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Dunmore Lakes Sand Project Annual Review

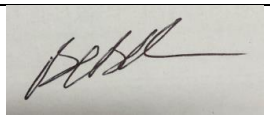
1 July 2022 – 30 June 2023

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
Name of holder of EPL	Boral Resources (NSW) Pty Ltd
Annual Review start date	1 July 2022
Annual Review end date	30 June 2023

I, Brodie Bolton , 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 2023 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	Brodie Bolton
Title of authorised reporting officer	Quarry Manager
Signature	
Date	29/09/2023

Document Control				
Ref	Prepared by	Approved by	Date	Distribution
V1.0	Matt Bray	Sharon Makin	30/09/2023	DPIE

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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
FY21	Financial Year 2021 (1 July 2020 – 30 June 2021)
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

This Annual Review (AR) covers the operation of the Dunmore Lakes Sand Project for the period 1st July 2022 to 30th June 2023 and has been prepared in accordance with the latest Department of Planning and Environment guidelines. 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 in regard to performance and compliance.

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 2023 Financial Year which is 1 July 2022 – 30 June 2023.

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 Planning Secretary, the Applicant must review the environmental performance of the development to the satisfaction of the Planning 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: • 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(c) of Schedule 2;	Section 4
	(c) identify any non-compliance or incident which occurred in the previous financial year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid reoccurrence;	Section 1.1
	(d) evaluate and report on:	Section 4

	• the effectiveness of the noise and air quality management systems; and • compliance with the performance measures, criteria and operating conditions of this consent;	
	(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.	Section 4
	The Applicant must ensure that copies of the Annual Review are submitted to the Planning Secretary and Council and are available to the Community Consultative Committee (see condition 6 of Schedule 5) and any interested person upon request.	
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(64)	The Applicant must (a) manage on-site sewage treatment and disposal in accordance with the requirements of an applicable EPL, and to the satisfaction of EPA and Shellharbour Council; (b) minimise the waste generated by the development; (c) ensure that the waste generated by the development is appropriately stored, handled, and disposed of; and (d) report on waste minimisation and management in the Annual Review.	Section 4.9
3(72)	The Applicant must: (e) Provide annual production data to the MEG using the standard form for that purpose; and (f) 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 2022–30 June 2023) 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	No

Two non-compliances were identified in the reporting period arising from the Dunmore Lakes Sand Project (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 is 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	Low Exceedances are attributed to external events not associated with the Development.	Turbidity and Chlorophyll-a at DW24 (Stage 5A) were outside the WQO described in S3.C24. Turbidity as well as total phosphorus and nitrogen were outside of the WQO in the Stage 2 and Stage 3 dredge pond DW-14 and DW-19. All exceedances were attributed to external events associated with extensive rainfall. Levels were comparative to	Section 4.4 (see Surface Water). Section 4.7, Appendix D (see groundwater)

Relevant Approval	Condition #	Condition Description	Compliance Status	Comments	Section addressed
		events such as heavy rainfall or tidal saline water inflow		background water samples at the same time. Short term exceedances are acknowledged in S3 C24 Table 5 Note and may occur. As described in the groundwater monitoring report and section 4.7 a number of exceedances of various analytes occur within the groundwater bores against Site specific trigger values These exceedances are considered natural occurrences, and /or related to tidal impacts.	
DA 195-8-2004	S3.C23	Except as may be expressly provided by an EPL, the Applicant must ensure that the discharges from any licenced discharge point/s do not cause additional exceedances of the criteria in Table 4 (6.5 < pH <	Low Exceedance is attributed to follow on effects of a major rain event. The discharge was uncontrolled and not associated with the operations of the Development .	An exceedance of the TSS limit of 50 was recorded in February 2023 at surface water sampling site DW20-b during an uncontrolled discharge. This was a single occurrence, and can be attributed to continued runoff after a 177mm rainfall event in February from surrounding paddocks that contributed to the	Section 4.4.2.2

Relevant Approval	Condition #	Condition Description	Compliance Status	Comments	Section addressed
		8.5; TSS < 50).		uncontrolled discharge. Additionally, at the time of the exceedance the EPL (EPL11147) didn't prescribe any limitations to TSS concentrations at this monitoring point. In the latest update of the EPL, this compliance monitoring point was removed.	

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 DLSP operations website:

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

Key contacts associated with the management of the DLSP, environment, safety and stakeholder relationships are provided in Table 4.

