of the development;	Section 4
	(e) Identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and	Section 4

	(f) Describe what measures will be implemented over the current financial year to improve the environmental performance of the development. The Applicant must ensure that copies of the Annual Review are submitted to Council and are available to the Community Consultative Committee (see condition 6 of schedule 5) and any interested person upon request.	Section 4
3(27)	The Applicant must ensure that the flood storage capacity of the site is no less than the pre-existing flood storage capacity at all stages of the development. Details of the available flood storage capacity must be reported in the Annual Review.	Section 4.6
3(57)	The Applicant must maximise the use of rail transport for delivery/despatch outside the Illawarra Region, to the satisfaction of the Secretary. Details of transportation modes and measures to assess and encourage rail transport must be provided in the Annual Review.	Section 2.5 and 2.6
3(72)	The Applicant must: (a) Provide annual production data to the DPI using the standard form for that purpose; and (b) Include a copy of this data in the Annual Review.	Section 2.5

1.1. Statement of Compliance

The statement of compliance for the current reporting period (1 July 2019 – 30 June 2020) is contain in Table 2 below

Table 2 Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
DA-195-8-2004	Yes

No non-compliances were identified in the reporting period arising from DLSP development activities. A number of observations are recorded in Table 3, where certain external events led to impacts in the DLSP monitoring data. The DPIE Annual Review Guidelines Compliance Status key outlined in Table 3.

Table 3 Annual Review Compliance Key

Relevant Approval	Condition #	Condition Description	Compliance Status	Comments	Section addressed
DA 195-8-2004	S3.C24	Applicant must ensure that water quality in the dredge ponds and groundwater comply with the water quality objectives (WQO) in Table 7 or other such levels as approved by the secretary. Note: The Department acknowledges that short term exceedances of these objectives may occur during natural events such as heavy rainfall or tidal saline water inflow	Development was carried out in compliance with conditions of consent. Exceedances are attributed to external events not associated with the Development.	Salinity and associated ions as well as algae was outside WQO described in S3.C24 in the Stage 2 and Stage 3 dredge pond DW-14 and DW-19	Section 4.4 (see Surface Water).
DA 195-8-2004	S3.C24	Applicant must ensure that water quality in the dredge ponds and groundwater comply with the water quality objectives in Table 7 or other such	Development was carried out in compliance with conditions of consent. Exceedances are attributed to external events not associated with the Development.	As described in the groundwater monitoring report exceedances of K, Mg and Cl in the deep aquifer to the east of the highway, and Mg in bores DG17 and DG31 are considered	Section 4.7, Appendix D (see groundwater)

Relevant Approval	Condition #	Condition Description	Compliance Status	Comments	Section addressed
		levels as approved by the secretary. Note: The Department acknowledges that short term exceedances of these objectives may occur during natural events such as heavy rainfall or tidal saline water inflow The Groundwater Monitoring and Mitigation Report (GMMP) was approved by the Secretary on 1 November 2018, which refers to the groundwater impacts from the surrounding environment.		natural occurrences, and the GMMP should be revised to reflect this occurrence	
DA 195-8-2004	S3.C19	The Applicant must ensure that dust generated by the development does not cause additional exceedances of the criteria listed in	Development was carried out in compliance with conditions of consent. Exceedances are attributed to external events not associated with the Development.	On 28 November 2019 the recorded PM10 at the DLSP HVAS (Monitoring Point 5) was 52.57 µg/m^3 On 10 December 2019 an elevated reading of 70.23	Section 4.2: Air Quality Monitoring

Relevant Approval	Condition #	Condition Description	Compliance Status	Comments	Section addressed
		Tables 3 to 5 at any residence on, or on more than 25 percent of, any privately-owned land. Table 4: Short term criteria for particulate matter Pollutant: Particulate matter < 10 µm (PM_{10}) Averaging period: 24 hour Criterion: 50 $\mu g/m^3$		$\mu g/m^3$ was recorded DLSP HVAS (Monitoring Point 5). The elevated levels for both of these events has been attributed to the large Currowan bushfire which was burning in the region at the time and not caused by DLSP operations. This fire caused the regional air quality to be above the thresholds described in the DLSP consent and licence. The department acknowledges that prescribed limits in DA 195-8-2004 (DLSP) S4.C22 excludes extraordinary events such as local bushfires.	

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
Administrative	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)

Copies of the AR will be submitted to the DPIE and made available to the public at on the Dunmore Lakes Sand Project (DLSP) operations website.

https://www.boral.com.au/locations/boral-dunmore-operations

Key contacts associated with the management of the Dunmore Lakes Sand Project (DLSP), environment, safety and stakeholder relationships are provided in Table 4.

Table 4 Key Contacts Associated with Dunmore Lakes Sand Project

Contact	Position	Contact Details
Chris Brown	DSS Quarry Manager	(02) 4237 8414 Email: chris.brown@boral.com.au
James Collings	Metropolitan Operations Manager NSW/ACT	(02) 9033 5155 Email: james.collings@boral.com.au
Ben Williams	Environmental Coordinator Dunmore	Tel: (02) 4237 8414 Email: ben.williams@boral.com.au
Paul Jackson	Stakeholder Relations Manager	Tel: (02) 9033 5215 Email: paul.jackson@boral.com.au

2. Site Operations

The Dunmore Lakes Sand Project, owned and operated by Boral Resources (NSW) Pty Ltd, is located at Tabbita Road Dunmore, approximately 12 kilometres north-west of Kiama in the Shellharbour Local Government Area. Dunmore Sand and Soil produces a range of sand and landscaping products through the process of sand dredging.

Development Consent (DA 195-8-2004), was issued 29 June 2005 for stages 2, 3 and 4 by the Minister for Infrastructure and Planning, allows Boral to produce up to 800,000 tonnes of product per year, and transport it offsite by road and rail to local and regional markets.

The Dunmore Lakes Sand Project (the site) covers approximately 88 hectares and is surrounded by private property, predominantly agricultural grazing land and tracts of remnant native vegetation, to the south and north. The site is bound by the Princes Motorway (Kiama Bypass) to the east and directly to the west is the Boral owned and operated Dunmore Quarry.

Operation of the quarry involves the sequential dredging and excavation of approximately eight million tonnes of sand and soil from Stages 2, 3 and 4. The method of extraction of these resources includes both sand and soil extraction by excavator and dredge sand extraction, followed by washing, processing and material blending. The final product is then stockpiled on site until the time that the material is transported to local and regional markets.

A layout of the site is illustrated in Figure 1.

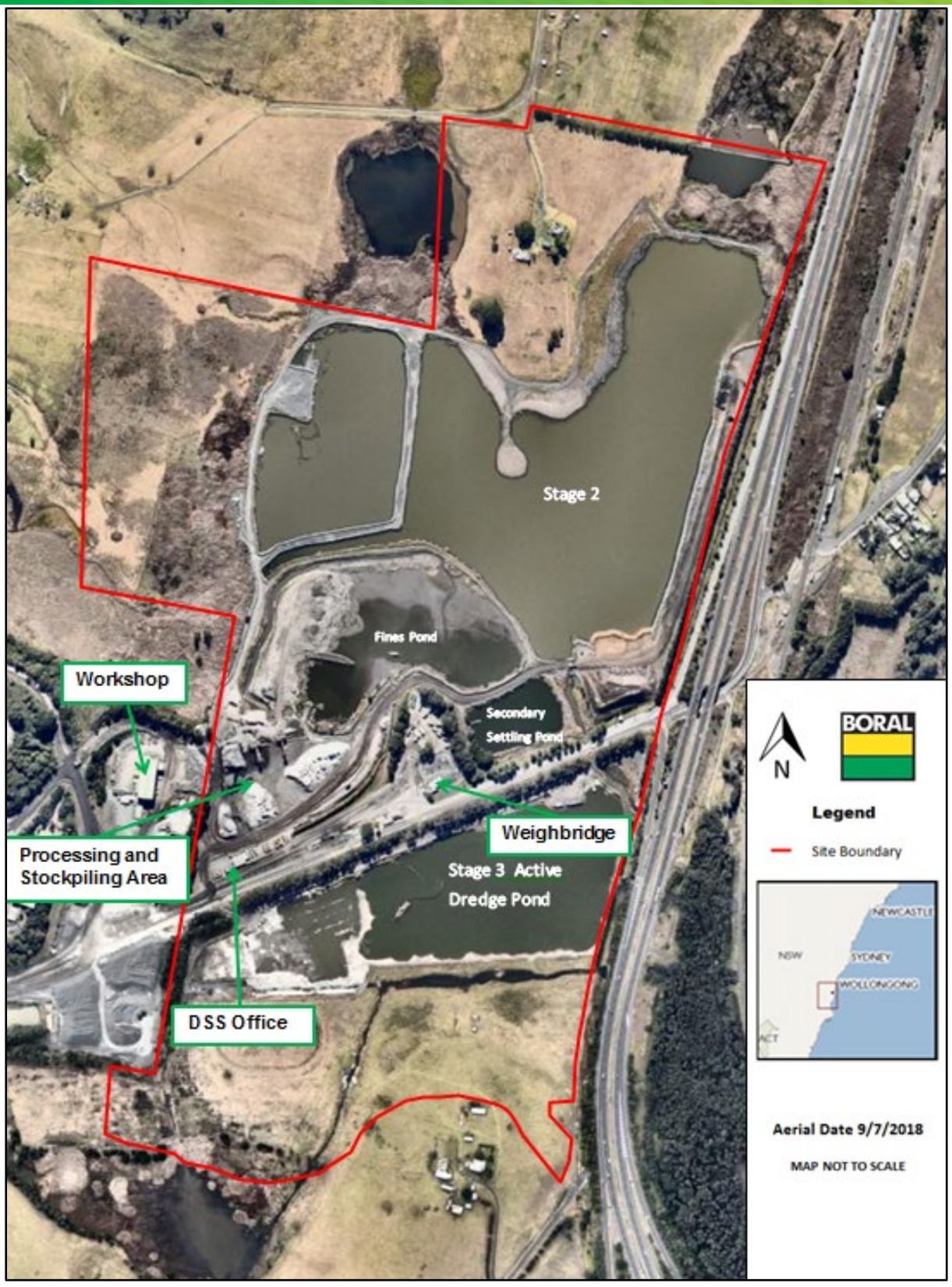

Figure 1 Dunmore Lakes Sand Project Site Layout

2.1. List of Relevant Approvals

A summary of all the relevant approvals relevant to DLSP are provided in Table 5.

Table 5 Dunmore Lakes Sand Project List of Relevant Approvals

Approval Type	Approval Authority	Approval No.	Date Granted
Development Consent	Department of Planning & Environment	195-8-2004 (MOD3)	29/06/2005
Environment Protection Licence	Environment Protection Authority	11147	04/05/04
Water Extraction Licence	Natural Resource Access Regulator (NRAR)	WAL24477	01/02/2018
Controlled Activity Approval	Natural Resource Access Regulator (NRAR)	10CX123242 (10 ERM2010/1116) 10CX122266	5/08/2019 18/12/2018

2.2. Modifications Approved in the Last 12 Months

Modification 3 (MOD 2) was approved in March 2020, which allows for the processing and blending of up to 120,000 tpa of Virgin Excavated Natural Material (VENM) for sale.

As a result, the Waste Management Plan and Water Management Plan were updated and are currently under review by DPIE and DPIE Water, respectively. All other management plans were reviewed and deemed not to require updates due to the activities described under MOD 3.

2.3. Operations last 12 months

Production at DLSP over the reporting period has been tied to demand and availability of the remaining resource. The importation of VENM and Potential Acid Sulphate Soil (PASS) material has continued as part of progressive rehabilitation works. A pipeline has been constructed to Stage 2 to allow extraction of the remaining resource in the northern section of Stage 2, for which a controlled activity approval extension was granted in August 2019.

2.4. Operations next 12 months

The remaining resources in Stage 2 and Stage 3 will be extracted during the next reporting period. Production figures will again be tied to demand and the availability of remaining resources. Rehabilitation will continue throughout Stage 2 and Stage 3.

Modification 2, which was submitted February 2019 has recently been referred to the Independent Planning Commission and will be progressed to determine the proposed expansion of operations to Stage 5A and Stage 5B.

2.5. Productions, Sales and Transport

A summary of production for the current reporting period is shown below in Table 6. The current reporting period production data as reported to the Department of Resources and Geoscience (DRG) is shown in Table 7.

Table 6 Current Reporting Period Production Data

Month	Production (t)	Sales (t)	
		Road	Rail Transfers Out
July 19	30,548	24,950	10,752
Aug 19	27,197	21,388	7,998
Sept 19	23,654	16,419	5,431
Oct 19	17,612	21,231	9,121
Nov 19	37,587	14,657	2,206
Dec 19	14,752	15,785	4,359
Jan 20	17,783	16,203	2,208
Feb 20	10,614	9,784	0
Mar 20	12,324	12,793	0
Apr 20	3,292	11,400	0
May 20	14,682	10,585	0
Jun 20	10,950	10,524	0
Total	220,995	185,719	42,075
		227,794	

Table 7 Current Reporting Period Production Data as Reported to DRG

Product	Quantity Tonnes current reporting period
Virgin Materials Crushed Coarse Aggregates	
Over 75mm	
Over 30mm to 75mm	
5mm to 30mm	**16,575**
Under 5mm	
Natural Sand	
Manufactured Sand	**28,646**

Prepared Road Base & Sub Base	
Other Unprocessed Materials	**6,058**
Construction Sand Excluding Industrial	**132,542**
Industrial Sand	
Foundry, Moulding	
Glass	
Other (Specify)	
TOTAL SITE PRODUCTION	**183,821**

2.6. Production Sales and Transport Next 12 Months

Production will be scaled back during the next reporting period to align with the volume of remaining reserves. It is planned that extraction will re-commence in the northern sections of the Stage 2 ponds up to the approved extraction limits described in DA195-8-2004 and CAA10CX123242 (10 ERM2010/1116). This area has not been previously extracted due to technical and financial constraints at the time.

Production volumes during the next 12 months will be dependent on the outcome of the MOD 2 determination, currently with the IPC. Rail transfers will continue to be maximised wherever possible.

3. Actions to be completed from the Last Annual Review

Aspect	Actions Taken	Section Discussed
Progress with updates to the weather station	The weather station was upgrade as part of the DLSP/Dunmore Quarry transition to real time dust monitoring	Section 4.1 Appendix A
Continue rehabilitation monitoring of planted sections of Swamp Oak Forest and Freshwater Wetland EEC in Stage 2 and Re-aligned Western Tributary.	Rehabilitation has continued as part of Rehabilitation Management Plan (RMP). Previously planted sections are progressing well as seen in Appendix E.	Section 4.8, Appendix E
Plant out sections of the Eastern Edge of Stage 2 with Swamp Oak Forest and Freshwater Wetland EEC.	Competed in December 2019. Planted sections have progressed well and have been incorporated into the site's maintenance and monitoring program.	Section 4.8, Appendix E
Commence Backfilling and landform construction in Stage 3 starting with the Eastern edge and the south eastern tidal zone.	Backfilling of the eastern edge of stage 3 has commenced in preparation of further landform construction to be undertaken in FY21.	Section 4.8, 4.9
Continue assessing salinity in the southern section of Stage 3.	Salinity was measured above WQO objectives in the Stage 3 pond, which was consistent with the EIS findings for the southern section of Stage 3, within the Rocklow Creek tidal zone. Recent high rainfall events has resulted in lower readings for salinity, indicating that flushing and dilution is occurring. It is expected that elevated salinity readings will be a short term occurrence, whilst extraction is occurring in the southern section of Stage 3.	Section 4.4
Update metering arrangements to align with new NRAR regulations	Metering upgrades were delayed as per the non-urban water meter policy. WaterNSW has delayed rollout of new metering framework for non-urban water take for coastal regions until 1 December 2023.	Section 4.5
Include DG-1 and monitoring bores in Stage 5 into monitoring program	DG-1 was incorporated into monitoring programs as DG59 had been destroyed due to dredging operations. Stage 5 background monitoring is continuing.	Section 4.7, Appendix D

4. Environmental Performance

Dunmore Lakes Sand Project has comprehensive management and monitoring programs, which collect information and data to enable the assessment of environmental impacts, regulatory compliance and performance against continual improvement objectives. Specific Management Plans define the framework for measuring environmental performance and compliance with statutory requirements for each relevant aspect of environmental performance

4.1. Meteorological Monitoring

An onsite weather station is located at DLSP which collects a range of meteorological parameters. This system was upgraded as part of the transition to real time air quality monitoring at Dunmore Quarry. The location of the weather station is shown in Appendix A.

There is currently no prescribed impact assessment criteria associated with the weather station monitoring data, with the meteorological monitoring used to provide background information for the management of the site. A detailed summary of the current reporting period and historical rainfall data can be found in Appendix A.

4.1.1. Meteorological Monitoring - Long Term Analysis and Trends

The current reporting period was drier than average, with 761mm of rain falling over the reporting period. Most of this rainfall fell in February 2020 where flooding impacted the region with 243mm of rainfall occurring in the seven days from the 7th February, 2020.

The Currowan bushfire that occurred from mid-November 2019 to early February 2020 caused periods of poor air quality throughout the Illawarra and South Coast regions, which subsequently led to increases in PM_{10} measurements at the on-site monitoring equipment that was observed to be outside of the normal parameters. The observed elevations are not attributable to the DLSP development operations despite causing elevated readings at the onsite HVAS.

Typically winds during the reporting period originated from the W/WSW for the majority of the year, with the exception of summer, where the prevailing wind was from the North. This is in line with historical trends. In February 2020, there were above average wind speeds from the SE, which was unusual when compared with historical trends. Furthermore, the Currowan bushfire burned from November 2019 to February 2020, which affected air quality throughout the whole of the South Coast/Illawarra region.

4.1.2. Meteorological Monitoring Summaries and Opportunities for Improvement

The weather station is now capable of providing real time data via download, which is an upgrade from the previous station. The next reporting period will focus on continuing the processes established during the current reporting period.

4.2. Air Quality Monitoring

Two methods of monitoring air quality are used at DLSP. Deposited dust gauges are used to measure the value of deposited dust every 30 days (+/- 2 days). A High Volume Air Sampler (HVAS) is used to measure fine particulate matter under 10 microns (PM_{10}) every 6 days. The locations of the compliance air quality monitoring locations are shown below. As part the

Air Quality Monitoring Plan (AQMP) the site also monitors the following locations depicted in green in Figure 2) as background data for the Stage 1/Stage 5 operations.

Figure 2 Air Quality Monitoring Locations

4.2.1. Deposited Dust Assessment Criteria

Deposited Dust impact criteria is assessed at a residence located on privately owned land. It is important to note that the assessment criteria refers to an annual averaging period (i.e. the rolling monthly average over the last 12 months).

The Impact Assessment Criteria is shown in Table 8 below.

Table 8 Deposited Dust Impact Assessment Criteria

Pollutant	Averaging Period	Criterion	
Deposited Dust[c]	Annual	2g/m^2/month[b]	4g/m^2/month[a,d]
• [a] Cumulative impacts (i.e. increases in concentration due to development plus all other sources)			

- [b] Incremental impact (i.e. increases in concentration alone, with zero allowable exceedences of criteria over the life of the development.
- [c] Deposited dust is defined as insoluble solids
- [d] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity as agreed by the Secretary.

4.2.2. Deposited Dust Monitoring Performance Review

All air emission monitoring sites were below the required assessment criteria for dust measured as insoluble solids over the annual averaging period. All sites were also below the 4g/m^2/month for the ash fraction, which excludes the organic (combustible) components of the dust sample such as vegetation, bird droppings and insects. These organic contaminants within the sample are typically representative of the surrounding wetlands and farmland areas within which the monitors are located.

A summary of deposited dust results measure at the gauge for the four compliance monitoring points is shown in Table 9 below. Additional dust monitoring is undertaken as background and shown in Table 10.

Table 9 Deposited Dust Compliance Monitoring Summary

Month	**DD-2 (EPL2)** grams/m^2/month		**DD-5 (EPL4)** grams/m^2/month		**DD-6 (EPL8)** grams/m^2/month		**DD-10 (EPL7)** grams/m^2/month	
	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash
current reporting period average	2.67	1.94	2.53	1.80	2.73	1.82	2.10	1.51
Criteria	4	-	4	-	4	-	4	-

Table 10 Deposited Dust Background Monitoring Summary

Month	**DD-1** grams/m^2/month		**DD-4** grams/m^2/month	
	Insoluble Solids	Ash	Insoluble Solids	Ash
current reporting period average	2.76	1.89	3.24	1.88
Criteria	4	-	4	-

It can be seen that all monitoring sites have similar values recorded for insoluble solids, which indicates that regional conditions are the biggest influence on measured dust levels rather than development operations at DLSP. These findings are to be expected considering that resource extraction via dredging is a wet process.

The DD-4 monitoring location was observed to be higher for insoluble solids, however possessed a similar ash fraction to the other sites. This is to be expected, as the DD-4 monitor is located in the immediate vicinity of constructed wetlands as part of the Stage 1 rehabilitation at Swamp Rd. Often DD-4 has more insects and vegetation within the dust sample, which is reflective of the surrounding land use rather than the DLSP operations.

It is important to note that DD-1 and DD-4 are not compliance monitoring points under the consent and the measured dust as insoluble solids is still below impact assessment criteria of 4g/m^2/month.

A state wide dust storm affected the region on 23 January 2020. This caused elevated readings for at all sites for the month of January 2020, which was not attributed to Dunmore operations. This dust storm is shown below in Figure 3.

Figure 3 January Regional Dust Storm

The rolling 12 month average for insoluble solids at each monitoring location was below 4g/m^2/month, as shown by the orange line in Figure 4 to 9. This demonstrates that operations were compliant during all stages of the reporting period despite the external influences of the January 2020 dust storms and the Currowan bushfires.