Table 4 Key Contacts Associated with the Dunmore Lakes Sand Project

Contact	Position	Contact Details
Brodie Bolton	DSS Quarry Manager	(02) 4237 8414 Email: brodie.bolton@boral.com.au
Angus Shedden	Metropolitan Operations Manager NSW/ACT	(02) 4237 8414 Email: angus.shedden@boral.com.au
Matt Bray	Environmental Coordinator Dunmore	Tel: (02) 4237 8414 Email: matt.bray@boral.com.au
Kate Woodbridge	Stakeholder Relations Manager	Tel: (02) 4237 8414 Email: kate.woodbridge@boral.com.au

2. Site Operations

The Dunmore Lakes Sand Project (DLSP) is an established dredge sand extraction operation at Dunmore, in the Illawarra region of New South Wales. It is owned by Dunmore Sand & Soil Pty Ltd, which is a wholly owned subsidiary of Boral Resources (NSW) Pty Ltd (Boral).

The project is an integral part of the NSW construction industry, as it supplies high quality construction sand products to the Illawarra and Greater Sydney regions. The DLSP has a maximum approved production rate of up to 800,000 tonnes per annum and average historical production rate of 450,000 tonnes per annum. It has historically been capable of supplying around 7.5% of the sand required for Sydney's construction industry, however production during the 2023 reporting period was impacted by flooding and the transition to the new Stage 5 area.

Development Consent (DA 195-8-2004) was issued 29 June 2005 for stages 2, 3 and 4 by the Minister for Infrastructure and Planning and in November 2020 for Stage 5. It 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 project is currently operating under development consent DA 195-8-2004, which has been modified three times as summarised below, and allows Boral to carry out sand extraction and processing operations until 2030.

- Modification 1 (granted in June 2016) which involved modifying S3.C10 of the consent to remove the requirement for the creek realignment to occur prior to commencing Stage 3 extraction. This allowed realignment to be carried out a later date, concurrent with extraction operations as per the private landowners request;
- Modification 2 (granted in November 2020) which involved establishing two new extraction areas, known as Stages 5A and 5B, within the existing approved life of the operations. These proposed extraction areas are situated on a private property located between the Princes Highway, Riverside Drive and the Minnamurra River;
- Modification 3 (granted in March 2020) which involved permitting the processing, blending and sale of up to 120,000 tonnes per annum of sand based VENM (known as excavation sand) from ongoing building projects within the surrounding regions.

The development consent DA 195-8-2004 as it currently stands allows Boral to:

- extract, process and transport sand products, including through the:
    - extraction of up to 800,000 tonnes of sand per annum until 2030;
    - development of extraction areas for dredging in Stages 2 to 5;
    - processing of extracted sand and up to 120,000 tonnes per annum of suitable imported Virgin Excavated Natural Material (VENM) to produce construction sand products;
    - road and rail transport of product sand, primarily to the Illawarra and Greater Sydney regions;
- construct and operate a range of ancillary infrastructure at the site, including:
    - a processing plant;
    - product stockpiles;

- access roads; and
- supporting administrative infrastructure.

- Undertake progressive rehabilitation via the importation of VENM material for the purposes of void reclamation and revegetate as per the approved Rehabilitation Management Plan.

A layout of the site is illustrated in Figure 1. Please note that Stage 1 operations have ceased and rehabilitation was signed off in 2014. Stages 2 and 3 are not currently undergoing extraction and rehabilitation is underway.