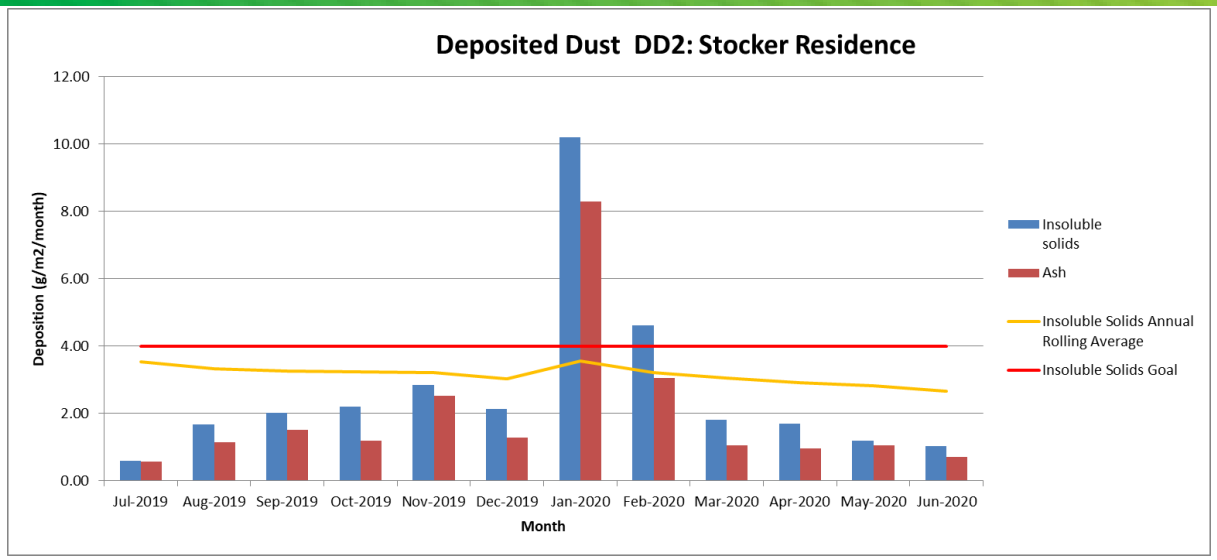

Figure 4 DD2 Deposited Dust Monitoring Summary

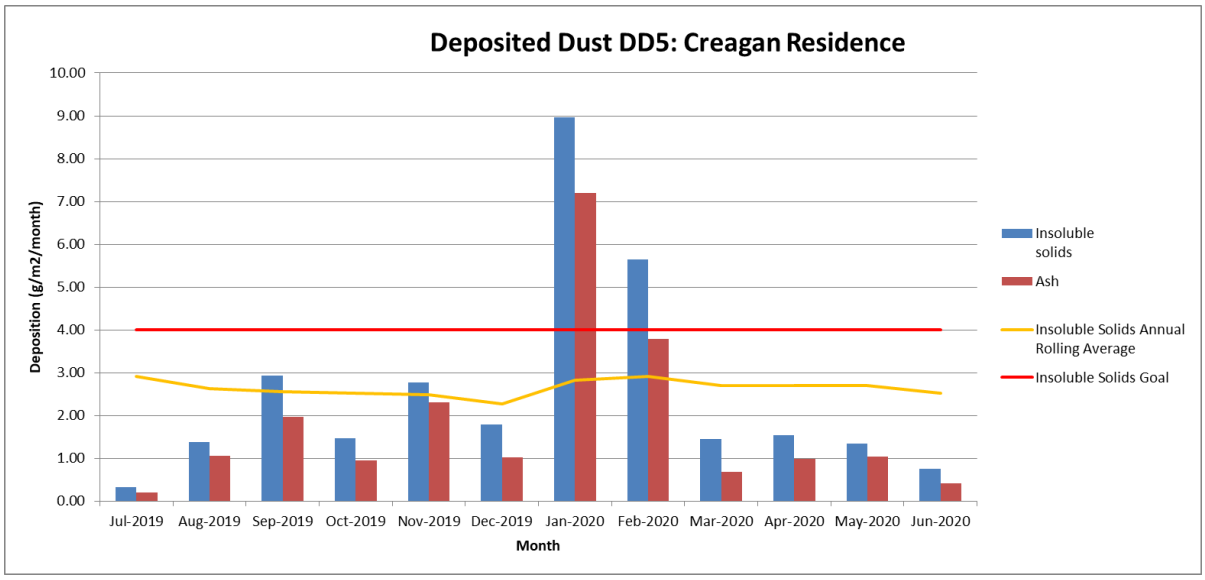

Figure 5 DD5 Deposited Dust Monitoring Summary

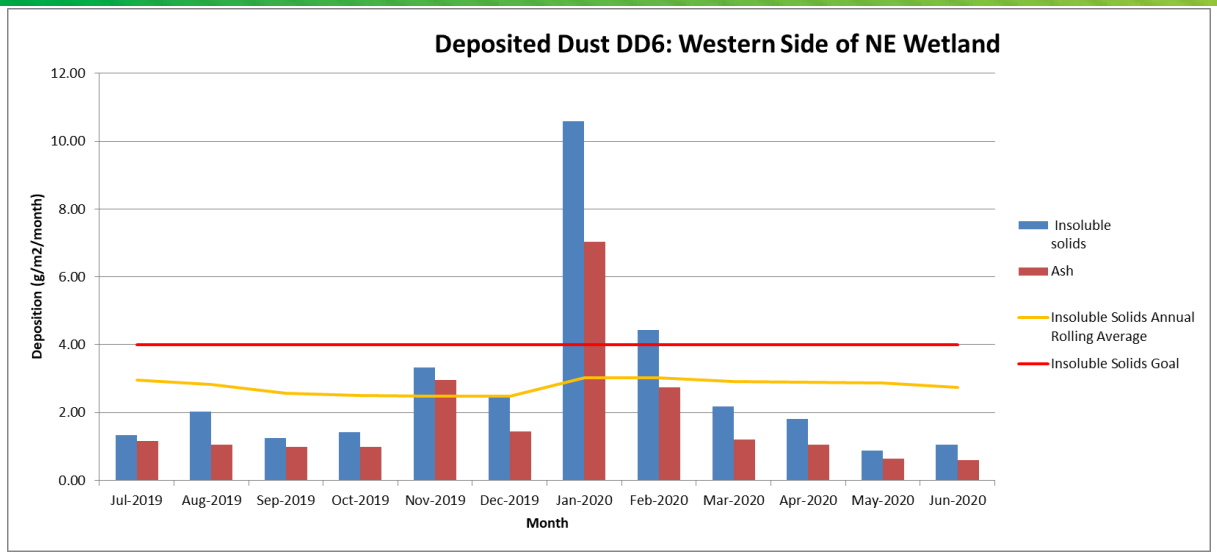

Figure 6 DD6 Deposited Dust Monitoring Summary

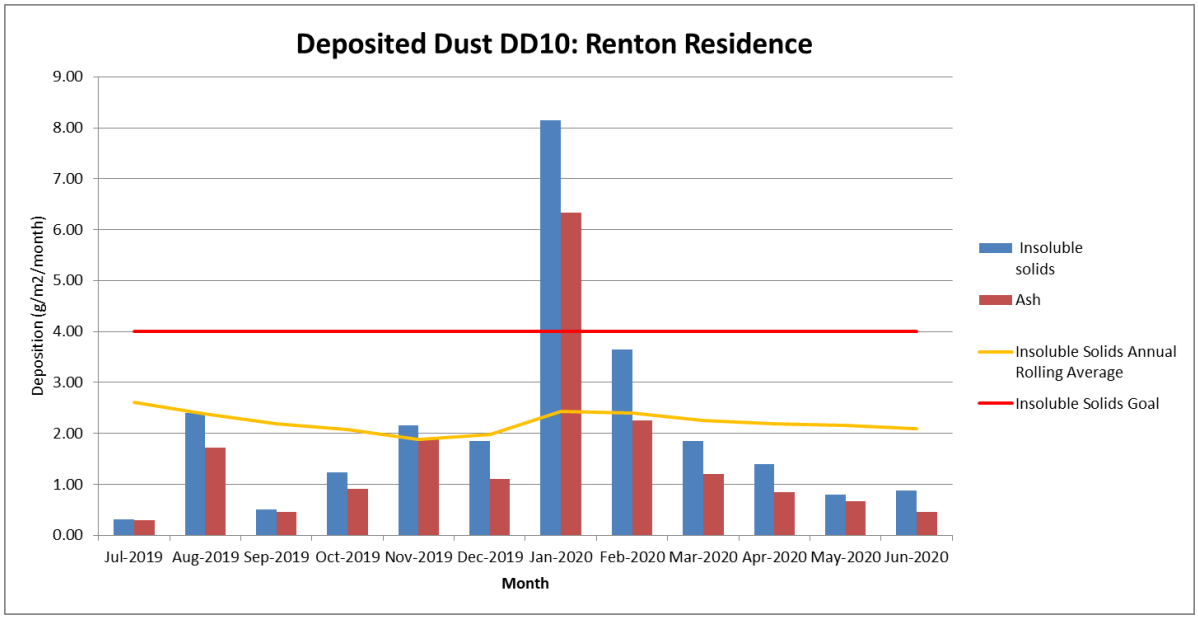

Figure 7 DD10 Deposited Dust Monitoring Summary

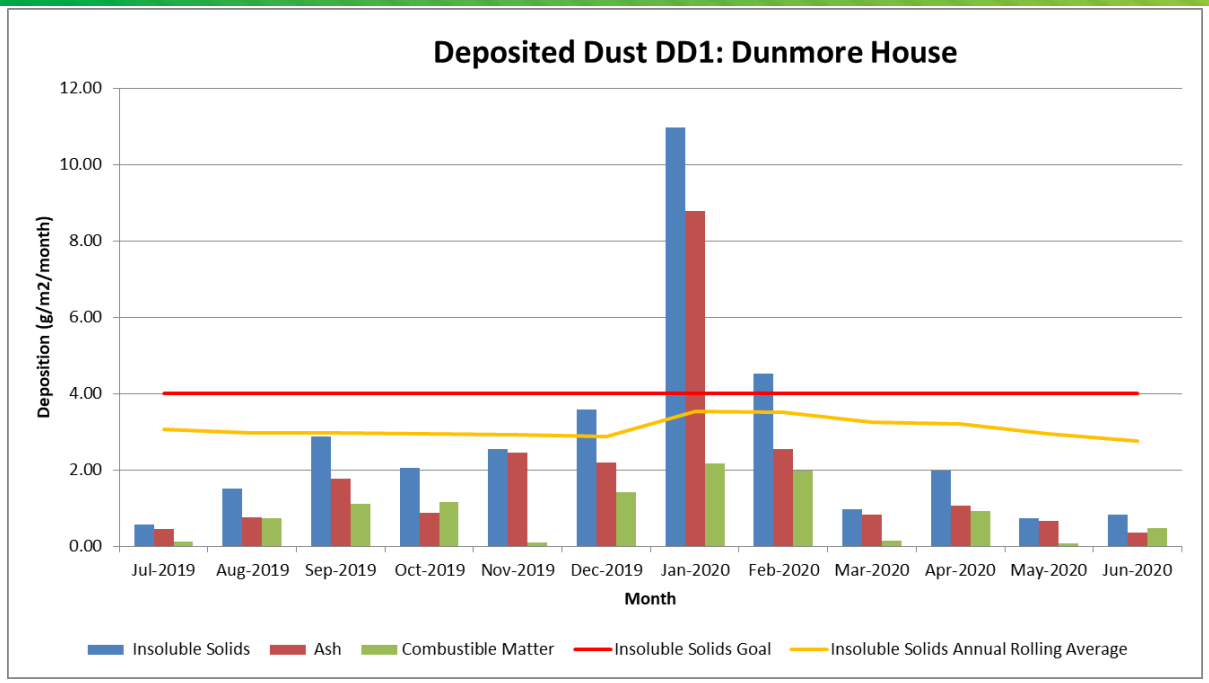

Figure 8 DD1 Deposited Dust Monitoring Summary

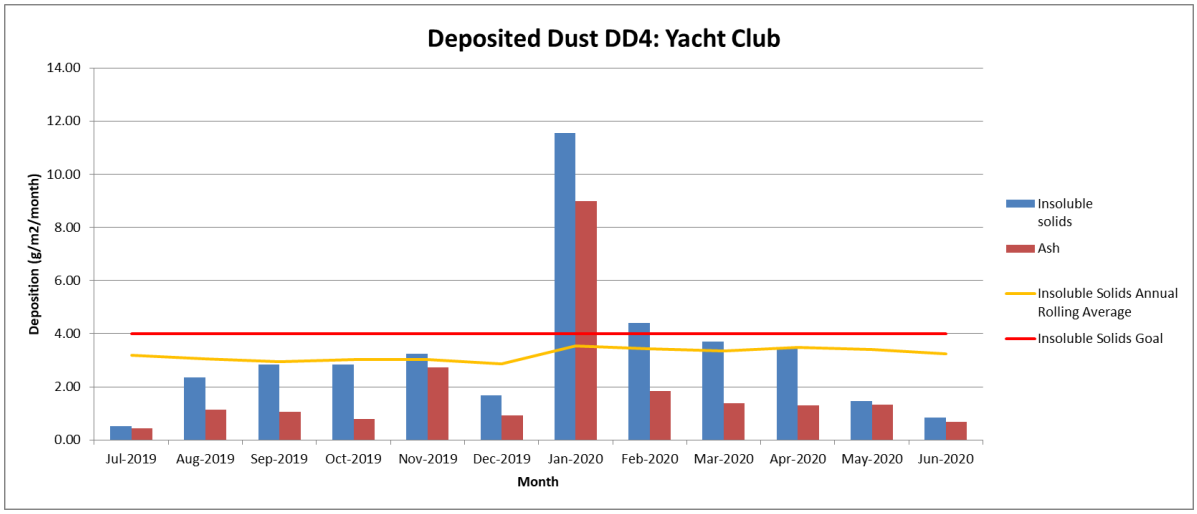

Figure 9 DD4 Deposited Dust Monitoring Summary

4.2.3. Particulate Monitoring Assessment Criteria

The impact assessment criteria for Particulate Monitoring as per Condition S3.C19 of the consent is shown below in Table 11.

Table 11 Particulate Monitoring Assessment Criteria

Pollutant	Averaging Period	Criterion
PM_{10}	Annual	[a,d] 30 µg/m³
PM_{10}	24 hour	[b]50 µg/m³
TSP	Annual	[a,d] 90 µg/m³

4.2.4. Particulate Monitoring Performance Review

Particulate Monitoring was affected by the Currowan bushfires, which burned large regions of the South Coast from 26 November 2019 to 9 February 2020. Throughout the fire's duration the region suffered periodic instances of reduced air quality, as reflected in the onsite monitoring data, which was not attributable to DLSP operations. The PM_{10} readings from the current reporting period can be seen in Figure 10 below.

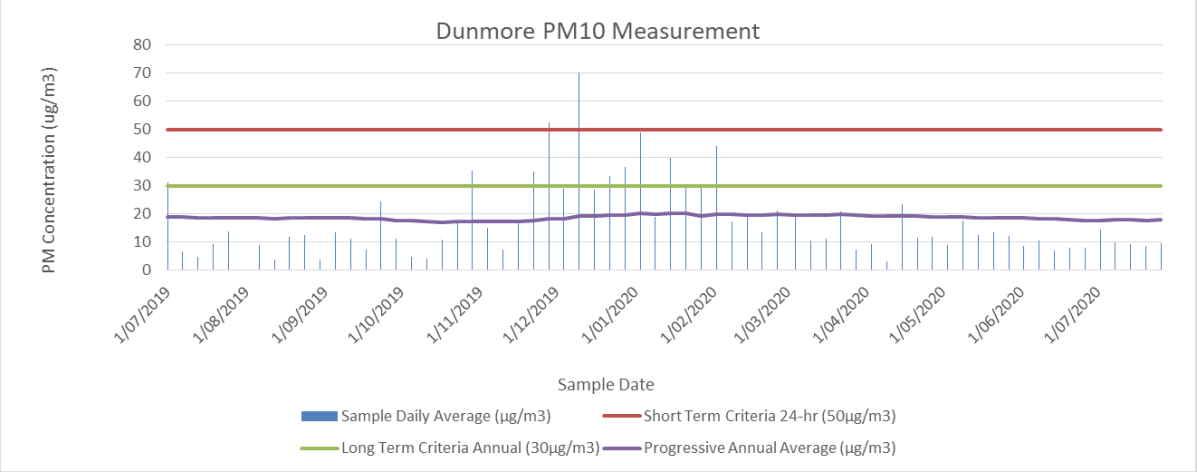

Figure 10 Dunmore PM10 Monitoring Summary

There was two instances of elevated of PM_{10} readings as measured by the onsite HVAS. These were observed on 28 November 2019 and 10 December 2019. During the time of the observed exceedances, the Currowan bushfire was burning in the south coast area and smoke haze was clearly visible throughout the Illawarra and South Coast region.

On 28 November 2019, the recorded PM_{10} at the DLSP HVAS (Monitoring Point 5) was 52.57 µg/m³. OEH Monitors located at Albion Park and Kembla Grange do not record hourly readings, however the Kembla Grange monitor was working for the full 24 hour period and recorded an average hourly reading of 67.8 µg/m³.

On 10 December 2019, an elevated reading of 70.23 µg/m³ was recorded at the DLSP HVAS (Monitoring Point 5). Air quality measured at the Albion Park monitor by OEH for the same date was 72.8 µg/m³. It was widely reported and visible that smoke haze had engulfed the region from bushfires in Sydney and the South Coast.

https://www.illawarramercury.com.au/story/6535064/thick-smoke-causes-hazardous-air-quality-levels-in-illawarra/

The elevated levels observed in the HVAS data for both of these events has been attributed to the large Currowan bushfire, which was burning in the region at the time and not associated with operations at DLSP operations. This fire caused the regional air quality to be above the thresholds described in the Dunmore quarry consent and licence. The department acknowledges that prescribed limits in DA 195-8-2004 (Dunmore Quarry) S4.C22 excludes extraordinary events such as local bushfires.

The annual average PM_{10} measurement for the reporting period from monitoring point 5 was below the impact assessment criteria of 50 µg/m³ for PM_{10} and 90 µg/m³ for TSP. The PM_{10} measurements were also similar to the Albion Park OEH monitor's annual averages. A summary of the particulate matter data for the current reporting period is shown below in Table 12.

TSP concentrations are not measured in the vicinity of the quarry, however annual average TSP concentrations can be derived based on typical ratios of PM_{10}:TSP. Rural areas (such as DLSP), typically experience a PM_{10}:TSP ratio of 0.4. This ratio has been applied to the annual average PM_{10} concentrations to derive a representative TSP background concentration in µg/m³. This methodology is in-line with the method used by Ramboll in the MOD 9 Environmental Assessment for the Dunmore Quarry.

Table 12 Summary of Particulate Matter Monitoring Data

Pollutant	Dunmore Quarry current reporting period average (µg/m³)	Albion Park current reporting period average(µg/m³)	Dunmore Quarry Long Term average (µg/m³)
Measured PM10	17.6	19.5	13.3
Derived TSP	44.0	-	-

4.2.5. Air Quality Monitoring Long Term Analysis and Trends

A graph of long term trends can be found in Figure 11 below and shows that typically deposited dust observed at the site has decreased over time.

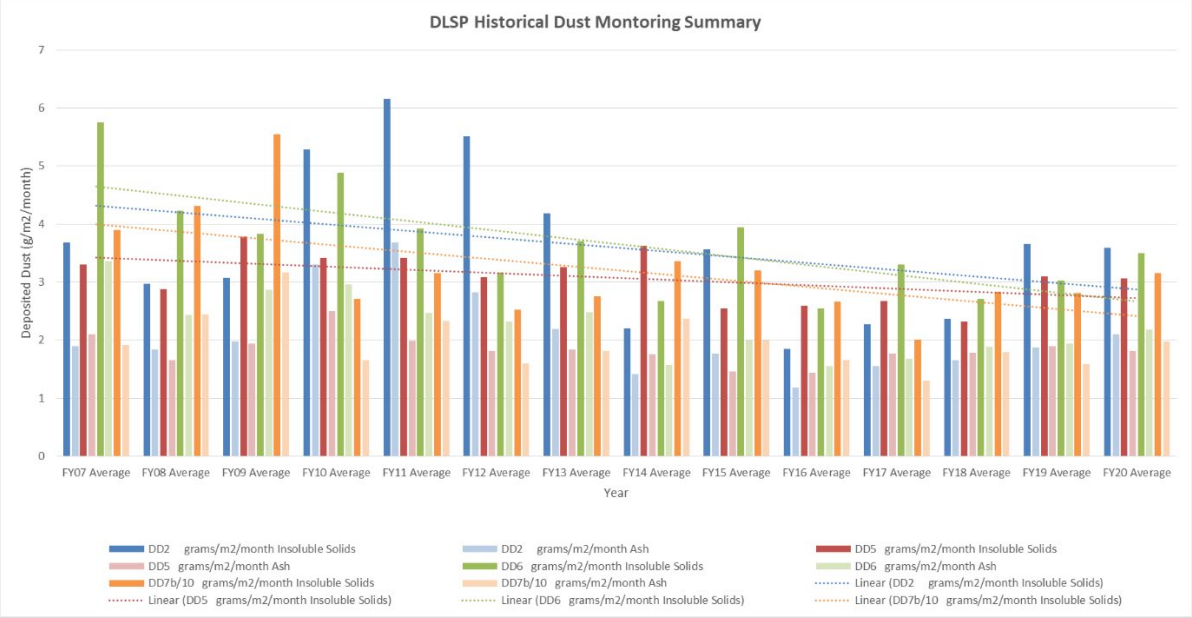

Figure 11 Historical Deposited Dust Trends

A general trend that has been observed, is that measured deposited dust is typically higher in dry summer months than winter months, which is to be expected. This trend is also confirmed with the PM_{10} measurements and is generally reflective of regional conditions as a whole. Figure 12 shows a 90 day average moving average in black, which clearly demonstrates a seasonal fluctuation of measured PM_{10} values.

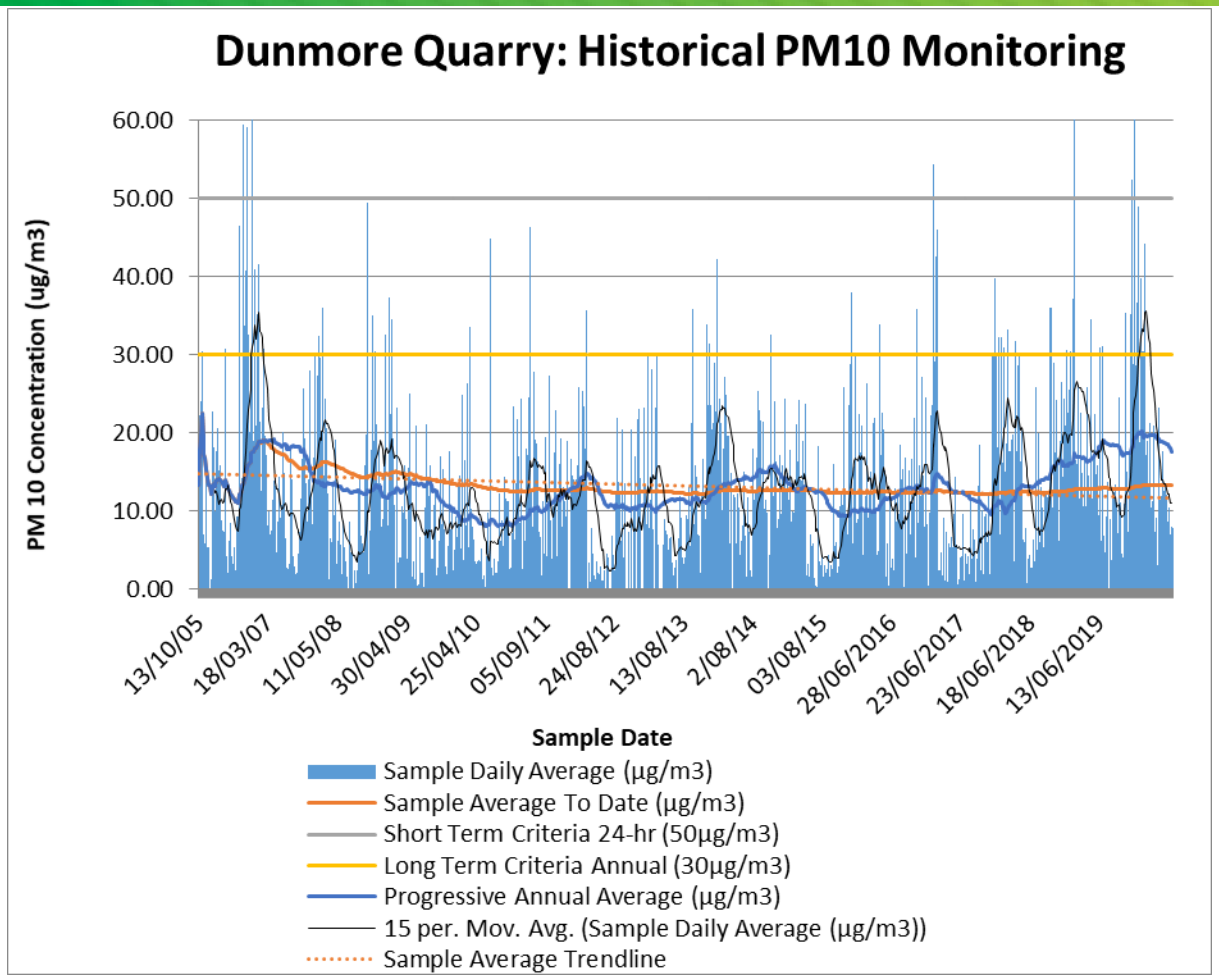

Figure 12 PM10 Historical Monitoring Trends

The seasonal fluctuations in PM_{10} measurements shows a clear trend that PM_{10} values are typically higher during summer dry periods and are lower during the winter periods. This fluctuation is mirrored in the OEH Albion Park PM_{10} measurements available on the OEH website. https://www.environment.nsw.gov.au/AQMS/search.htm. These trends indicate the measured PM_{10} and deposited dust values are typically influenced by ambient local conditions rather than development operations at DLSP.

4.2.6. Air Quality Monitoring Summary and Opportunities for Improvement

Deposited dust measurements were observed to occur within the impact assessment criteria for all compliance monitoring points. Derived TSP and PM_{10} measurements were observed to be below the impact assessment criteria for all time periods, excluding periods when the Currowan bushfire was causing poor air quality regionally. Analysis of long term monitoring trends typically suggest that local ambient regional conditions have a greater impact on air quality results than DLSP operations.

Resource extraction at DLSP occurs as a wet operation via dredging with an associated low risk of mobilising dust or particulate matter. Dust mitigation methods and controls on site have been effective at minimising any generated dust or particulate matter.

Current dust mitigation measures and monitoring will continue during the next reporting period.

4.3. Noise Monitoring

Annual Noise Monitoring is undertaken in winter each year to determine the contribution by DLSP to noise impacts experienced at nearby private residence. The annual noise monitoring undertaken during the current reporting period indicated compliance with the relevant noise limits.

4.3.1. Noise Monitoring Impact Assessment Criteria

Associate noise limits extracted from L3.1 in EPL1147 and S3.C13 from DA 195-8-2004 are reproduced below in Table 13

Table 13 Noise Monitoring Impact Assessment Criteria

Receiver Location	Noise Limits dB (A)			
	LAeq (15 minute)			
	Shoulder	Day	Evening	Night
DN-6 Renton	46	46	43	37
DN-7 Dunmore Village	47	49	44	41
DN-8 Stocker	47	49	44	38

4.3.2. Noise Monitoring Performance Review

Annual Noise Monitoring data indicated compliance with the noise limits described in Section 6.2 during all times. Table 14 details the findings of the noise monitoring report. The annual noise compliance report is included in Appendix C.

Table 14 Annual Compliance Noise Monitoring Report

Location No.	Period	DLSP Contribution dB, LAeq(15min)	Criteria dB, LAeq(15min)	Compliant
DN-6	Day	<45	46	✓
DN-7	Day	<49	49	✓
DN-8	Day	<45	49	✓
DN-6	Evening	<42	43	✓
DN-7	Evening	<44	44	✓
DN-8	Evening	<40	44	✓
DN-6	Night	<34	37	✓
DN-7	Night	<39	41	✓
DN-8	Night	<30	38	✓
DN-6	Morning Shoulder	<46	46	✓
DN-7	Morning Shoulder	<47	47	✓
DN-8	Morning Shoulder	<47	47	✓

Note: Day - the period from 7am to 6pm Monday to Saturday or 8am to 6pm on Sundays and public holidays; Evening - the period from 6pm to 10pm; Night - the remaining periods and the morning shoulder period is from 6am to 7am.

4.3.3. Noise Monitoring Long Term Analysis and Assessment

Attended noise readings have typically remained stable or decreased slightly in the last 10 years as seen in Figure 13 below. Noise monitoring results were generally higher in the current reporting period, despite to the lower production volumes and operations compared to the previous reporting period. It is important to note that noise monitoring was still within the compliance limits prescribed.

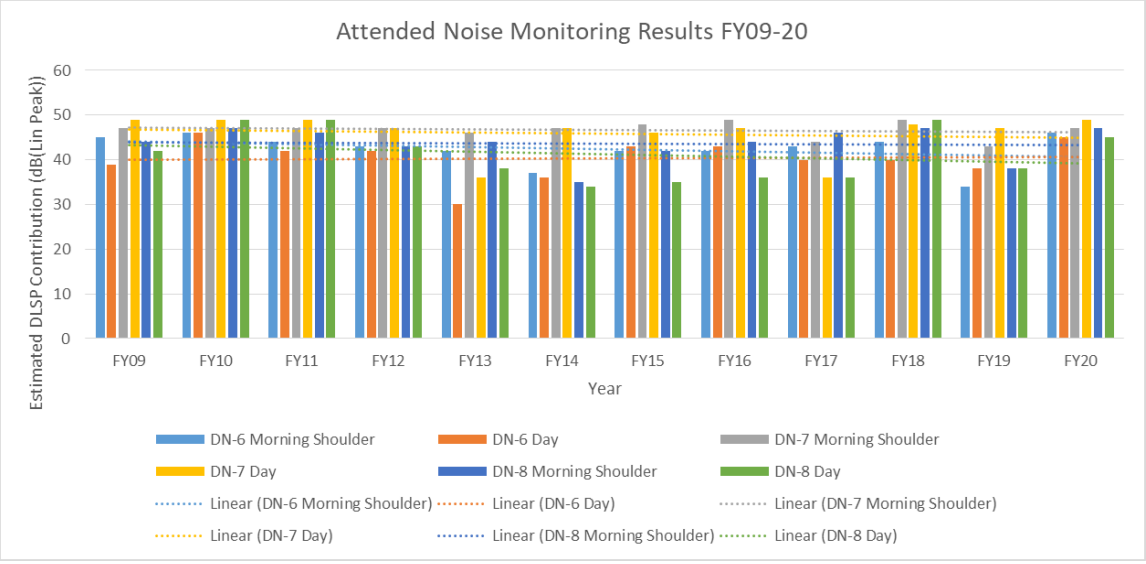

Figure 13 Noise Monitoring Historical Noise Monitoring Trends

4.3.4. Noise Monitoring Summary and Opportunities for Improvement

The noise monitoring results were within compliance limits during the current reporting period.

The weather station has now been upgraded on the site, which allows personnel to immediately access weather information. This will allow a more intuitive reaction to adverse meteorological conditions, which may affect noise impacts on nearby sensitive receptors, such as temperature inversions.

4.4. Surface Water Monitoring

Discharge water quality monitoring indicated compliance during all periods with the impact criteria at the licenced discharge point of the site at DW20b (EPL9). Monthly monitoring results for the dredge ponds were observed to align with predicted EIS results.

The WQO for most parameters within the dredge ponds were met within the reporting period. Typically, water quality within the operational ponds and discharge points was of higher quality than that sobered at the upstream locations with the exception of salinity and associated parameters.

Monitoring Point Locations are shown in Figure 32 in Appendix D. Monitoring is generally taken monthly. Two special frequency water monitoring are also required as part of EPL 1147

- Within 24 hours from receiving more than 20 mm in any 24 hour period for background and discharge water quality monitoring points (to confirm rainfall does not impact discharge water quality).
- This frequency was changed on 17 December 2019 when EPL 11147 was varied, where special frequency 1 was modified to be required within 24 hours of 50mm of rainfall within any 48 hour period. As a result the water management plan has been updated and submitted to DPIE Water for consultation.

Monitoring is also undertaken in the Stage 2 dredge pond during the placement of Potential Acid Sulphide Soils (PASS) for rehabilitation. The required frequency described in condition E1-E11 in EPL 11147 is daily for a period of 30 days for surface waters. Monitoring then reverts back to weekly frequency until PASS is received again. To date, PASS has only been placed in the Stage 2 pond so only this monitoring location has been activated for this frequency.

The location of the water monitoring points are shown below in Figure 14. Please note that monitoring locations denoted by “*” will have a variable location due to dredging operations

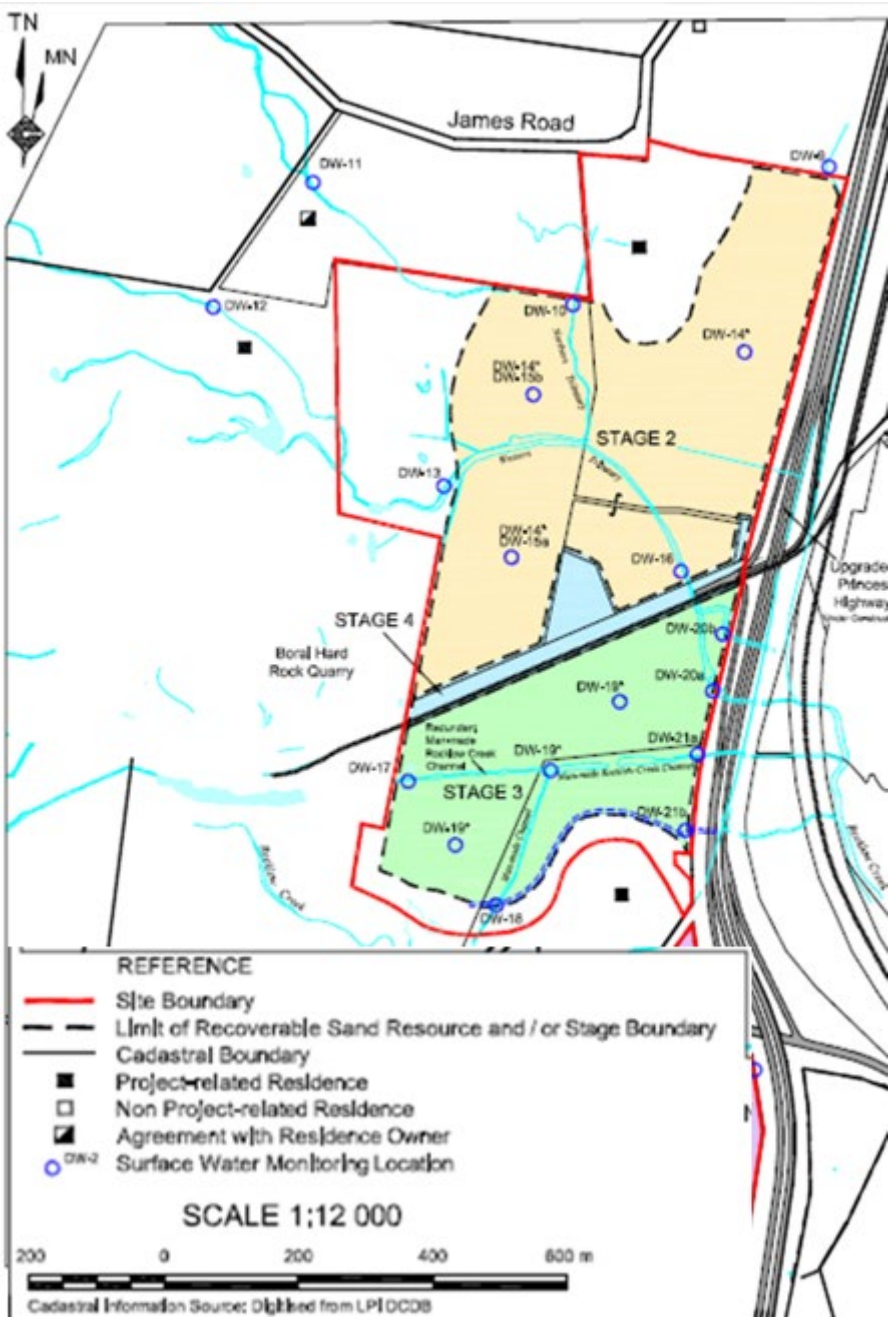

Figure 14 Surface Water Monitoring Locations

4.4.1. Surface Water Quality Impact Criteria

There are 5 compliance monitoring points listed in EPL 1147 which are reproduced below:

- DW 11 (EPL12) – Upstream of Western Tributary in Stage 2
- DW 12 (EPL11) – Upstream of Western Tributary in Stage 2
- DW 18 (EPL13) – Upstream of Rocklow Creek in Stage 3
- DW 20b (EPL9) – Licenced discharge point of DLSP via the re-aligned Western Tributary

- DW 21b (EPL13) – Secondary licenced discharge point to be activated after re-aligning Rocklow Creek. This site has not been activated as Rocklow Creek has not been re-aligned. Extraction is not expected to occur in the southern section of Stage 3 due to the landowners requests.

Discharge water quality criteria for DW20b is detailed in S3.C23 of DA-195-8-2004 and is replicated below in Table 15.

Table 15 Water Discharge Impact Assessment Criteria

Pollutant	Unit of measure	Total Suspended Solids (mg/L)
Total Suspended Solids	mg/L	50
pH	pH	+/- 1.0 of background (6.6-8.6)

There are two compliance operational monitoring points at DLSP for water quality. These are the dredge ponds in Stage 2 (DW-14) and Stage 3 (DW-19). The Water Quality Objectives (WQO) associated with the dredge ponds is detailed below in Table 16.

Table 16 Dunmore Lakes Sand Project Water Quality Objectives

Pollutant	Unit of Measure	Water Quality Objective
Turbidity	NTU	5-20
pH	pH	6.5 – 8.5
Salinity	µS/cm	<1,500
Dissolved oxygen	mg/L	>6
Total phosphorus	µg/L	5-50
Total nitrogen	µg/L	100-500
Chorophyll-a	µg/L	2-10
Faecal coliforms	Median No./100mL	<1000
Enterococci	Median No./100mL	<230
Algae and blue-green algae	No.cells/mL	<15,000
Sodium	mg/L	400
Potassium ion	mg/L	50
Magnesium ion	mg/L	50
Chloride ion	mg/L	300
Sulphate ion	mg/L	250
Bicarbonate ion	mg/L	750
Soluble Iron ion	mg/L	6
Ammonium ion	mg/L	20

Notes:
- *The objectives for dissolved oxygen, turbidity and algae are relevant to surface water only;*
- *The Department acknowledges that short term exceedances of these objectives may occur during natural events such as heavy rainfall or tidal saline water inflow.*

It is important to note that the department acknowledges that short term exceedances of these objective may occur during natural events such as heavy rainfall or tidal saline water flow. This notation is important in consideration of the tidal inflow that occurs at the DLSP development, which subsequently impacts the water quality results for the site.

Additional monitoring points are collected as part of the approved Water Management Plan, to provide additional background water quality data for water entering the DLSP operational area and are summarised below:

- DW-9 Upstream of Stage 2 Eastern Tributary
- DW-10 Upstream of Stage 2 Northern Tributary
- DW-13 Upstream of Stage 2 Western Tributary
- DW 15a Fines Pond
- DW 16 Water transfer point between Stage 2 and Stage 3
- DW-21a Background monitoring for the man-made Rocklow Creek channel

4.4.2. Surface Water Monitoring Performance Review

A summary of the water quality monitoring points is shown below in Table 17. The dredge pond (DW-14 and DW-19) and discharge point (DW20b) are shown in grey. Monitoring sites in white are upstream monitoring locations and are monitored for background purposes only.

Table 17 Surface Monitoring Summary

Sample ID	pH	Turbidity (NTU)	TSS (mg/L)	EC (µS/cm)	Sulfate (mg/L)	Chloride (mg/L)	Iron (mg/L)	Potassium (mg/L)	Magnesium (mg/L)	Soduim (mg/L)	Total Phosphorus	Ammonia -N (mg/L)	Bicarbonate Alkalinit	Total Nitrogen (mg/L)	Dissolved Oxygen	Faecal Coliforms	Enterococci (CFU/10	Total Algae (cells/ml	Chlorophyll-a (mg/m3)*
DW9	7.0	15.8	23.3	429	12	68	2.08	2	9	28	0.136	0.17	83	0.59	8.08	13	13	2858	9
DW10	6.6	38.6	50.8	488	17	83	3.48	3	12	31	0.277	1.13	78	1.65	6.72	358	185	74526	124
DW11	7.4	14.4	18.7	801	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
DW12	6.3	18.7	16.0	314	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
DW13	7.0	37.4	14.0	706	47	128	0.59	4	9	181	0.140	/	155	1.04	7.75	/	/	375	2
DW14	8.2	9.4	7.6	1991	170	441	0.18	11	33	142	0.051	0.06	118	0.60	8.73	8	9	145248	3
DW15a	8.1	30.9	37.7	5973	403	1753	0.81	34	93	418	0.093	0.11	130	5.07	8.65	48	24	506520	12
DW16	8.0	16.7	11.0	2432	/	/	/	/	/	/	/	/	/	/	10.40	/	/	/	/
DW18	7.0	12.4	36.3	667	/	/	/	/	/	/	/	/	/	/	5.86	/	/	/	/
DW19	8.1	8.3	10.6	5252	336	1530	9.09	32	96	464	0.047	0.18	131	4.11	8.77	7	6	729733	5
DW20b	7.9	6.5	9.8	3441	/	/	/	/	/	/	/	/	/	/	9.16	/	/	/	/
DW21a	7.6	6.8	15.8	19238	/	/	/	/	/	/	/	/	/	/	10.60	/	/	/	/

Upstream drainage channels (DW-9, DW- 10, DW-11, DW-12, and DW-13) are ephemeral and are generally impacted by upstream agriculture land uses with cattle grazing often observed in the immediate vicinity of monitoring locations. These streams flow directly into the Stage 2 dredge pond and subsequently impact the ponds water quality.

Upstream monitoring points are located away from the tidal zone at Rocklow Creek and are typically fed by springs and run-off following rainfall events. Typically, water quality within operational ponds and discharge points are of higher quality than the upstream conditions.

Discharge monitoring undertaken during the reporting period was within limits prescribed in condition S3.C23 of the consent during all instances of sampling. A breakdown of discharge water quality monitoring results at DW20b is summarised below in Table 18.