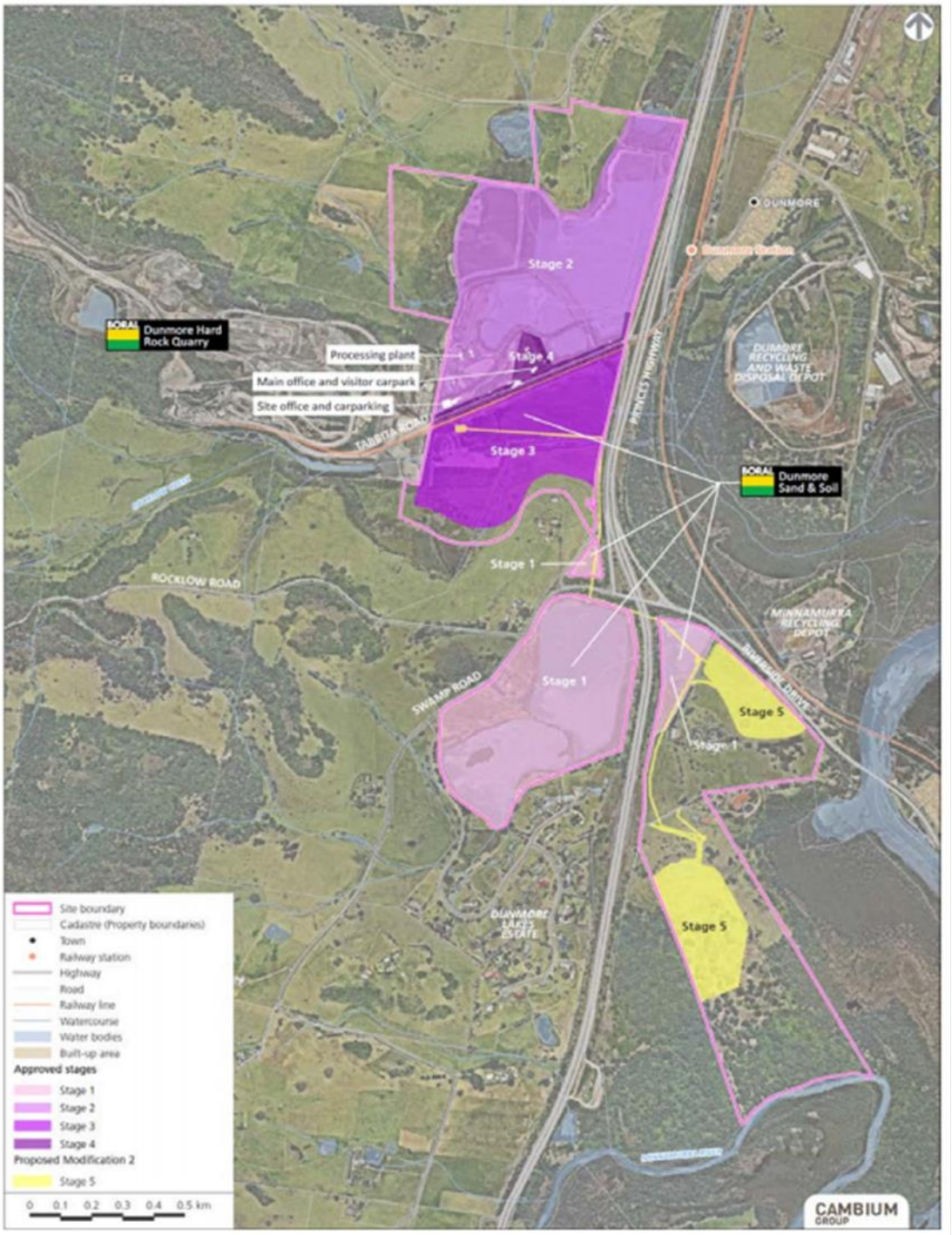


Figure 1 Dunmore Lakes Sand Project Site Layout

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 (as modified)	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

No additional modifications have been sought to the current approval over the 2023 reporting period. The current consent allows for an additional extraction area (Stage 5) to the south of the former Stage 1 extraction area which was commenced during the previous reporting period. Stage 5 encompasses an area of 38 hectares (ha) and includes two separate extraction areas, Stage 5A and Stage 5B. The sand resource to be extracted from Stage 5A is estimated at 234,000 t and approximately 1,123,000 t from Stage 5B. These resource volumes are the estimated sand resource only, and additional tonnage of soil material (known as overburden) will be extracted in addition to the sand resource.

An overland transfer pipeline has been established from the Stage 5 extraction areas to the existing Stage 2 processing area. This pipe will be transferred from Stage 5A to Stage 5B once extraction activities commence. At the Stage 2 processing area, the sand and water will pass over an initial screen to separate oversize organic matter or debris and into a large wash tank to float out any fines. The sand will then be pumped through a cyclone and stockpiled for further dewatering. Water will drain to an existing fines pond and a secondary settling pond before being pumped back to the Stage 5B dredge pond.

Dewatered sand will then be loaded with a front-end loader for dispatch by road and rail. Water pumped from the Stage 5 extraction areas will be returned to these extraction areas via the transfer pipeline. Mobile plant and equipment will be operated across both extraction areas. Extraction methods will be identical to those in Stages 2 and 3.