Table 18 Discharge Surface Water Monitoring Results

Sample Type	Date Sampled		pH	TSS (mg/L)

Jul Monthly	2/08/2019	0	8.1	10
Aug Monthly	22/08/2019	0	7.8	8
August 20mm	30/08/2019	33.5	8.3	5
Sept Monthly+20mm	18/09/2019	25.5	8.1	9
Sept 20mm	19/09/2019	19	8.1	8
Oct 20mm	12/10/2019	25	8.2	8
Oct Monthly	24/10/2019	0	7.9	4
Nov Monthly	21/11/2019	1	7.7	9
Dec Monthly	Site dry no sample taken			
Jan Monthly	Site dry no sample taken			
Feb 50mm	11/02/2020	174	7.7	16
Feb Monthly	25/02/2020	0	7.7	22
Mar Monthly	26/03/2020	3	7.6	4
Apr Monthly	30/04/2020	9	7.5	12
May Monthly	22/05/2020	13	7.9	14
Jun Monthly	26/06/2020	0	8.0	8
current reporting period Average	/	/	7.9	9.8

During the reporting period, PASS was placed in the Stage 2 pond (placement commenced 26 June 2018) and the Fines Pond 2 (DW15a) (placement commenced 13 February 2020).

PASS material is typically received in “campaigns” and there were three periods where PASS importation had ceased for 30 days and monitoring reverted back to the weekly sampling regime.

A summary of the water quality monitoring after placement of PASS in the Stage 2 dredge pond is shown below in Figure 15 and 17.

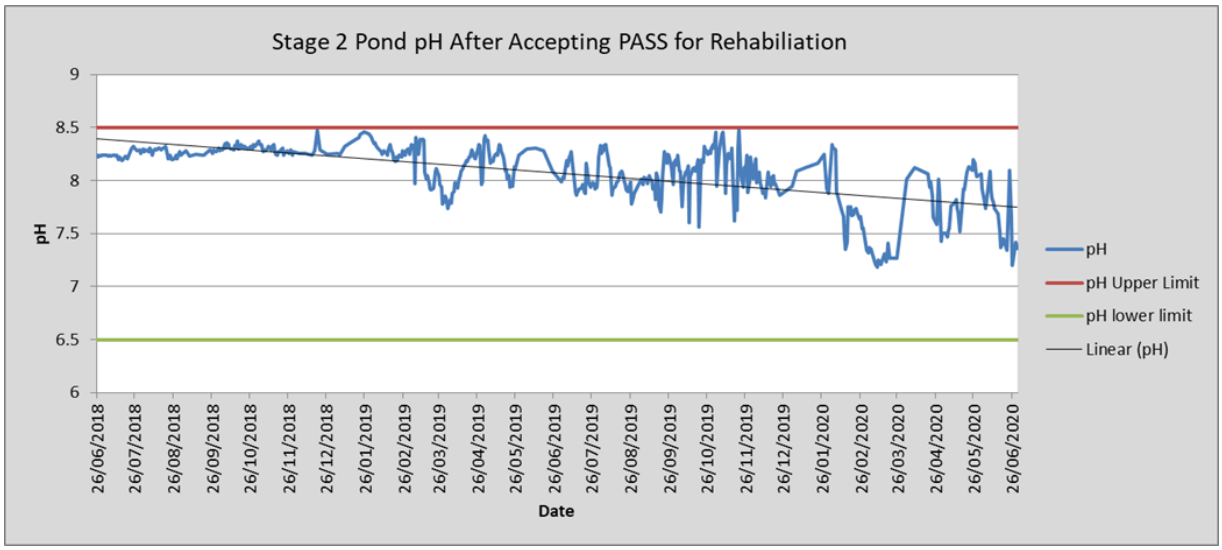

Figure 15 Stage 2 Pond pH After Accepting PASS

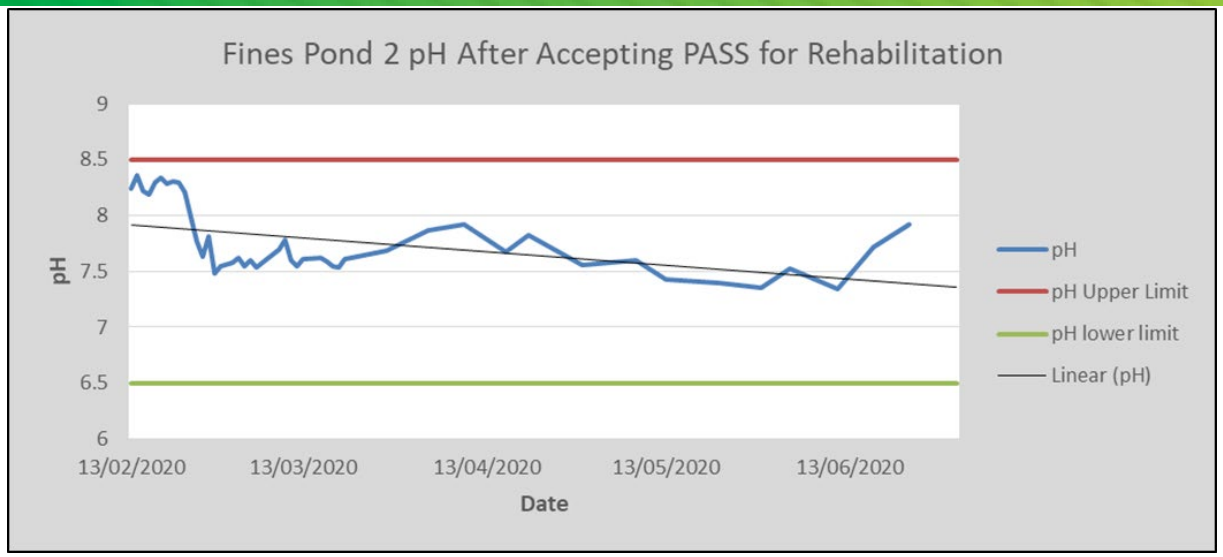

Figure 16 Fines Pond 2 After Accepting PASS for Rehabilitation

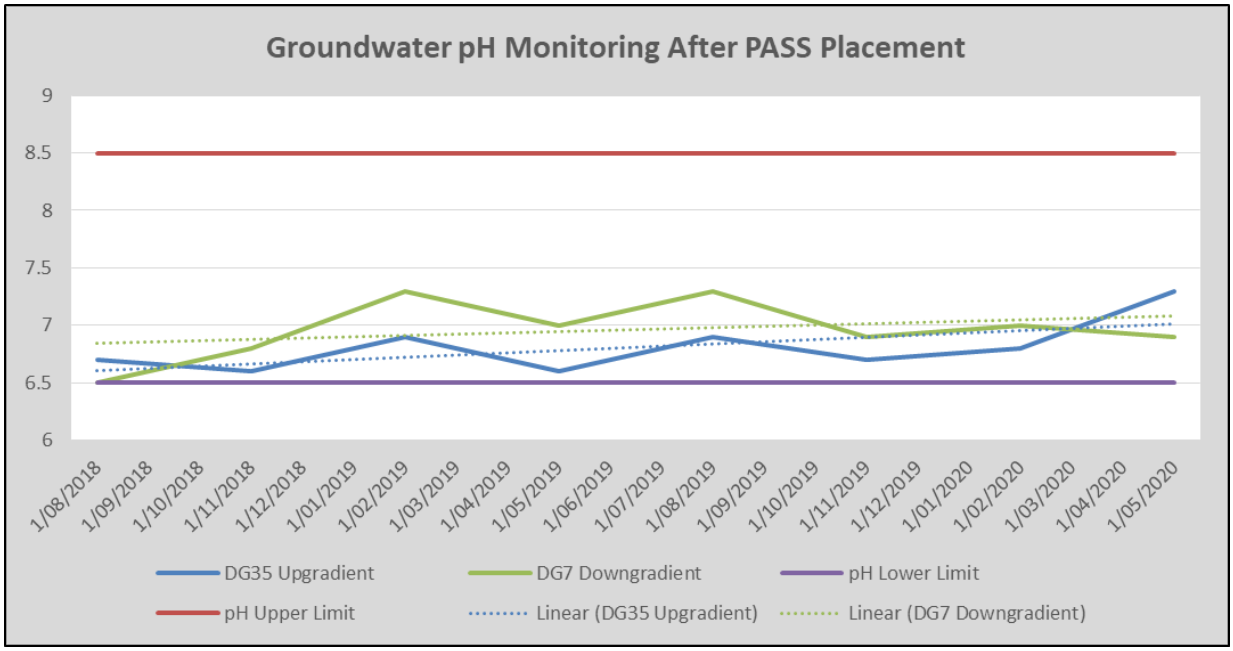

Figure 17 Groundwater pH After Accepting PASS for Rehabilitation

One instance of flooding occurred in February 2020, which led to an overflow of the Stage 3 dredge pond at culvert 2. During this flood event 220mm of rain fell from 7 February, 2020 to 10 February, 2020, which led to regional flooding and site closure. Sampling was delayed until 11 February, 2020 as per M2.4 note in EPL 11147 due to safety and access concerns and the EPA were notified and satisfied with the arrangements. A further 20.6mm of rain fell from the 16 to 17 February, 2020, which led to further overflow at the Stage 3 pond before holding capacity could be re-instated.

Dredging and backfilling operation ceased during periods of overflow of the dredge pond in accordance with the EPL 11417 conditions. Due diligence monitoring was also undertaken and is summarised in Table 19 below:

Table 19 Due Diligence Flood Overflow Monitoring

Date	Sample	pH	TSS (mg/L)	Turbidity (NTU)
11/02/2020	C2 Overflow	7.8	26	30.1
11/02/2020	C2 Downstream	7.6	22	34.3
12/02/2020	C2 Overflow	7.74	6	15.7
12/02/2020	C2 Downstream	7.75	12	15.1
13/02/2020	C2 Overflow	7.5	14	11.9
13/02/2020	C2 Downstream	7.7	9	10.9
14/02/2020	C2 Overflow	7.6	6	8.9
14/02/2020	C2 Downstream	7.5	6	6.9
17/02/2020	C2 Overflow	8.2	10	5.6
17/02/2020	C2 Downstream	7.9	18	5.6
18/02/2020	C2 Overflow	8.4	11	4.4
18/02/2020	C2 Downstream	7.9	13	5.2

It can be seen that no adverse impacts were experience either at the discharge point or downstream of the site during the overflow events described above.

4.4.3. Surface Water Monitoring Long Term Assessment and Analysis

Graphs of Water Quality over time can be seen below in Figure 18 to Figure 21.

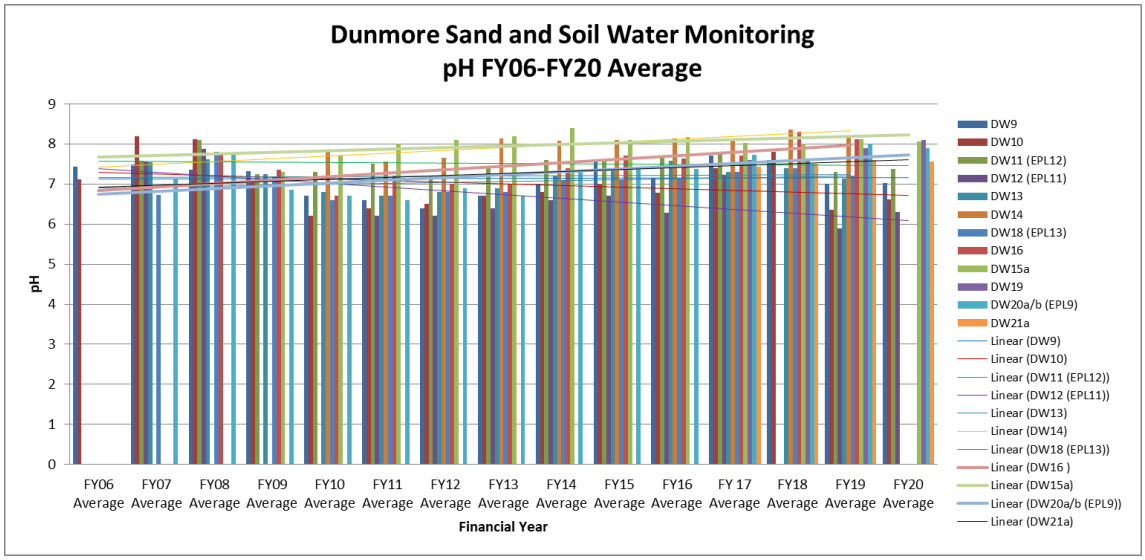

Figure 18 Surface Water pH Historical Monitoring Trends

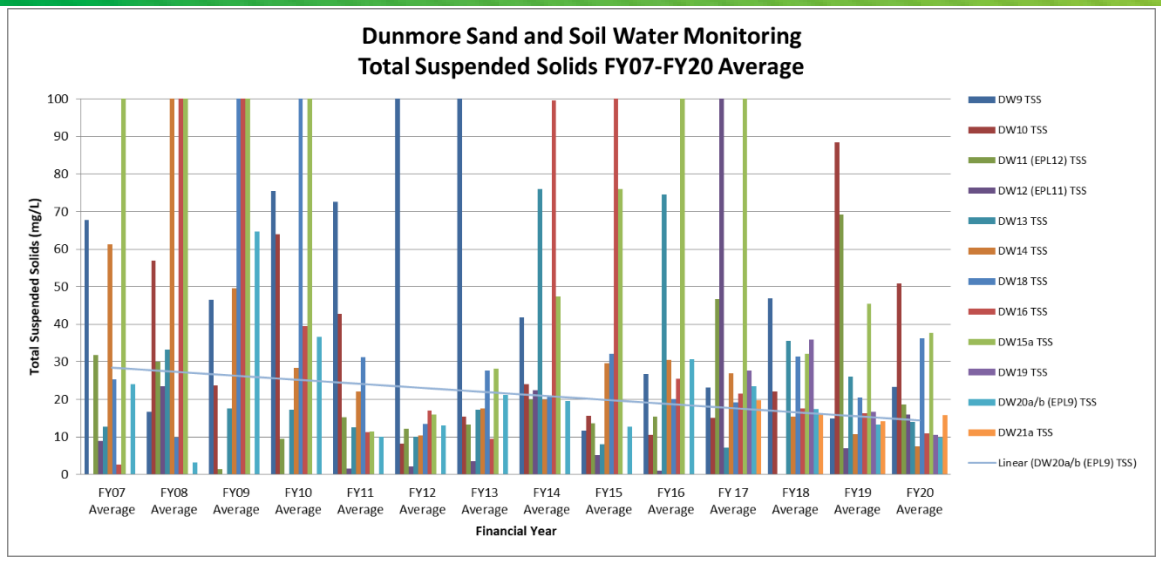

Figure 19 Surface Water TSS Historical Monitoring Trends

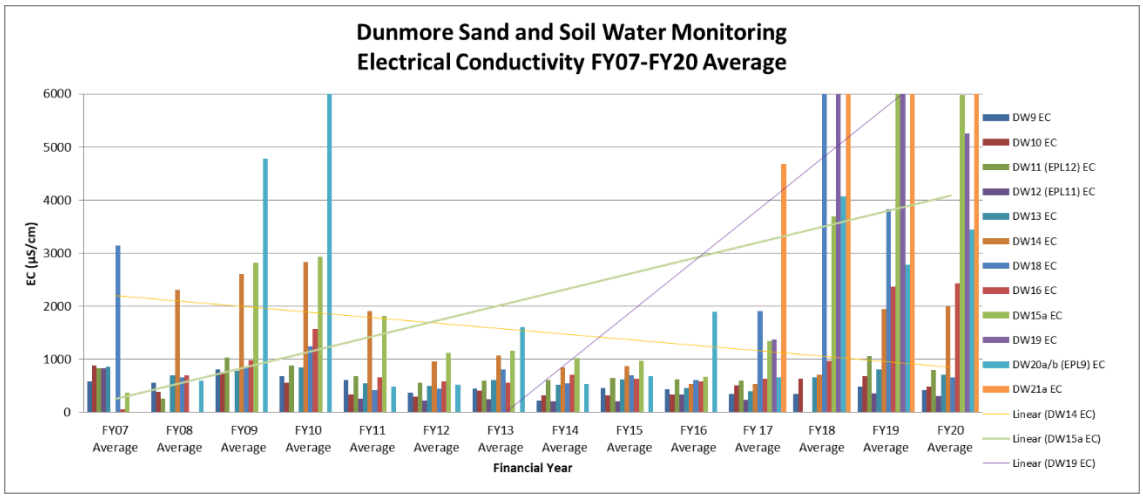

Figure 20 Surface Water Conductivity Historical Monitoring Trends

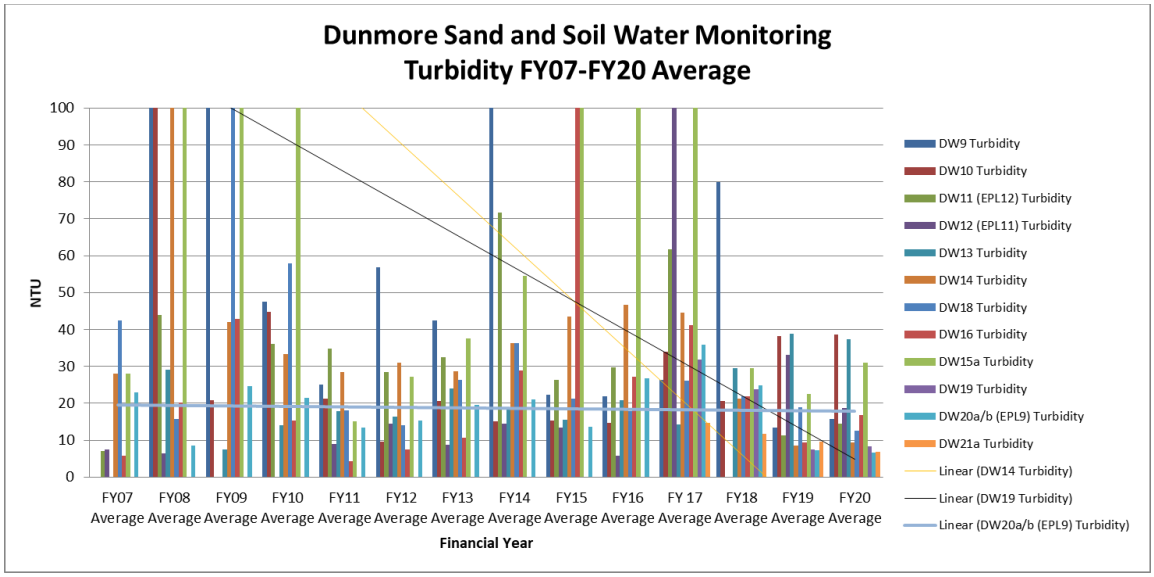

Figure 21 Surface Water Turbidity Monitoring Historical Trends

The following general trends can be observed from the above data:

- Typically upstream pH, DO and conductivity is lower when compared to the compliance monitoring locations, which aligns with observations that upstream drainage channels are ephemeral and generally only flow during periods of rainfall. These upstream sites are also impacted by upstream agriculture with cattle grazing.
- Upstream turbidity, TSS faecal coliforms and enterococci are higher at the upstream monitoring locations when compared to the compliance monitoring locations due to the impacts of cattle grazing and defecation. These inputs also contribute to increased nitrogen in the upstream water flows. The operational dredge ponds typically have lower turbidity than upstream conditions, whereby the dredge ponds act as large settling basins, which allow a reduction in turbidity and sediment load downstream of the ponds during periods of high rainfall.
- Typically the fines pond has a higher turbidity and TSS than the dredge pond, which is to be expected due to its function. The fines pond is kept offline and protected by a 3.7m AHD bund designed for protection in the event of a 1 in 100 year flood event.
- Salinity is generally higher in the southern sections of Stage 3, which is located in close proximity to the tidal zone at Rocklow Creek. This is a predicted outcome from the EIS based on the natural conditions of the site and is discussed below.
- Algae was consistently above WQO in the dredge ponds (DW-14 and DW-19) and upstream at DW-10. This would be attributed to the low flow conditions described above and the adjacent land uses that include farm and agricultural land and cattle grazing causing elevated nutrient levels such as Nitrogen.

Initial investigations from the original DLSP EIS commissioned by R.W Corkery described that the groundwater within the southern section of Stage 3 contains slightly brackish water (TDS >2,500), which corresponds to a salinity far greater than the 1,500µS/cm threshold described in the WQO detailed in condition S3.C24 of the consent. As the dredging progresses south in Stage 3 near Rocklow Creek, the infiltration of this tidal brackish water into the Stage 3 dredge pond will be unavoidable and is to be expected based on the natural conditions present in Stage 3.

The department acknowledges in condition S3.C24 of the consent, as per the note, that short term exceedance of the WQO may occur due to natural events such as tidal saline inflow, such as those identified in the south of Stage 3. Groundwater data collected in Stage 3 since 2003 describes the aquifer as having a rapid response to rainfall. This is explained in greater detail in the Groundwater Annual report in Appendix D.

4.4.4. Surface Water Monitoring Summary and Opportunity for Improvements

Monitoring will continue for all water quality parameters in the next reporting period. Backfilling will commence within the southern and eastern section of Stage 3 during the next 12 months. It is expected once backfilling and landform construction commences in the southern section of Stage 3, salinity caused by tidal saline flow will decrease in the stage 3 pond. In addition the higher rainfall already experienced in the next reporting period (at time of writing) has led to a decrease in salinity within the Stage 3 pond.

4.5. Water Balance

Water extracted from the DLSP ponds is measured and considered in relation to the applicable groundwater licence. Water is used for dust suppression and sand processing and is sourced from the fines pond and dredge pond under a groundwater Water Access Licence (WAL24477) issued under the Water Management Act 2000. The licence permits the groundwater take of 77ML of water from the Sydney Basin South Groundwater Source.

4.5.1. Surface Water Flows

- Surface water enters the site ponds from the Western Eastern and Northern Tributaries and flows out of the ponds back into the re-aligned Western Tributary.
- One instance of flooding occurred in February 2020 which led to an overflow of the Stage 3 dredge pond. Inflows are assumed to be the same as outflows during overflow events

The influence of surface water on the site water balance is therefore considered to be neutral.