As a result of modification 3, a number of management plans were updated as described below:

- Waste Management Plan was approved 16 June 2021
- Stage 5 Survey Plan and Extraction Limits was approved 17 June 2021
- Staging of Management Plans was approved 18 June 2021
- Air Quality Management Plan was approved 8 July 2021
- Noise Management Plan was approved 8 July 2021
- Stage 5 Soil and Water Management Plan was approved 14 July 2021
- Traffic Management Plan was approved 13 July 2021
- Flora Fauna Management Plan was approved 20 July 2021
- Heritage Management Plan was approved 20 July 2021
- Rehabilitation and Riparian Management Plan was approved 20 July 2021
- The Acid Sulphate Soils Management Plan

Approved management plans are available on the Dunmore website https://www.boral.com.au/locations/boral-dunmore-operations

2.3. Operations last 12 months

Over the last 12 months, production continued from Stage 5A with VENM material continuing to be received in Stage 2 and 3 for landform construction. The Stage 5A resource was exhausted by early 2023, with work on Stage 5B being delayed due to a required assessment against the EPBC Act.

Backfilling and rehabilitation continued in the Stage 2 and 3 areas and will be ongoing during the coming reporting periods.

Requirements of the condition of consent in relation to Biodiversity offsets, habitat management (nest box installation) and traffic management works were undertaken.

2.4. Operations next 12 months

Dredging has commenced in Stage 5B with sand continued to be processed in the existing Stage 2 processing area.

Backfilling of Stage 2 and 3 will continue with the addition of Stage 5A as per consent.

2.5. Production, 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)
July 22	11,788	10,514
Aug 22	21,441	12,208

Sept 22	22,152	12,272
Oct 22	23,536	18,375
Nov 22	23,752	14,453
Dec 22	9,437	14,369
Jan 23	15,492	6,376
Feb 23	13,809	14,245
Mar 23	12,840	13,887
Apr 23	6,784	11,506
May 23	7,712	15,841
Jun 23	8,600	7,197
Total	177,343	151,243

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	
Under 5mm	
Natural Sand	
Manufactured Sand	
Prepared Road Base & Sub Base	
Other Unprocessed Materials	
Construction Sand Excluding Industrial	**72,328**
Industrial Sand	
Foundry, Moulding	
Glass	
Other (Specify)	

Product	Quantity Tonnes current reporting period
TOTAL SITE PRODUCTION	**72,328**

2.6. Production Sales and Transport Next 12 Months

Production will increase from FY23 levels over the next 12 months due to the commencement of dredging in Stage 5B in 2023.

It is expected that production will increase over the next 12 months as production from Stage 5B ramps up. It is anticipated that Industrial Sand sales will continue to be strong while construction sands and blended products will improve with increased construction activities within the region and Sydney.

3. Actions to be completed from the Last Annual Review

Table 8 Completed Actions (FY22 Annual Review)

Aspect	Actions Taken	Section Discussed
Continue rehabilitation monitoring of planted sections of Swamp Oak Forest and Freshwater Wetland EEC in Stage 2 and Re-aligned Western Tributary.	Rehabilitation and Maintenance of planted sections by licenced bush regenerators has continued. Progress photos are included in Appendix E.	Appendix E
Continue backfilling and landform construction in Stage 2 and 3 s	Backfilling of Stage 3 Eastern edge has continued using VENM. Stage 2 has been backfilled with a combination of VENM and PASS.	Section 4.4.2.3 and 4.9
Continue Swamp Oak Forest planting along the edge of Stage 2 and undertake flood repair work as required.	Swamp Oak Forest planting and growth continues and further planting is planned for the FY24 year.	
Plant out a further section of Swamp Oak forest on the eastern edge of Stage 2	Planting of Swamp Oak Forest is going to commence in the FY24 year as this year there was a focus on weed containment in the current rehabilitation areas.	
Continue assessing salinity in the southern section of Stage 3 as per the recommendations in the DLSP EIS.	Salinity has been observed to decrease as dredging ceased in the southern section of Stage 3 and the saline section of Rocklow Creek.	Section 4.4.4, 4.13 and 4.14
Update Stage 2-4 Water Management for the use of site specific trigger values as per the independent auditor recommendations and to align with Stage 5 Soil and Water Management Plan. The updated plans will be combined into a one Soil and Water Management Plan	Stage 2 –4 water management plan and stage 5 soil and water mangement plan have been reviewed and will be issue to DPE in the current reporting period.	
Purchase and finalise offsets prior to commencement of Stage 5B vegetation clearing	Biodiversity credits have been retired and vegetation clearing has not commenced.	
Install nest boxes in Stage 5B prior to vegetation clearing in Stage 5B	Nest boxes were installed at Stage 5B successfully by EMM consulting.	

Review and if necessary, update management plans as per S5.C4 post Annual Review and IEA	Management plans reviewed as necessary.	

4. Environmental Performance

DLSP 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 wetter than average, with 1,715mm of rain falling over the reporting period. The highest volume month was July, which experienced 450mm of rainfall.