4.5.2. Water Use for Dust Suppression

- Typically five tanker loads of water is used during dry days in summer
- The water cart on site holds 30,000 L
- The site was operational for 5 days a week
- There were 98 rain days during the current reporting period

The use of water due to dust suppression can be calculated as 27ML.

4.5.3. Water Use from Production

- Water is extracted with the sand during dredging operations, with additional water added to this during processing.
- Pumping rates and volumes of added water is shown in Table 20.
- The extracted water returns via overland flow to the fines return pond (i.e. flows back into the system) so is excluded from the water balance calculations and reported for information only.

Table 20 Dredge and Spray Pump Rates

Processing Steps	Pumping Rate (L/s)	Water Required (ML/8hr day)
Dredge pump (combined water and sand)	250	7.2
Pump to sand wash bin for dust washing	150	4.33
Pump for oversize screen sprayers	50	1.47
Total	N/A	12.96

This 12.96 ML is returned to the stage 3 pond via the fines return pond and is therefore excluded from the water balance calculation

- However, some residual water is exported from the site along with the sold sand product (approximately 8% of exported sand product by weight is water).
- Current reporting period production was 220,995 tonnes.
- Water loss from sand production is calculated as 20.62 ML.

Total water use is therefore calculated as water use for dust suppression (27ML) plus water loss from sand production (20.62ML).

This volume is 47.62ML which is within the volumes of groundwater take of WAL24477 of 77ML/year.

4.6. Flood Storage Capacity

The site is located at the confluence of three tributaries of the Minnamurra River and, given the close proximity of groundwater to the surface, has a potential for flooding. Water backing up along Rocklow Creek from the Minnamurra River is also a major contributor to on-site flooding.

The EIS noted that the RTA designed and constructed the North Kiama by-pass to "match the openings of the downstream railway embankment which was designed and constructed following a flood study completed by Webb McKeown (1989) – predicting a 100 year average recurrence interval (ARI) flood level of up to 3.3m on Rocklow Creek". The EMP went on to state that: "The culvert system would, therefore, not impact on local flooding regimes, which based on previous flood studies of Rocklow Creek, (including Webb McKeown 1989), are considered to approximate the following:

- 100 year Average Recurrence Interval (ARI): 3.6m AHD
- 20 year Average Recurrence Interval (ARI): 3.3m AHD
- 10 year Average Recurrence Interval (ARI): 3.2m AHD.

To protect the site from floods, up to and including the 1 in 100 year event, the processing and stockpile area have been constructed above 3.6m AHD and site bunds are generally at 3.7 metres AHD. The majority of the access road off Tabbita Road is also above 3.6 metres AHD; however, the ramp abutting Tabbita Road was constructed below 3.6 metres AHD due to the presence of overhead powerlines and potential safety risks to heavy vehicles.

Extraction volumes exceeded backfilling volumes during the reporting period, so it has been assessed that the flood storage capacity of the site is greater than the previous reporting period as per condition S3.C27 of the consent.

4.7. Groundwater Monitoring

Environment Earth Sciences (EES) have been commissioned to undertake analysis of the groundwater aquifer at Dunmore Lakes since 2003. The full Groundwater Annual Report is located in Appendix D and relevant sections have been reproduced below.

4.7.1. Groundwater Monitoring Impact Assessment Criteria

EES have devised site specific trigger values, derived from monitoring the aquifer in Stage 2 and Stage 3 since 2003 and prior to the commencement of operations in Stage 2 and 3. These site specific trigger values have been adopted in the approved Water Management Plan and are reproduced below in Table 21.

Table 21 Groundwater Impact Assessment Criteria

Analyte	Units	Trigger Value		
		DA Criteria	Western bores [1]	Eastern bores [2]
pH	-	6.5-8.5	6.5-8.5	6.5-8.5
Electrical Conductivity (EC)	µS/cm	<1,500	1,500	33,000
Phosphorous (PO_4)[3]	µg/L	5-50 [3]	4.0	0.7
Total Nitrogen	µg/L	100-500	-	-
Sodium (Na)	mg/L	400	560	5,500
Potassium (K)	mg/L	50	50	170
Magnesium (Mg)	mg/L	50	90	420
Chloride (Cl)	mg/L	300	1,400	6,900
Sulfate (SO_4)	mg/L	250	300	1,170
Bicarbonate (HCO_3)	mg/L	750	400	420
Dissolved Iron (Fe)	mg/L	6	3.0	4.0
Ammonium (NH_4)	mg/L	20	1.0	3.0

Notes:
1. Western bores: BHA to BHF; DG17, DG21, DG31, DG36, DG59, DG60 are those located west of the Princes Highway
2. Eastern bores: DG1 to DG7 are those generally located east of the Princes Highway
3. Note value is for total phosphorous not phosphate (multiply by 3.06 when reported as phosphorus)

The location of the groundwater monitoring points and groundwater flow direction can be seen below in Figure 22

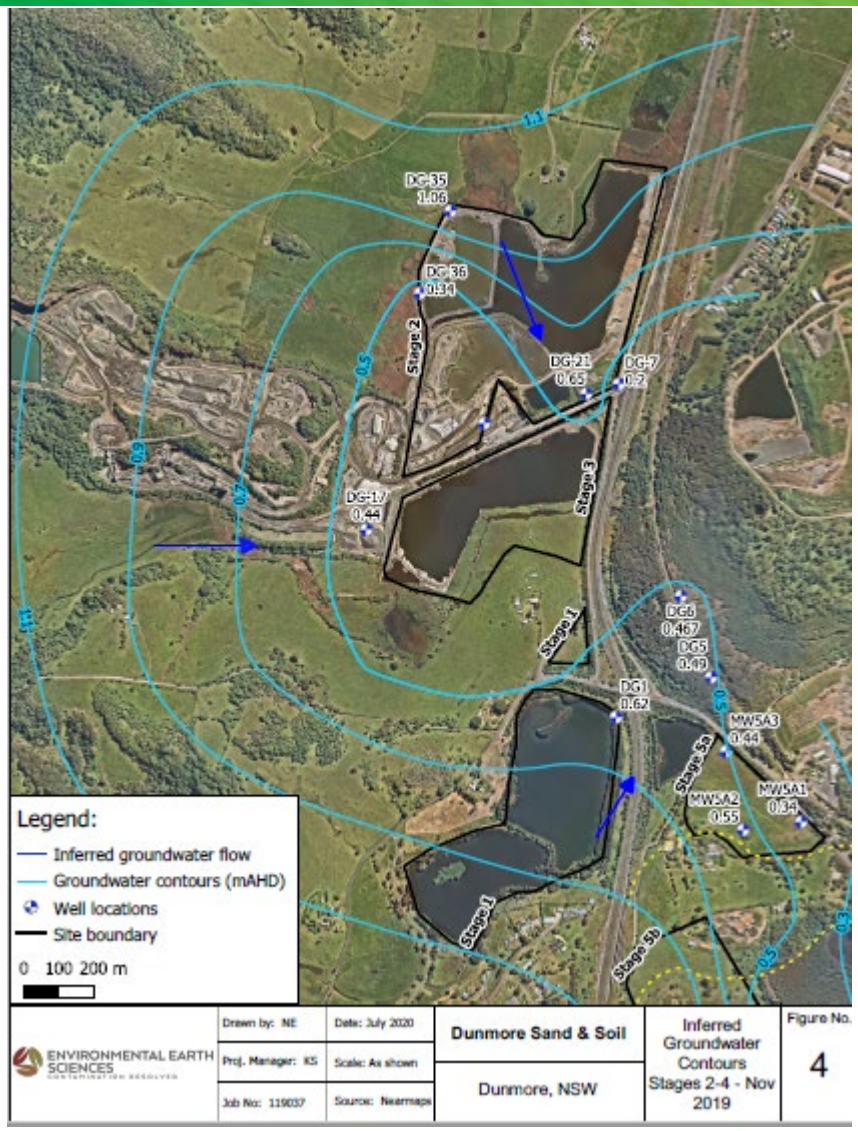

Figure 22 Groundwater Monitoring Locations and Derived Flow

4.7.2. Groundwater Monitoring Current Reporting Period Performance Review

A summary of the groundwater quality data for monitoring bores located west and east of the highway can be seen below in Table 22 and Table 23.

Table 22 Groundwater Monitoring Summary East of Highway

Analyte[1]	Units	Trigger Value		DG1*				DG17				DG21				DG31*				DG35				DG38			
		DA[2]	GMMP[3]	Aug-19	Nov-19	Feb-20	May-20	Aug-19	Nov-19	Feb-20	May-20	Aug-19	Nov-19	Feb-20	May-20	Aug-19	Nov-19	Feb-20	May-20	Aug-19	Nov-19	Feb-20	May-20	Aug-19	Nov-19	Feb-20	May-20
pH	-	6.5 – 8.5	6.5 – 8.6	7.5	7.2	7.2	7.5	7.3	7	7.2	7	6.5	6.4	6.6	6.2	7	6.6	7.1	7	6.9	6.7	6.8	7.3	7.2	6.8	7.1	7.8
EC	µS/cm	<1,500	1,600	-	-	603	591	-	-	2,720	2,870	-	-	2,120	1,824	-	-	1,246	6,380	-	-	1,023	1,077	-	-	1,454	1,259
TDS	mg/L	-	-	390	330	-	-	1,390	1,220	-	-	1,020	1,260	-	-	2,930	2,820	-	-	655	505	-	-	660	1,020	-	-
Total N	mg/L	100 – 500	-	2.6	1.5	3.81	0.64	1.4	0.33	1.65	0.12	1.9	0.9	0.27	0.12	0.6	0.46	0.77	4.45	3.5	1.3	1.24	0.94	0.1	0.3	0.34	0.12
Na	mg/L	400	680	44	42	50.77	13.05	310	295	683.1	149.7	260	290	342	102.4	705	686	129.5	283.6	95	74	65.62	38.94	120	215	123.4	40
K	mg/L	50	60	3.3	2.2	4.16	5.292	30	22	116.8	30.68	10	26	10.14	3.77	29	23	11.45	21.44	9.5	7.9	9.83	6.781	15	15	19.44	10.78
Mg	mg/L	50	80	15	14	12.28	16.52	92	65	81.82	112.4	44	50	42.29	37.3	93	76	19.2	104.4	36	35	29.18	43.75	38	44	35.99	40.14
Cl	mg/L	300	1,400	37	39	37.16	40	330	340	456.7	486	450	555	483.2	482	1230	1260	218.1	1667	58	58	63.26	70	110	175	159.8	127
Ca	mg/L	-	-	67	62	53.04	96.67	86	81	143.7	72.78	52	64	117.4	64.27	215	190	44.57	224.2	73	55	49.92	105.5	66	73	57.24	81.27
F	mg/L	-	-	0.19	0.16	<0.5	<0.5	0.51	0.45	0.6	0.7	0.15	0.13	<0.5	<0.5	<0.1	<0.1	<0.5	<0.5	0.15	0.15	<0.5	<0.5	0.33	0.29	<0.5	<0.5
Fe	mg/L	6	3	0.29	0.07	1.48	2.816	0.12	0.47	3.04	0.58	1.2	1.9	1.07	1.696	0.74	0.47	0.42	1.471	23	20	<0.01	2.425	0.47	0.47	<0.01	0.682
NO_3	mg/L			0.31	<0.1	1.16	0.52	0.22	<0.1	0.24	0.08	<0.1	<0.1	0.2	0.12	<0.1	<0.1	0.18	4.2	2.7	<0.1	0.2	0.08	0.18	<0.1	0.14	0.12
SO_4	mg/L	250	300	8	10	1.23	4.1	26	55	41.57	7.8	150	195	183.57	133	670	480	192.6	451	230	140	212.8	253	155	290	2247	149
PO_4[5]	mg/L	5 – 50	4	<0.1	0.12	-	-	1.7	0.34	-	-	0.12	0.1	-	-	<0.1	<0.1	-	-	<0.1	<0.1	-	-	0.13	<0.1	-	-
HCO_3[6]	mg/L	750	400	335	295	281	258	860	780	738	838	90	98	120	94	230	150	46	176	270	255	187	223	335	350	311	313
NH_4N[7]	mg/L	20	1	0.3	0.8	<0.01	<0.01	0.8	1.8	0.54	0.28	0.2	0.3	<0.01	<0.01	<0.1	<0.1	<0.01	0.05	0.2	1.3	1.18	0.82	<0.1	<0.1	0.03	<0.01

Notes:

1. EC = Electrical Conductivity; TDS = Total Dissolved Solids; PO4 = Phosphorous; Total N = Total Nitrogen; Na = Sodium; K = Potassium; Mg = Magnesium; Cl = Chloride; Ca = Calcium; F = Fluoride; SO4 = Sulfate; HCO3 = Bicarbonate; Fe = Dissolved Iron; NH3N = Ammonia
2. DA Criteria is not site specific and outlined under Development Consent 195-8-2004 (2004), issued on 29 June 2005 for The Dunmore Lakes Sand Project (Stages 2 – 4).
3. GMMP Criteria are site-specific criteria for groundwater quality and a sub-plan to the WMP (Arcadis, 2016).
4. Elevated concentrations to site-specific GMMP criteria are shaded and bold.

Table 23 Groundwater Monitoring Summary West of Highway

Analyte[1]	Units	Trigger Value		DG6-S				DG6-D				DG8-S				DG8-D				DG7			
		DA[2]	GMMP[3]	Aug-19	Nov-19	Feb-20	May-20	Aug-19	Nov-19	Feb-20	May-20	Aug-19	Nov-19	Feb-20	May-20	Aug-19	Nov-19	Feb-20	May-20	Aug-19	Nov-19	Feb-20	May-20
pH	-	6.5 – 8.5	6.5 – 8.5	7.5	7.1	7.7	7.6	7.5	7.2	7.7	7.5	6.8	6.6	7.1	6.6	7.2	6.8	6.9	6.9	7.3	6.9	7	6.9
EC	µS/cm	<1,500	33,000	1,331	1,190	1,611	1,548		9,564	16,490	18,130	1,792	283	25,300	19,490	2,315	2,193	18,950	25,400	177	140	271	514
TDS	mg/L	-	-	770	810	-	-	14,400	13,600	-	-	12,100	11,100	-	-	15,900	17,100	-	-	92	215	-	-
Total N	mg/L	100 – 500	-	1.9	1.1	0.72	0.61	5.5	5.6	2.58	2.01	2.2	2.5	20.52	0.66	2.4	2.7	0.47	18.3	1.3	0.7	0.99	0.32
Na	mg/L	400	6,600	130	145	127	48.97	4220	4020	21.18	1354	3580	3190	41.01	1572	4870	4930	8114	1849	19	55	15.31	14.27
K	mg/L	50	170	8.2	7.9	12.62	6.656	190	140	9.65	143.2	160	130	13.13	182.8	210	176	263.3	192.1	2.8	3.7	0.91	2.966
Mg	mg/L	50	420	18	18	20.66	19.13	686	620	123.1	297.7	480	450	80.85	351.3	686	670	688.3	438.2	4.1	8.2	10.15	14.73
Cl	mg/L	300	8,800	210	245	310.1	306	8020	7300	5920.6	7271	6440	6090	8381.6	9808	8710	9220	6810	9889	19	49	26.65	63
Ca	Ca-	-	-	125	140	86.25	122.6	340	315	97.86	260.1	235	220	74.78	224.4	330	400	95.39	350.6	10	9.1	22.14	62.94
F	mg/L	-	-	0.16	0.19	<0.5	<0.5	0.28	0.3	0.6	0.5	0.36	0.34	<0.5	0.5	0.26	0.23	0.5	<0.5	0.38	0.34	<0.5	<0.5
PO_4	mg/L	5 – 50	0.7	0.12	0.12	-	-	0.2	0.12	-	-	<0.1	<0.1	-	-	<0.1	<0.1	-	-	0.37	0.13	-	-
NO_3	mg/L	-	-	1.7	0.58	0.18	0.6	<0.1	<0.1	0.32	0.82	0.18	0.18	20.1	0.65	<0.1	<0.1	0.23	17.9	2.1	<0.1	0.23	0.19
SO_4	mg/L	250	1,170	96	100	75.32	89	1020	960	742.5	878	850	750	1338.8	959	1280	1420	908	1383	10	62	21.81	26
HCO_3[4]	mg/L	750	420	345	345	284	252	436	385	277	298	460	390	389	277	486	486	294	365	55	44	34	132
Fe	mg/L	6	4	0.2	0.14	0.09	1.693	0.11	0.1	3.04	5.849	1.9	0.52	0.59	4.069	0.06	12	1.66	1.382	0.31	0.24	1.12	2.171
NH_3N[7]	mg/L	20	3	<0.1	0.2	0.3	<0.01	4.8	5.3	1	1.99	0.8	1	1.2	0.03	0.7	1.4	0.34	0.96	<0.1	0.4	0.3	0.09

Notes:

1. EC = Electrical Conductivity; TDS = Total Dissolved Solids; PO4 = Phosphorous; Total N = Total Nitrogen; Na = Sodium; K = Potassium; Mg = Magnesium; Cl = Chloride; Ca = Calcium; F = Fluoride; SO4 = Sulfate; HCO3 = Bicarbonate; Fe = Dissolved iron; NH3N = Ammonia
2. DA Criteria is not site specific and outlined under Development Consent 195-8-2004 (2004), issued on 29 June 2005 for The Dunmore Lakes Sand Project (Stages 2 – 4).
3. GMMP Criteria are site-specific criteria for groundwater quality and a sub-plan to the WMP (Arcadis, 2016).
4. Elevated concentrations to site-specific criteria are shaded and bold.

4.7.3. Groundwater Long Term Assessment and Analysis

The data obtained from the data loggers installed in bores DG1, DG5, DG6, DG7, DG17, DG21, DG31, DG35, and DG36 indicate that over the current reporting period natural fluctuations in water levels were occurring in response to rainfall and tidal influences, as illustrated in Appendix A. This is consistent with previous findings dating back to 2003 (Environmental Earth Sciences 2009, 2010, 2011, 2012, 2013a, 2014, 2015, 2016a, 2017 and 2018a, 2019).

All data obtained from the monitored bores strongly indicated the following:

- Influences on groundwater levels are related to recharge from rainfall and minor tidal influx (this finding is supported by chemical monitoring of tidal seawater intrusion from Rocklow Creek);
- Reductions in groundwater levels are related to periods of low rainfall where the aquifer is slowly draining from Rocklow Creek and the south-east aquifer boundary; and
- Water-table fluctuations are therefore naturally occurring and cannot be seen to be impacted by dredging activities in the area, except in immediate proximity to the dredge pond.

4.7.4. Groundwater Summary and Opportunities for Improvement

Based on the data collected to date, it is recommended that DLSP operations:

- continue to monitor SWL in all bores with downloads and manual measurements at quarterly intervals;
- exceedances of K, Mg and Cl in the deep aquifer to the east of the highway, and Mg in bores DG17 and DG31 are considered natural occurrences, and the GMMP should be revised to reflect this occurrence;
- continue to monitor groundwater quality in all active bores at quarterly intervals.

4.8. Rehabilitation and Flora and Fauna Management Review

Rehabilitation has been ongoing since operations began and includes landform construction, planting out and maintenance of previous planting campaigns.

4.8.1. Rehabilitation Assessment Criteria

Condition S4.C42 of the consent outlines that the applicant must progressively rehabilitate the site to the satisfaction of the secretary in a manner generally consistent with the concept final landform in the EIS (Appendix 2 of DA 195-8-2004) and in accordance with the DA consent.

S3.C37 outlines that the site must establish and conserve:

- 6 hectares of Freshwater Wetlands on Coastal Floodplains (which may include areas of associated wetland pondage) and;
- 3 hectares of Swamp Oak Floodplain forest;

In consideration of the extent of rehabilitation and visual screening plantings on the site in a manner that integrates the compensatory habitat with existing similar habitats on or near the site, the final landform for DLSP exceeds this number.

4.8.2. Rehabilitation and Flora and Fauna Management Performance Review

Rehabilitation works are ongoing along the northern area of stage 2 with 6,300 native plants from the Swamp Oak Forest and Freshwater Wetlands in Coastal Floodplains community types planted along the north western edge of Stage 2 in 2017. A bird island was also constructed and planted out with the communities and species described above.

The banks of the realigned Western Tributary channel in Stage 3 commenced rehabilitation in 2017, with the laying of jute matting and approximately 2,600 tube stock of freshwater wetland species planted out.

In December 2019 a further 8500m^2 of Swamp Oak forest was planted on the NE section of Stage 2. These saplings are progressing well.

The tree screens planted in 2007 are progressing well with individuals now 13 years old.

Landform construction using VENM is ongoing along the southern and eastern section of Stage 2. This landform will form the foundations for a further section of Swamp Oak Forest to be planted. The location of rehabilitation areas can be seen below in Figure 23.

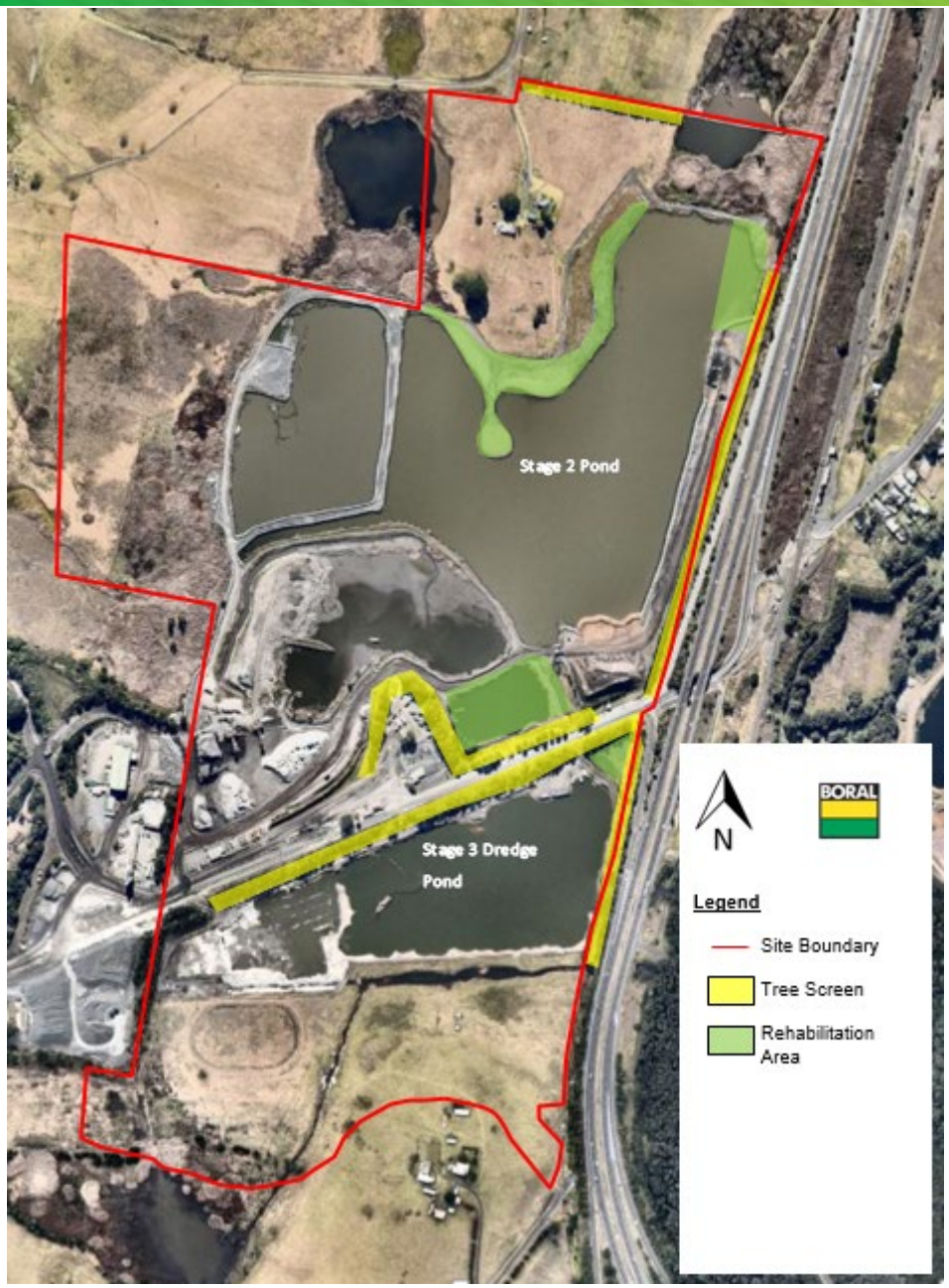

Figure 23 Rehabilitation Area Locations

Maintenance of these sections has been ongoing throughout the current reporting period by the bushland regeneration contractor Jamberoo Native Nursery, which works on site weekly.

4.8.3. Rehabilitation and Fauna and Flora Management Long Term Analysis and Assessment

Planted sections have progressed well with many specimens now over 3m tall. So far approximately 2.4 hectares of Swamp Oak Forest and Freshwater Wetland communities have been planted. Comparison photos over the last four reporting periods are shown in Appendix E.

4.8.4. Rehabilitation and Flora and Fauna Summary and Opportunities for Improvement

Maintenance of planted areas will continue during the next reporting period. Backfilling works and landform construction will continue in the next reporting period.

4.9. Waste Management

Operational waste associated with the project includes management of production fines generated by the processing plant and VENM received for backfilling of ponds and rehabilitation. Both of these materials will be used to progressively rehabilitate previously extracted areas to create wetlands and flood-free land for the final landform.

4.9.1. VENM Verification Acceptance and Disposal

In January 2018, the site began accepting Virgin Excavated Natural Material from external sources for the purposes of backfill to support site rehabilitation. VENM is classified as an 'inert' non-liquid waste under Schedule 1 Part 3 of the Protection of the Environment Operations Act 1997 and defines VENM as being:

"Virgin excavated natural material (e.g. clay, gravel, sand, soil and rock) that is not mixed with any other waste and that:

(a) has been excavated from areas that are not contaminated, as a result of industrial, commercial, mining or agricultural activities, with manufactured chemicals and that does not contain sulphidic ores or soils, or

(b) consists of excavated natural materials that meet such criteria as may be approved by the EPA."

Approximately 5 million tonnes of VENM will be required to create the final landform detailed in the Rehabilitation Management Plan. The vast majority of this material will be VENM within the meaning of part (a) above. A small portion of the backfilling materials for the project will consist of VENM within the meaning of part (b) above.

EPL 11147 contains specific conditions relating to VENM verification and acceptance including provisions to accept VENM (b) material that satisfies all the requirements for classification as VENM, except that it contains Potential Acid Sulfate Soil (PASS). After placement of the first load of PASS special frequency water monitoring of Stage 2 surface water and groundwater is triggered. The results of this monitoring is detailed in Section 4.4.2.

Volumes of external VENM received for the current reporting period are detailed below in Table 24

Table 24 VENM and PASS Backfilling Volumes

Month	VENM (a) received (t)	VENM (b) PASS received (t)
Jul 18	719.08	6,375.20
Aug 18	1,335.4	0
Sept 18	365.18	1,752.16
Oct 18	2,429.7	7,177.00
Nov 18	17,536	319.56
Dec 18	713.36	0

Jan 19	816.6	305.70
Feb 19	2,439.62	13,830.48
Mar 19	592.4	0
Apr 19	2235.7	1,906.20
May 19	5,105.74	563.34
Jun 19	8,429.44	2,299.26
Total	42,718.22	34,528.90

4.9.2. Waste Minimisation and Tracking

Boral is committed to ensuring its extraction and processing activities produce minimal waste material. Approximately 85-90% of the sand processed at Dunmore Sand and Soil becomes washed sand for internal and external sales.

The remaining 10-15% of by-product created during the washing process is considered as fines material or oversized material. The fines material is washed into the fines ponds which is used in the creation of the wetlands area, while the oversized product is used in site rehabilitation.

Boral is committed to non-production waste minimisation in accordance with the waste hierarchy, and minimising the amount of waste sent to landfill. To achieve this, all liquid and solid wastes are classified and sorted so they can be appropriately re-used or recycled. Table 25 outlines the total waste and waste types generated by DLSP over the reporting period. In the current reporting period, a considerable focus was placed on increasing recycling volumes. Please note that items like filter bins/oily rags and scrap metal are sent to the workshop at Dunmore Quarry and are included in the Dunmore Quarry Waste Tracking Register.

Table 25 Waste Tracking Register

	General Waste (t)	Cardboard (t)	Commingle Recycling (t)	Oil/Oily Waters (L)	Effluent (L)
Jul-19	0.272	0.045	0.045	0	0
Aug-19	0.182	0.05	0.03	0	183
Sep-19	0.101	0.12	0.03	0	0
Oct-19	0.213	0.09	0	0	0
Nov-19	0.195	0.059	0.01	0	0
Dec-19	0.1	0.02	0	3000	0
Jan-20	0.183	0.09	0.08	0	0
Feb-20	0.06	0	0.002	0	0
Mar-20	0.189	0.12	0.005	0	0
Apr-20	0.113	0	0	0	183
May-20	0.072	0.039	0.003	0	0
Jun-20	0.162	0.045	0.003	0	0
Total	1.842	0.678	0.208	3000	366

4.9.3. Waste Minimisation Long Term Trends and Analysis

The long term analysis of the waste tracking over the last 4 years is shown below in Table 26.

Table 26 Historical Waste Tracking Summary

Waste Classification		FY17	FY18	FY19	current reporting period
Solid Waste	General Waste Tonnes	4.731	4.466	2.605	1.842
	Cardboard Tonnes	0.636	0.948	0.274	0.678
	Comingle Tonnes	0.36	0.345	0.33	0.208
Liquid Waste	Oil/Oily Water Litres	0	1560	5080	3000
	Effluent Litres	3800	600	250	366
	Other Litres	0	0	0	0

General Waste volumes decreased during the current reporting period compared to the previous reporting period. A larger ratio of cardboard and comingle was recycled during the current reporting period due to the improvements in bin placement and staff training. Just under 40% of solid waste generated was recycled which is an improvement from the previous period (19% solid waste recycled)

Effluent is pumped out from the portable facilities on the dredge, which was slightly above the previous periods volumes. The office is serviced by an underground aerated waste water treatment system (AWTS) which does not require effluent pump out. This system is regularly serviced and maintained by Bio-septic

4.9.4. Waste Management Summary and Opportunities for Improvement

Education on efficient waste re-use will continue in the next reporting period. VENM will continue to be utilised from Dunmore Quarry and external sources. Further work will continue with subcontractors to optimise the record keeping for waste collection. A particular focus will be increasing the ratio of comingle recycling.

4.10. Incident and Emergency Response Management

The following management actions were undertaken in regards to incident and emergency response.

- The Pollution Incident Response Management Plan was updated in May 2020. The current version is available online on the Boral Dunmore Operations website.
- A Site Emergency Response Plan is available onsite in order to outline procedures in the case of emergency authorities being required on the site.
- A vehicle pedestrian safety upgrades were completed during the reporting period. Car park and traffic areas were refurbished to minimise pedestrian and vehicle interactions wherever possible.

4.11. Dangerous and Hazardous Goods Storage

Storage of dangerous goods and hazardous material have continued as per established operations. All dangerous goods and chemicals are handled and transported in accordance with the AS1940 and AS25956 and the Dangerous Goods Code and condition S3.C70.

4.12. Community

The DLSP Community Consultative Committee (CCC) continues to serve as a valuable dialogue between Boral and the local community with valuable input and feedback being provided by the community regarding quarry operations and plans. The CCC is run as per condition S5.C6 and the Departments Community Consultative Committee Guidelines for State Significant Developments (2016).

Members include:

- An independent chairperson
- At least 2 representatives from Boral (typically the environmental co-ordinator and quarry manager)
- A member from Shellharbour City Council
- Five local community representatives

Members are informed of the environmental performance of the site, provided with an update on operations and given a chance to tour the site and ask questions they may have regarding the operation. CCC members have also been diligent in disseminating the information from the meetings to other interested community members in the local area. The minutes of each meeting is published in the Boral website.

https://www.boral.com.au/locations/boral-dunmore-operations

The CCC met twice during the current reporting period (August 2019 and February 2020).

4.12.1. Environmental Complaints Management

DLSP maintains a complaints register that identifies actions required to resolve issues and concerns raised by the community. The complaints register is also published on the Boral website.

There was one (1) community complaints during the reporting period.

On 9 July, 2019 Danny Benedetti from RMS rang regarding concerns about dust tracking on the exit ramp from Tabbitta Rd onto the Princes Motorway northbound. He requested that Boral expand the street sweeping service currently undertaken on Friday for the northbound on ramp.

Street sweeping for the northbound on ramp was subsequently expanded to two days per week (Tuesday and Friday). Street sweeper services will continue to operate within Tabbitta Rd and weighbridge area Monday to Friday.

Figure 24 provides an overview of the noise, vibration and dust complaints received since 2007. There have been minimal complaints received over the history of the project.

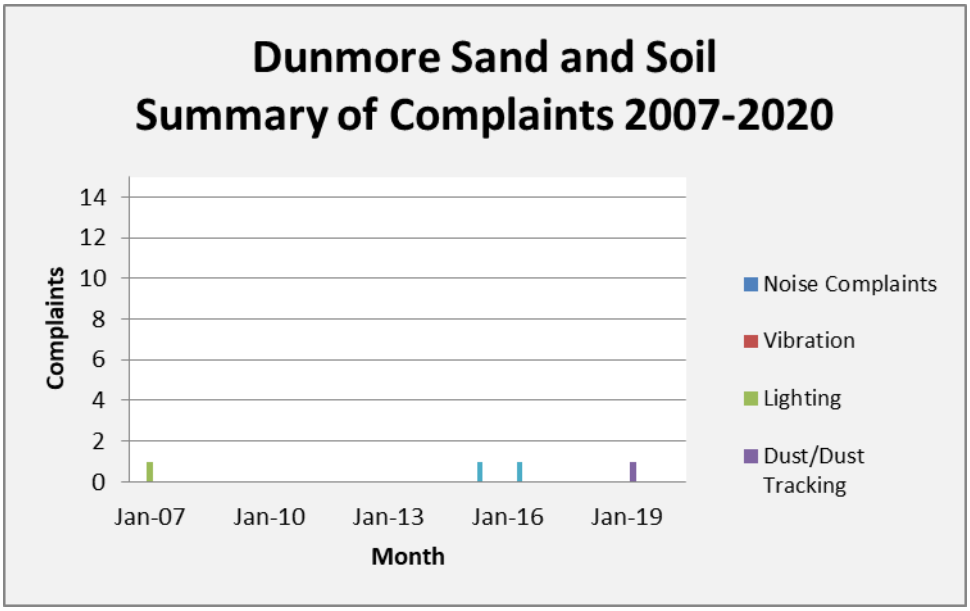

Figure 24 Summary of Historical Complaints

4.13. Summary of Regulatory Notifications

One (1) regulatory notification was received during the current reporting period. A formal warning letter was issued by the EPA for a failure to publish within 14 days after obtaining final monitoring report data.

The EPA notified DLSP on 28 October, 2019 and site representatives uploaded the data the same day. The Environmental Permit Planner (EPP) for the site has been updated to ensure that the POELA Report data is uploaded to the correct website to stop this happening in the future.

5. Conclusion

DLSP continues to focus on ensuring the environment and the neighbouring community are not adversely impacted by site operations.

Throughout this reporting period, extraction and processing of sand materials has decreased compared to previous years, as production aligns with the remaining approved resource. Dredging within 10m of Rocklow Creek will occur as per the approval conditions of CAA 10CX122266. Extraction will re-commence in the northern section of Stage 2 as per CAA 10CX123242 (10 ERM2010/1116.

This reporting period saw the continuation of rehabilitation within the Stage 2 area, which will remain a strong focus during the next reporting period. Rehabilitation will continue in Stage 2 and 3 while the remaining resource is extracted.

The focus on the next 12 months will be continuing operational compliance and utilising remaining resource reserves. The MOD 2 determination is expected to be received during the next reporting period and will govern the nature of future operations in the next Financial Year.

6. Activities to be completed by the Next Reporting Period

The next reporting period will contain a strong focus on maintaining regulatory compliance and optimising management actions established in the current reporting period.

The Independent Environmental Audit (IEA) for the site will be prepared in accordance with Schedule 5, Condition 10 and 11 of DA 195-8-2004 and is scheduled to be completed in October 2020 with any recommendations to be reported in the next annual review. A list of actions to be completed by the next reporting period is shown below

- Continue rehabilitation monitoring of planted sections of Swamp Oak Forest and Freshwater Wetland EEC in Stage 2 and Re-aligned Western Tributary.
- Continue backfilling and landform construction in Stage 3 starting with the Eastern edge and the south eastern tidal zone.
- Update the GMMP to reflect exceedances of K, Mg and Cl in the deep aquifer to the east of the highway, and Mg in bores DG17 and DG31 are considered natural occurrences, as per consultant recommendations
- Continue assessing salinity in the southern section of Stage 3 as per the recommendations in the DLSP EIS.

- Complete the IEA which is currently scheduled for October 2020
- Report on and action recommendations in next Annual Review
- Review and update management plans as per S5.C4 post Annual Review and IEA.

7. Appendix A Meteorological Monitoring

The location of the onsite weather station is shown below.

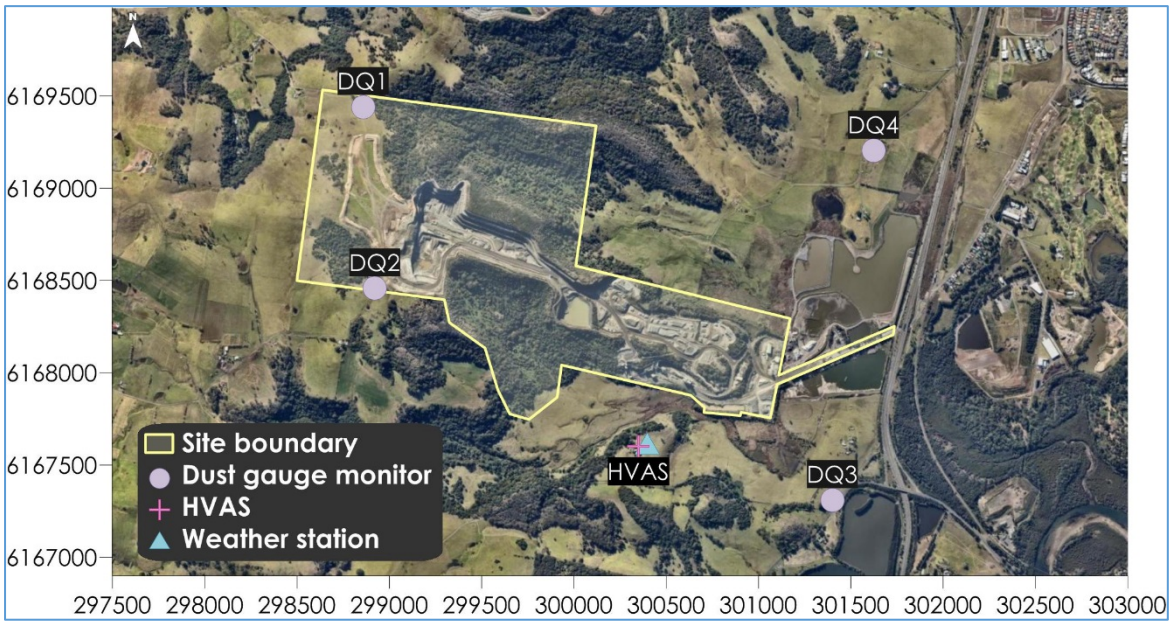

Figure 25 Weather Station Location

A monthly review of weather data is undertaken by the environmental co-ordinator. Important meteorological conditions that are assessed include rainfall, wind speed direction and atmospheric stability.

Rainfall data has been collected since FY2003. A summary of the rainfall measured from the Dunmore Quarry weather station is shown below in Table 27. Historical trends are shown in Table 28 and in red are the months where rainfall was above the regional average.

Table 27 Dunmore Rainfall Summary

Rainfall (mm)			
Month	**Current Reporting Period**	**Site Average**	**Regional Average**
July	20.5	52.2	49
August	39	64.5	53.5
September	59.5	49.7	42.7
October	38.5	70.2	64.5
November	25.5	89.9	83.1
December	2.5	84.3	67
January	65	79.6	72.9
February	272.5	147.8	140.5
March	65.5	133.2	122.3

April	85	88.7	73.8
May	52	64.7	55.8
June	35	118.6	93.7
Total	760.5	1043.5	925.6

Table 28 Dunmore Historical Rainfall

	Rainfall (mm)																			
Month	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	Site Average	Regional Average
July	20	23.5	54.2	41	96	30.5	63.5	35.5	78	194	39	61.7	5	48	97.5	25	6	20.5	52.2	49
August	13.5	38.5	23	3	42.5	58.5	39	0.5	72	85.5	4.5	17	252	327	76	39	31	39	64.5	53.5
September	14	7.5	40.6	33	101	39	56	19.5	146	58.5	11.5	85.5	48.7	82	51	1	41.5	59.5	49.7	42.7
October	6.5	49	245	48	0	17	79	126	126	125	83.5	6.5	103	36.5	32	14.5	128	38.5	70.2	64.5
November	17	150	127	145	39.5	162	46.5	65	198	164	25	173	24	48	33	85	92	25.5	89.9	83.1
December	70	40.5	136	36.5	54	120	113	80.5	148	63	32	70.5	234	117	58	53	90.5	2.5	84.3	67
January	68	30.5	129	90	0	65.5	9.5	79	59.5	50.5	183	43.5	193	156	32.5	36	144	65	79.6	72.9
February	112	70	180	87.1	187	352	108	198	48	258	143	59	113	29.5	283	129	35.5	272.5	147.8	140.5
March	121	84	118	43.5	67.5	36.5	39	74	363	196	23.5	326	57	145	441	41.5	157	65.5	133.2	122.3
April	91.5	200	24.4	8	145	90.5	106	63	37.4	87.5	136	64.5	305	37.5	40.5	26.1	48.5	85	88.7	73.8
May	428	43.5	85.6	65.5	23	8	20	80.5	58.3	9.5	81	13	53.5	35.5	51.5	44	13.5	52	64.7	55.8
June	74.5	42	84.4	124	319	85.5	67	52	92	89	239	34	76	429	57	134	103	35	118.6	93.7
Total	1036	779	1248	724	1074	1064	746	873	1425	1379	1001	954	1462	1490	1253	627	890	760.5	1043.5	925.6

Monthly wind roses and seasonal wind roses are shown below in Figure 29 to Figure 38. Please note calm is defined as winds averaging less than 0.3m/s over the averaging period.

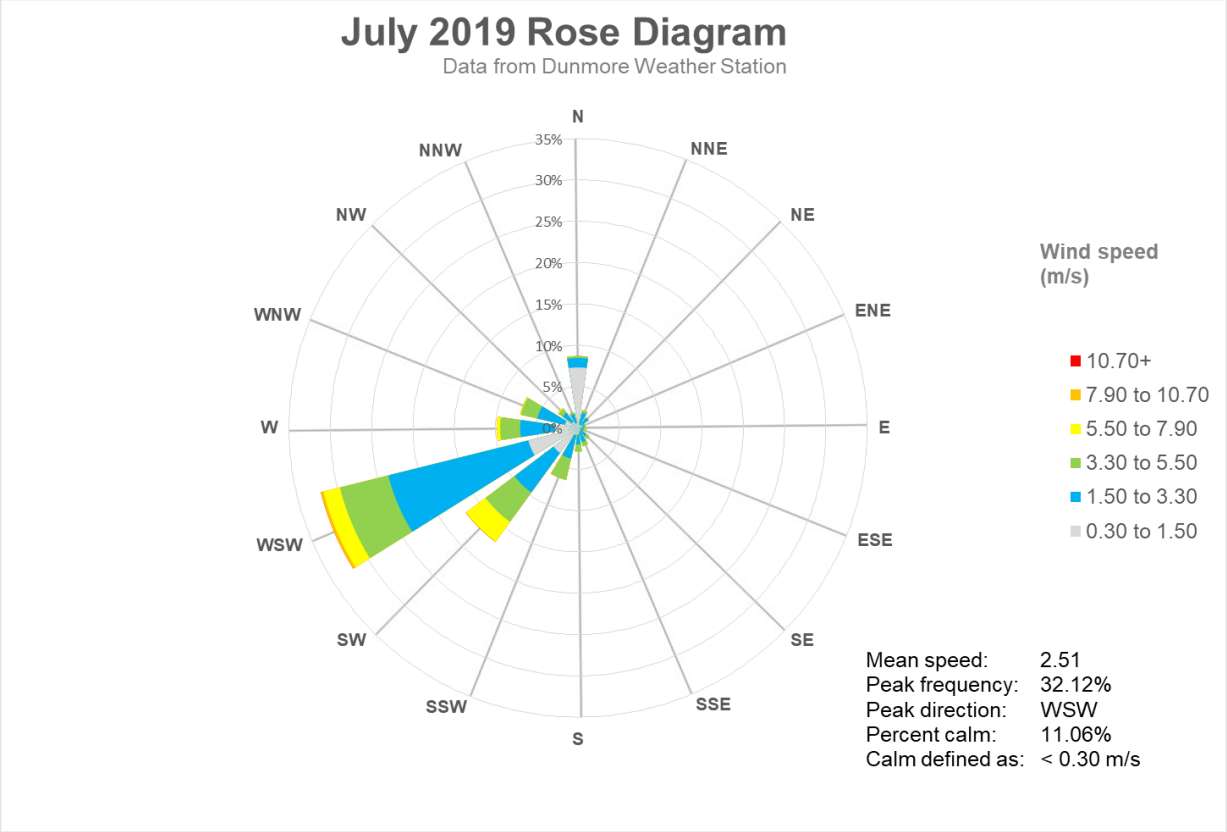

Figure 26 July Wind Rose

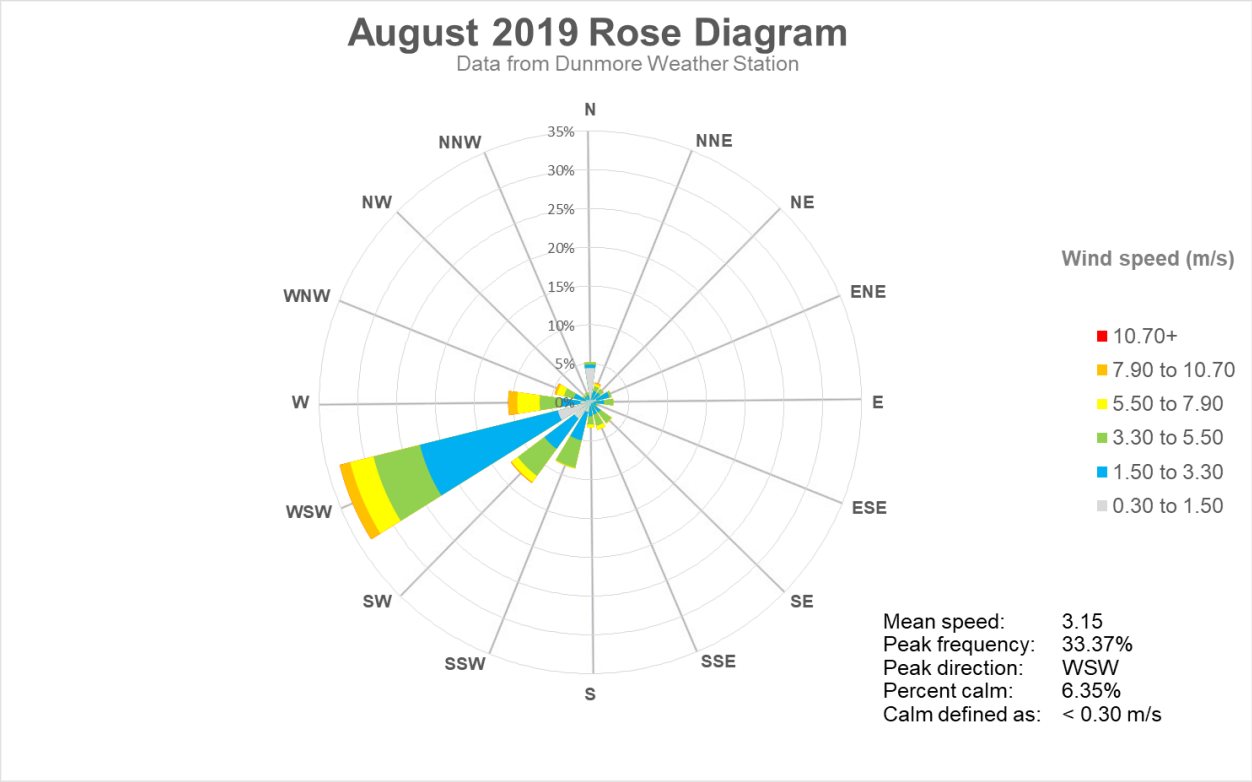

Figure 27 August Wind Rose

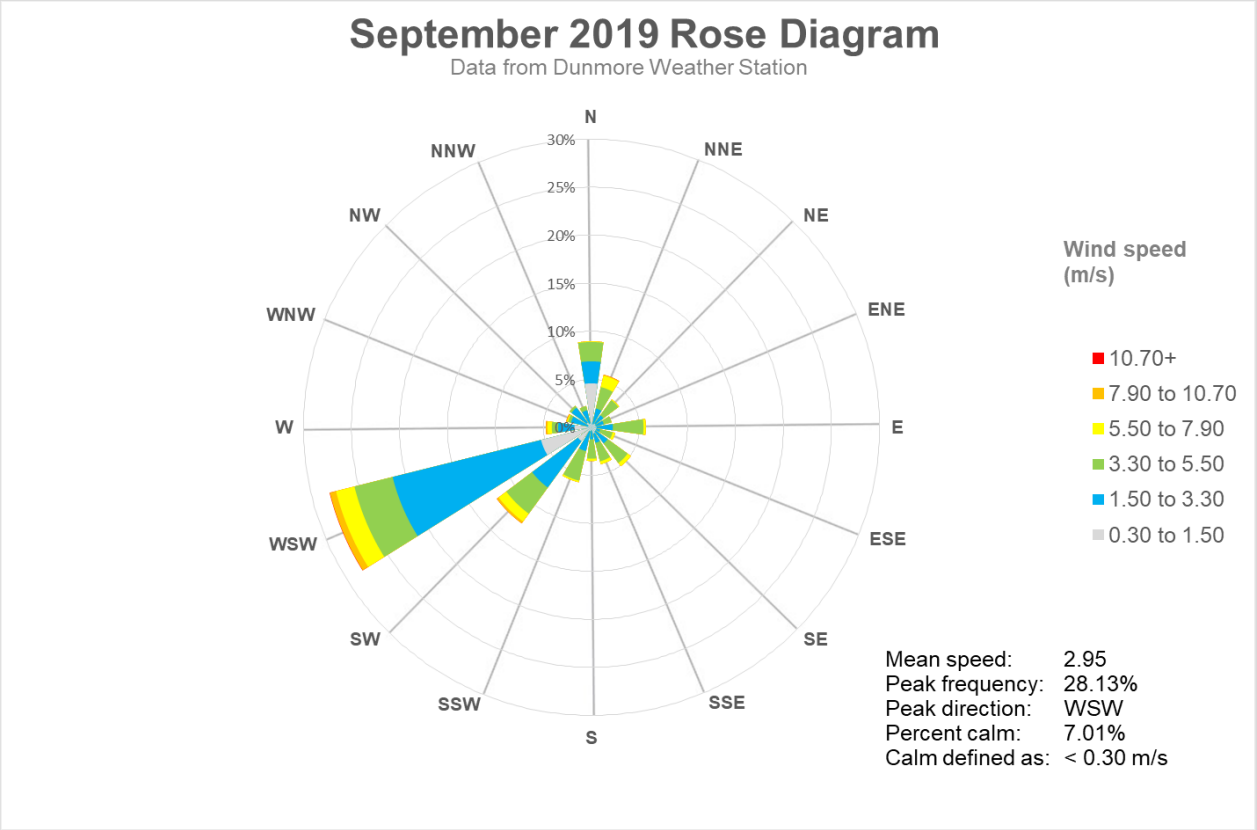

Figure 28 September Wind Rose

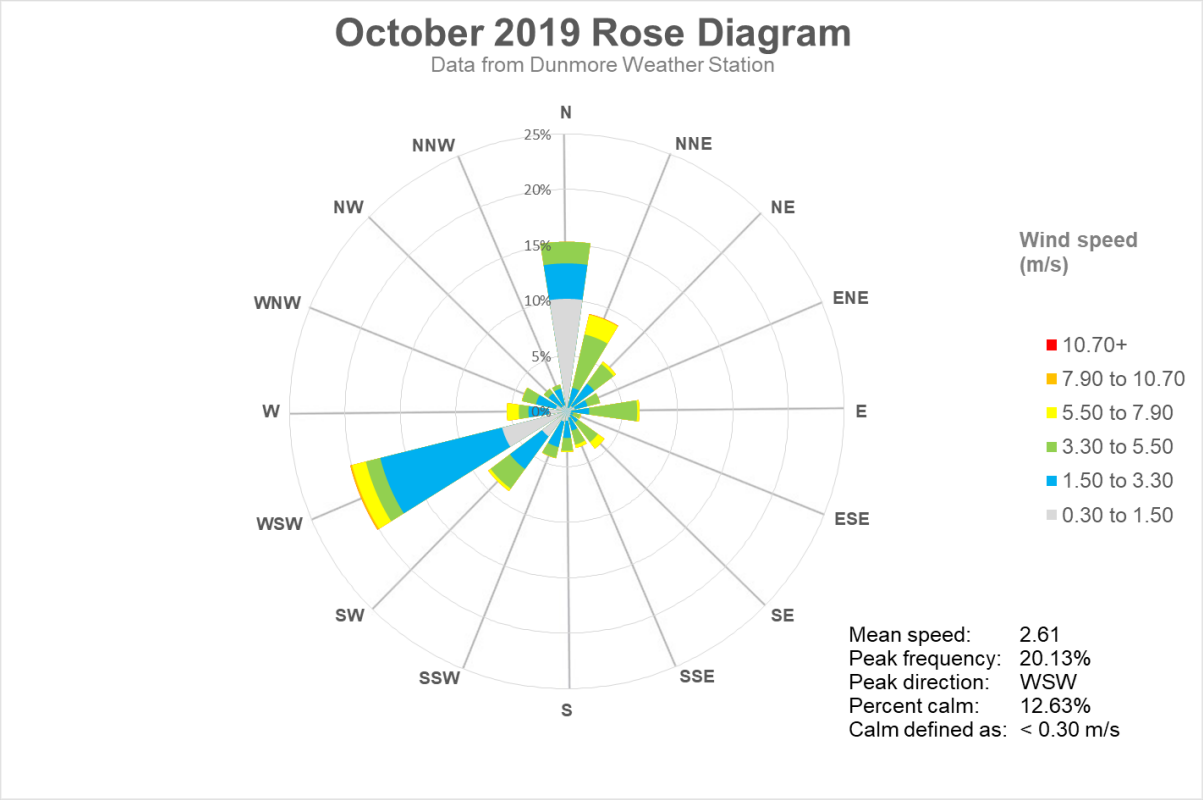

Figure 29 October Wind Rose

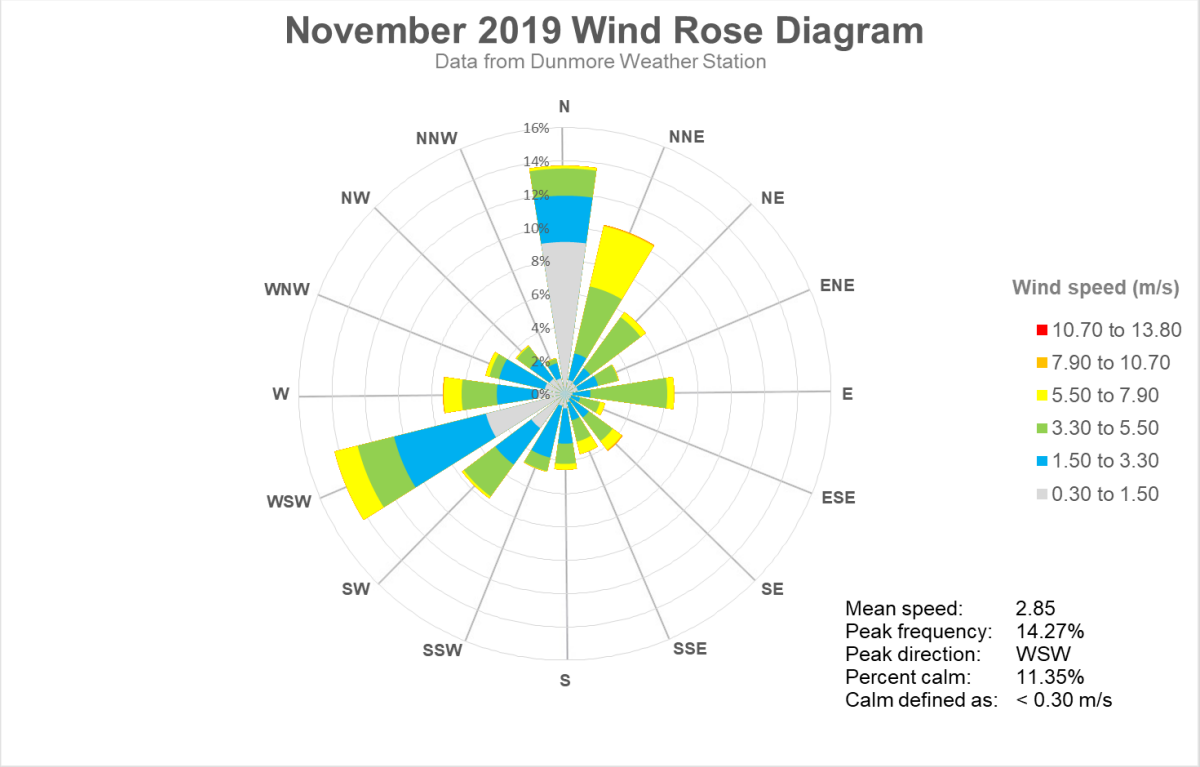

Figure 30 November Wind Rose

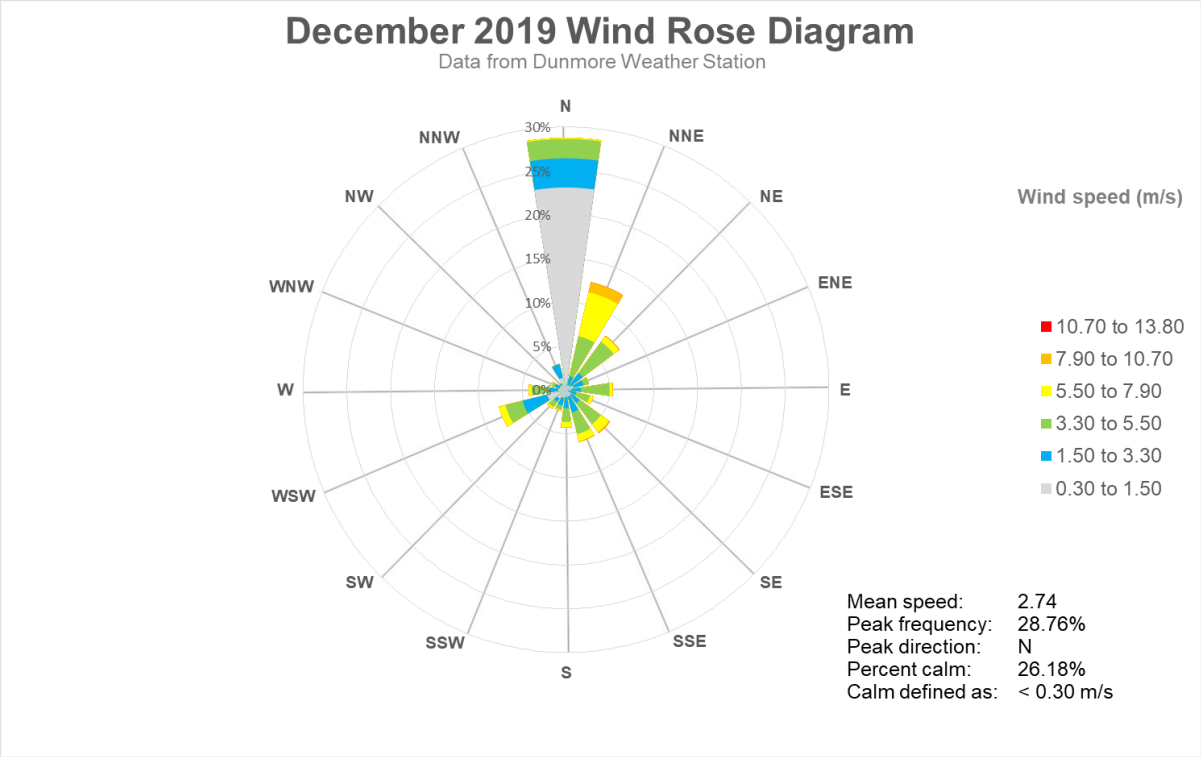

Figure 31 December Wind Rose

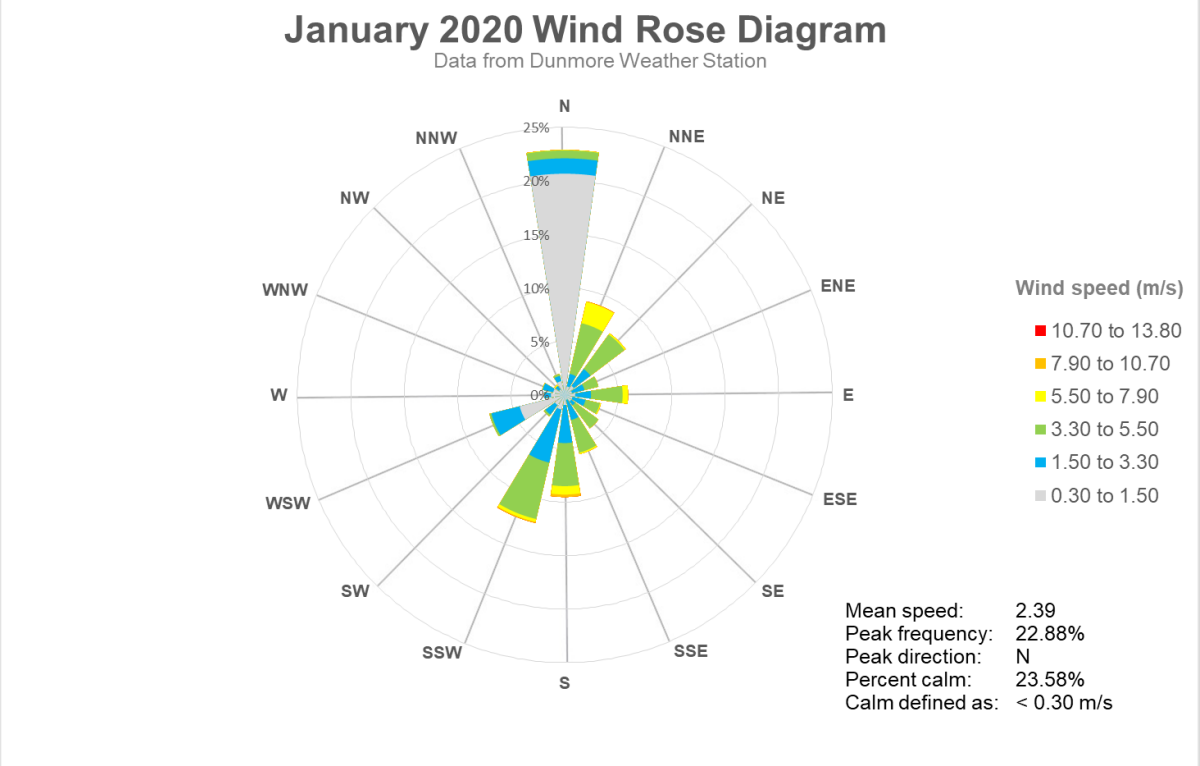

Figure 32 January Wind Rose

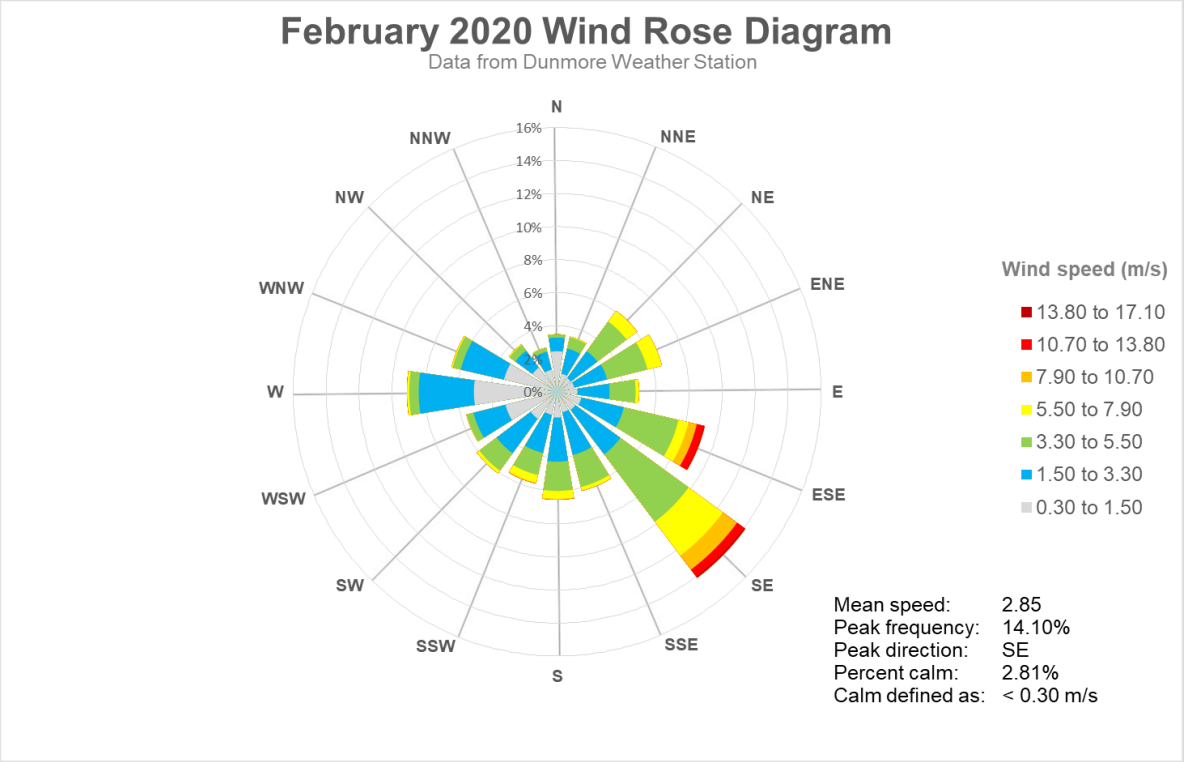

Figure 33 February Wind Rose

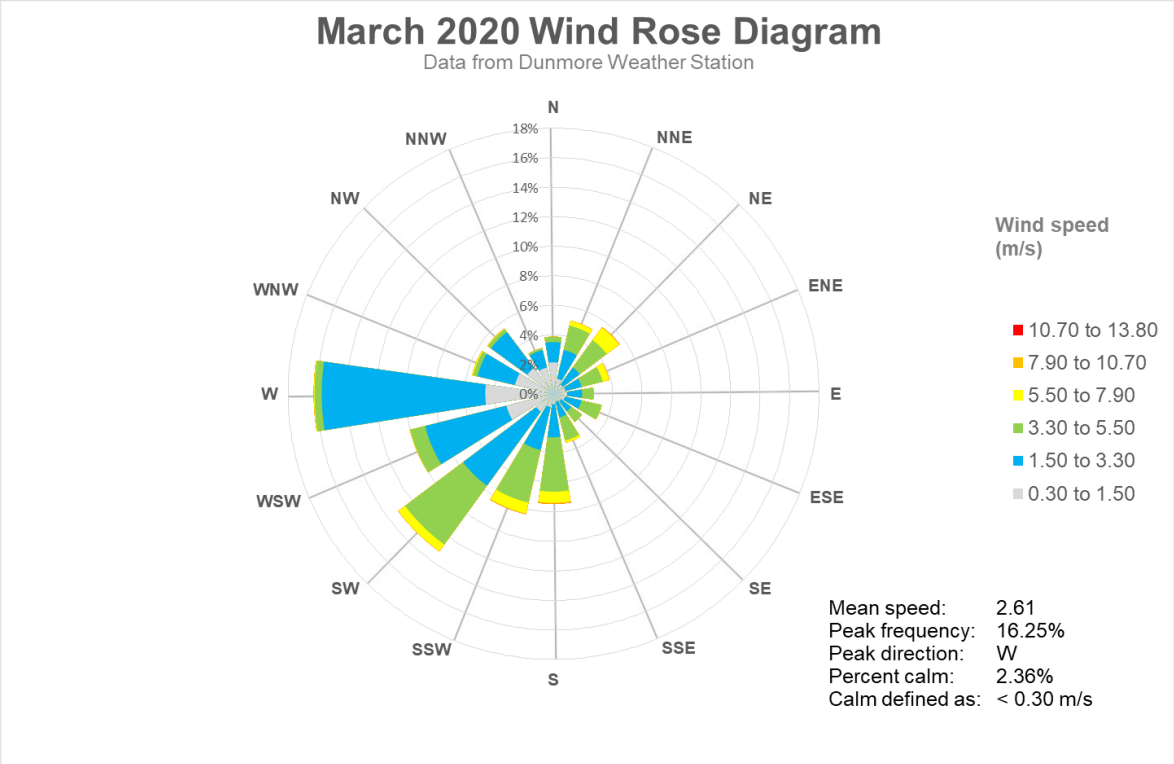

Figure 34 March Wind Rose

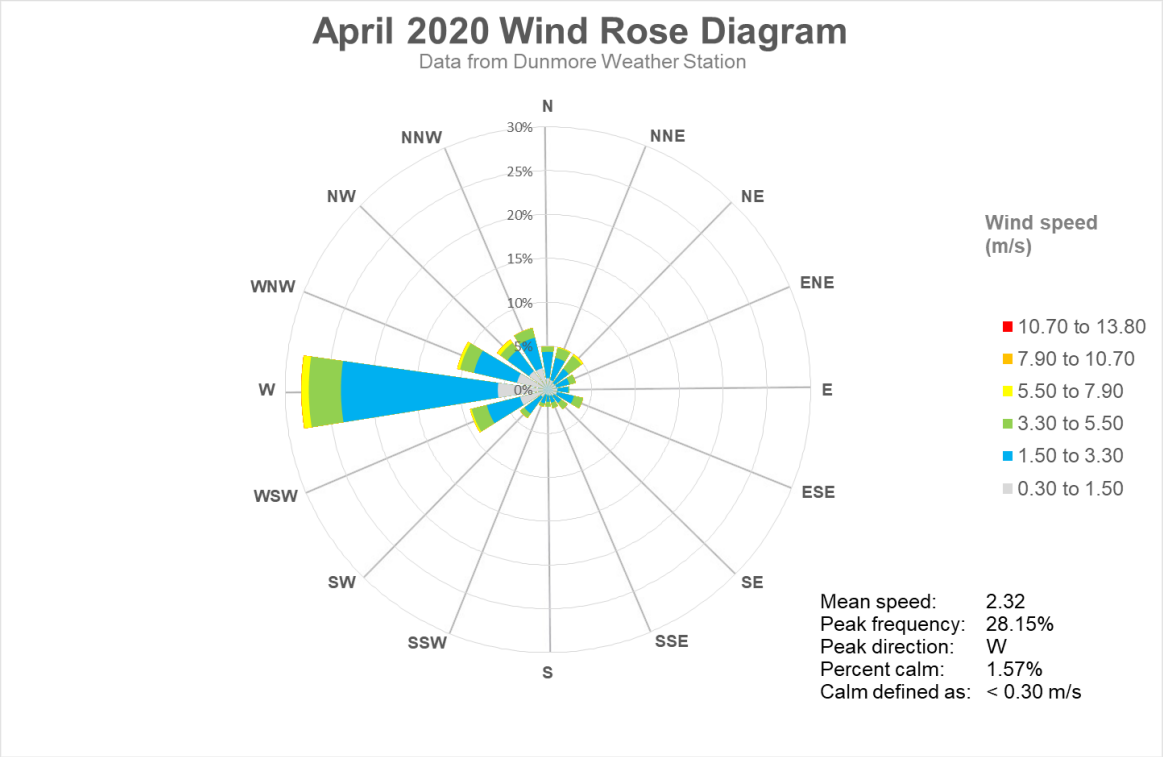

Figure 35 April Wind Rose

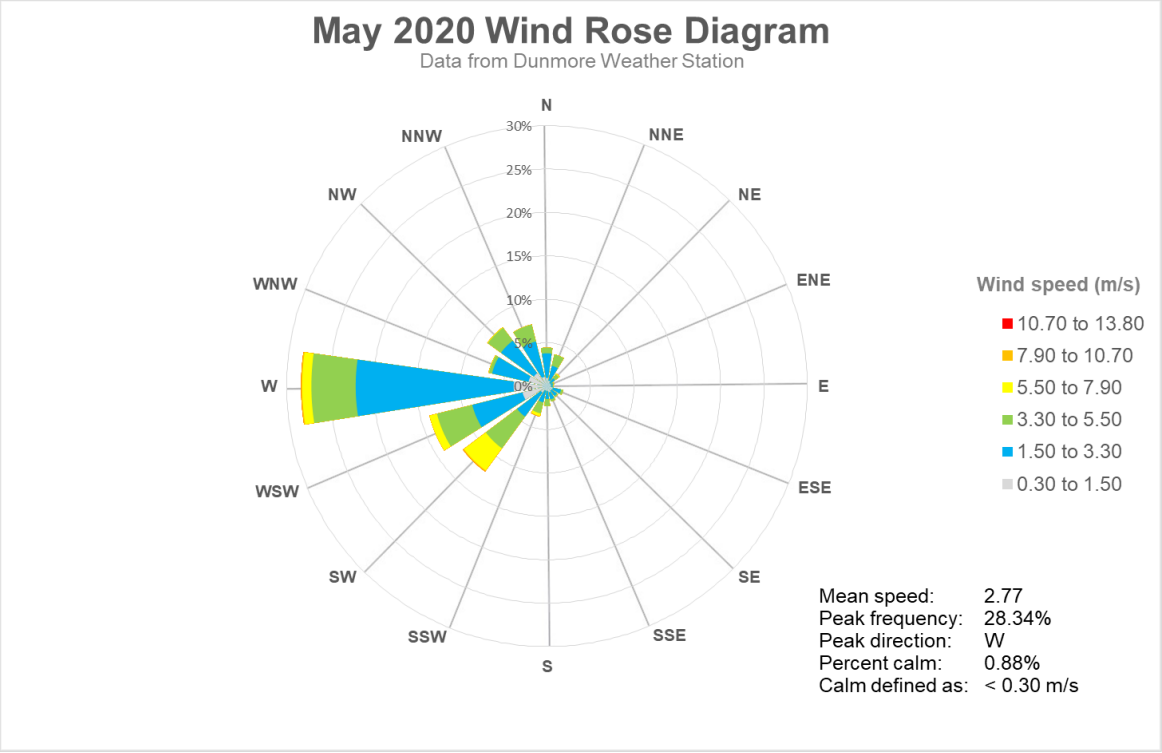

Figure 36 May Wind Rose

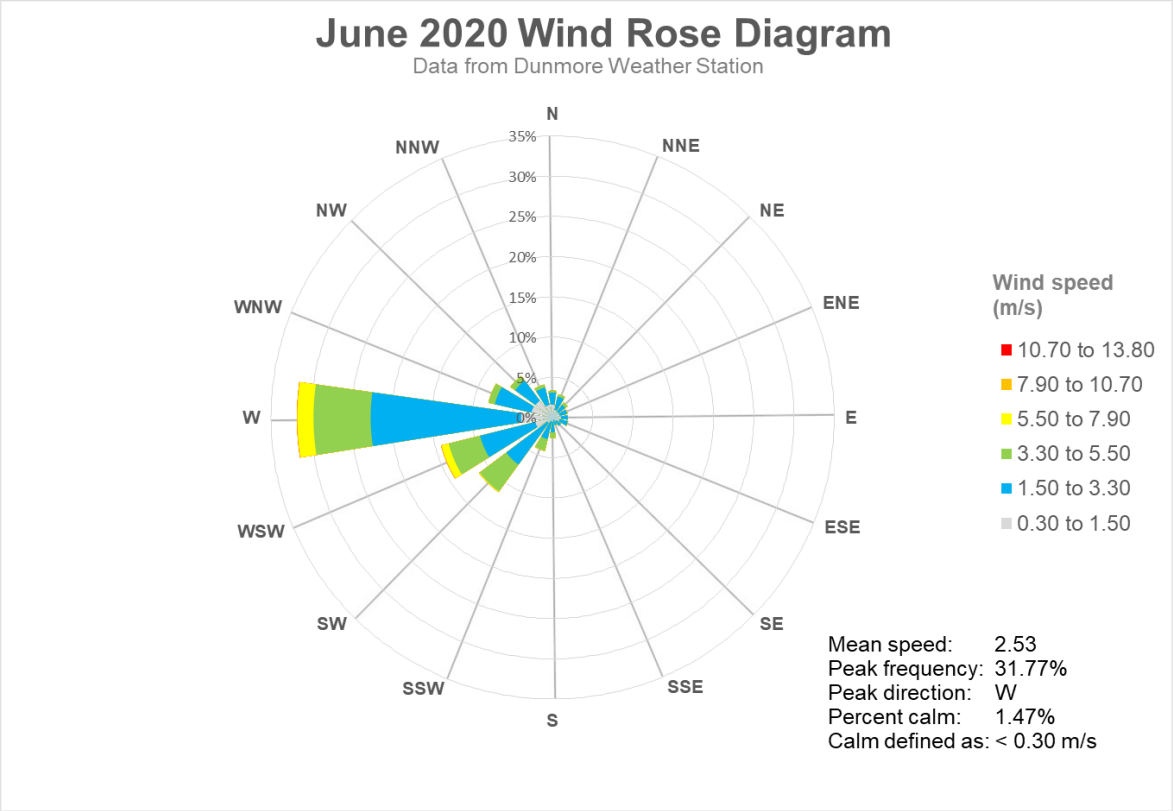

Figure 37 June Wind Rose

Figure 38 Dunmore Seasonal Wind Rose Data

8. Appendix B Air Quality Additional Data and Graphs

A monthly breakdown of deposited dust monitoring is shown in the Table 29 below. Dominant wind directions and production data are also shown within Table 29.

Table 29 Detail Summary of Historical Dust Data

Month	DD2 grams/m²/month		DD5 grams/m²/month		DD6 grams/m²/month		DD7b/10 grams/m²/month		Deposited Dust Goal	Dominant Wind Direction	Direction of Strongest Winds	Production Tonnes
	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash				
FY07 Average	3.68	1.9	3.3	2.1	5.75	3.36	3.9	1.92	4			
FY08 Average	2.97	1.84	2.88	1.66	4.23	2.43	4.31	2.44	4			
FY09 Average	3.07	1.96	3.79	1.94	3.83	2.87	5.55	3.17	4			
FY10 Average	5.29	3.3	3.42	2.5	4.88	2.96	2.71	1.66	4			
FY11 Average	6.16	3.68	3.42	1.99	3.92	2.47	3.15	2.33	4			
FY12 Average	5.51	2.82	3.09	1.82	3.17	2.32	2.53	1.6	4			
FY13 Average	4.19	2.19	3.26	1.84	3.7	2.48	2.75	1.81	4			
FY14 Average	2.21	1.42	3.63	1.76	2.67	1.58	3.36	2.36	4			
FY15 Average	3.57	1.77	2.55	1.46	3.94	2	3.2	2	4			
FY16 Average	1.85	1.19	2.59	1.44	2.55	1.55	2.66	1.66	4			
FY17 Average	2.28	1.56	2.67	1.77	3.31	1.68	2.01	1.30	4			
FY18 Average	2.36	1.65	2.32	1.78	2.71	1.88	2.84	1.79	4			
FY19 Average	3.66	1.87	3.1	1.9	3.03	1.94	2.81	1.59	4			
FY20 Average	3.59	2.11	3.06	1.82	3.49	2.18	3.16	1.98	4			
Jul-2019	0.60	0.57	0.32	0.19	1.34	1.16	0.31	0.3	4	WSW (32%)	WSW	30,548
Aug-2019	1.67	1.14	1.37	1.05	2.03	1.06	2.4	1.72	4	WSW (33%)	WSW	27,197
Sep-2019	2.01	1.51	2.93	1.96	1.24	0.99	0.5	0.46	4	WSW (28%)	WSW	23,654
Oct-2019	2.19	1.18	1.46	0.94	1.42	0.98	1.24	0.91	4	WSW (20%)	WSW	17,612
Nov-2019	2.84	2.52	2.77	2.31	3.33	2.95	2.16	1.91	4	WSW (14%)	WSW, NNE	37,587
Dec-2019	2.14	1.27	1.79	1.02	2.50	1.43	1.84	1.1	4	N (29%)	NNE	14,752
Jan-2020	10.20	8.28	8.97	7.19	10.58	7.04	8.14	6.33	4	N (23%)	NNE	17,783
Feb-2020	4.62	3.06	5.65	3.78	4.43	2.74	3.64	2.26	4	SE(14%)	ESE, SE	10,614
Mar-2020	1.81	1.05	1.44	0.68	2.17	1.20	1.85	1.2	4	W(16%)	NE	12,324
Apr-2020	1.69	0.95	1.53	0.99	1.81	1.05	1.4	0.85	4	W(28%)	W	3,292
May-2020	1.18	1.04	1.34	1.03	0.87	0.63	0.79	0.67	4	W(28%)	SSW	14,682
Jun-2020	1.03	0.70	0.76	0.42	1.05	0.59	0.87	0.46	4	W (32%)	WSW	10,950
FY20 Average	2.67	1.94	2.53	1.80	2.73	1.82	2.10	1.51	4			220,995

A detailed breakdown of the particulate monitoring via the HVAS can be seen in Table 30 below. In grey are the monitoring time periods that were affected by the Currowan bushfire.

Table 30 Detailed Summary of PM10 Monitoring Data

Date	Sample Daily Average (µg/m^3)	Short Term Criteria 24-hr (50µg/m^3)	Long Term Criteria Annual (30µg/m^3)	Progressive Annual Average (µg/m3)	Comments
1/07/2019	31.08	50	30	18.98	
7/07/2019	6.83	50	30	19.03	
13/07/2019	4.75	50	30	18.68	
19/07/2019	9.38	50	30	18.75	
25/07/2019	13.73	50	30	18.65	
31/07/2019	0	50	30	18.55	
6/08/2019	8.95	50	30	18.48	
12/08/2019	3.69	50	30	18.37	
18/08/2019	11.69	50	30	18.48	
24/08/2019	12.44	50	30	18.60	
30/08/2019	3.86	50	30	18.45	

5/09/2019	13.37	50	30	18.46	
11/09/2019	11.05	50	30	18.45	
17/09/2019	7.25	50	30	18.37	
23/09/2019	24.48	50	30	18.18	
29/09/2019	11.05	50	30	17.76	
5/10/2019	4.63	50	30	17.66	
11/10/2019	4.04	50	30	17.25	
17/10/2019	10.93	50	30	17.14	
23/10/2019	16.7	50	30	17.28	
29/10/2019	35.29	50	30	17.47	
4/11/2019	15.09	50	30	17.44	
10/11/2019	7.37	50	30	17.46	
16/11/2019	17.65	50	30	17.44	
22/11/2019	35.12	50	30	17.58	
28/11/2019	52.35	50	30	18.21	Currowan Bushfires
4/12/2019	28.82	50	30	18.29	Currowan Bushfires
10/12/2019	70.23	50	30	19.11	Currowan Bushfires
16/12/2019	28.7	50	30	19.40	Currowan Bushfires
22/12/2019	33.27	50	30	19.45	Currowan Bushfires
28/12/2019	36.6	50	30	19.68	Currowan Bushfires
3/01/2020	48.96	50	30	20.07	Currowan Bushfires
9/01/2020	18.84	50	30	19.88	Currowan Bushfires
15/01/2020	39.81	50	30	20.28	Currowan Bushfires
21/01/2020	30.5	50	30	20.16	Currowan Bushfires
27/01/2020	30.5	50	30	19.31	Currowan Bushfires
2/02/2020	44.15	50	30	19.78	Currowan Bushfires
8/02/2020	17.23	50	30	19.80	
14/02/2020	19.01	50	30	19.68	
20/02/2020	13.5	50	30	19.62	
26/02/2020	21.21	50	30	19.78	
4/03/2020	19.71	50	30	19.73	

10/03/2020	10.52	50	30	19.66	
16/03/2020	11.29	50	30	19.67	
22/03/2020	20.92	50	30	19.74	
28/03/2020	7.37	50	30	19.68	
3/04/2020	9.11	50	30	19.40	
9/04/2020	3.15	50	30	19.21	
15/04/2020	23.29	50	30	19.40	
21/04/2020	11.47	50	30	19.26	
27/04/2020	12	50	30	18.88	
3/05/2020	8.97	50	30	18.84	
9/05/2020	17.65	50	30	18.85	
15/05/2020	12.6	50	30	18.69	
21/05/2020	13.55	50	30	18.67	
27/05/2020	12.12	50	30	18.60	
2/06/2020	8.61	50	30	18.59	
8/06/2020	10.45	50	30	18.25	
14/06/2020	6.95	50	30	18.26	
20/06/2020	8.08	50	30	18.03	
26/06/2020	7.84	50	30	17.64	

9. Appendix C Annual Noise Monitoring Compliance Report

10. Appendix D Annual Groundwater Monitoring report

11. Appendix E Rehabilitation Progress Monitoring

FY17 Re-aligned Western Tributary Rehabilitation Progress

FY18 Re-aligned Western Tributary Rehabilitation Progress

FY19 Re-aligned Western Tributary Rehabilitation Progress

FY20 Re-aligned Western Tributary Rehabilitation Progress

FY17 NW Stage 2 Rehabilitation Progress

FY18 NW Stage 2 Rehabilitation Progress

FY19 NW Stage 2 Rehabilitation Progress

FY20 NW Stage 2 Rehabilitation Progress

NE Stage 2 Rehabilitation Progress current reporting period