Typically winds during the reporting period originated from the west and west-south-west for the majority of the year. In Summer, prevailing winds were also from the north-east. These results are mostly consistent with historic trends and generally had a greater concentrations of winds from the west and north-east.

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.

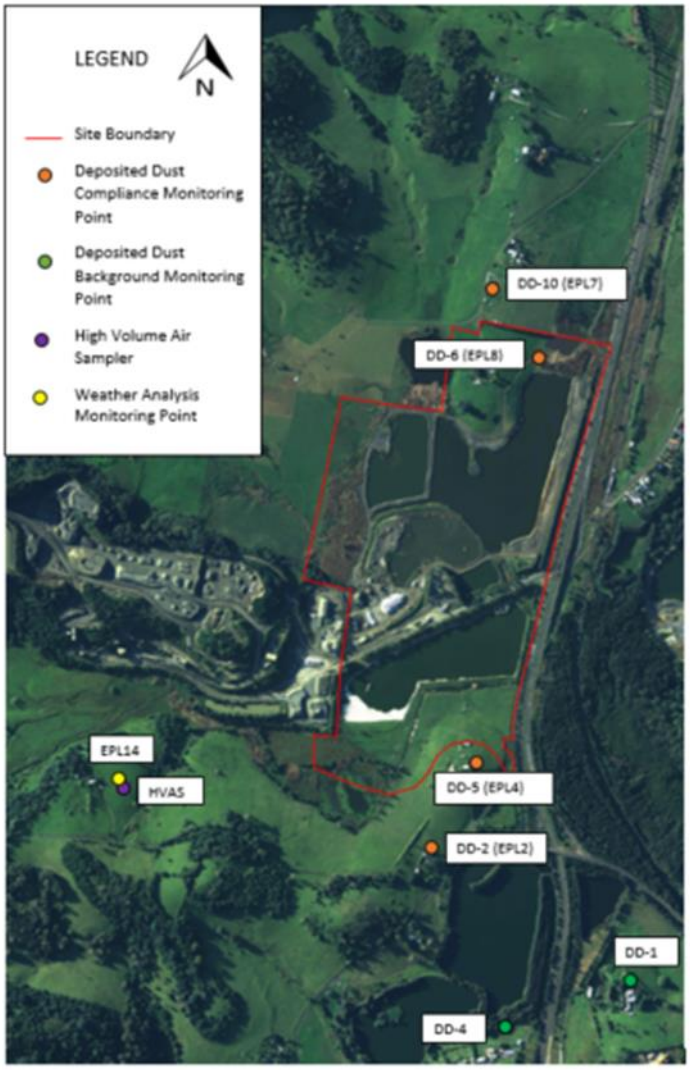


Figure 2 Air Quality Monitoring Locations

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 9.

Table 9 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 exceedances 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 10 below. Additional dust monitoring is undertaken as background and shown in Table 11.

Table 10 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
FY23 average	2.39	1.39	1.86	1.19	1.69	1.12	1.32	0.90
Criteria	4	-	4	-	4	-	4	-

Table 11 Deposited Dust Background Monitoring Summary

Month	**DD-1** grams/m^2/month		**DD-4** grams/m^2/month	
	Insoluble Solids	Ash	Insoluble Solids	Ash
FY23 average	1.83	0.82	2.87	1.57
Criteria	4	-	4	-

Monitoring sites recorded similar values for insoluble solids, indicating that regional conditions are the largest contributors to measured dust levels rather than development operations at DLSP. These findings are within expectations as resource extraction at DLSP is a wet process.

The DD-4 monitoring location was again observed to be higher for insoluble solids, however possessed a similar ash fraction to other monitoring sites. This is again within expectation as the DD-4 monitor is located in the immediate vicinity of the constructed wetlands as part of the Stage 1 rehabilitation at Swamp Road. 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.

The DD-1 and DD-4 monitoring locations are not compliance monitoring points, however measured dust as insoluble solids are still below the impact assessment criteria of 4g/m^2/month.

Minor elevated readings were recorded in the month of July 2022 at DD-2 and December 2022 at DD-5. The wind direction was predominantly from the west in July and from the west in December (see Figure 26 and 27 in Appendix A). These wind directions are not from the direction of DLSP operations at these monitoring locations and are likely reflective of ambient conditions rather than operations. Despite these elevated readings, monitoring results were well below impact assessment criteria and compliance thresholds.

The rolling 12 month average for insoluble solids at each monitoring location was below 4g/m^2/month, as shown by the green line in Figure 3 to 8. This demonstrates that operations were compliant during most stages of the reporting period despite the external influences.

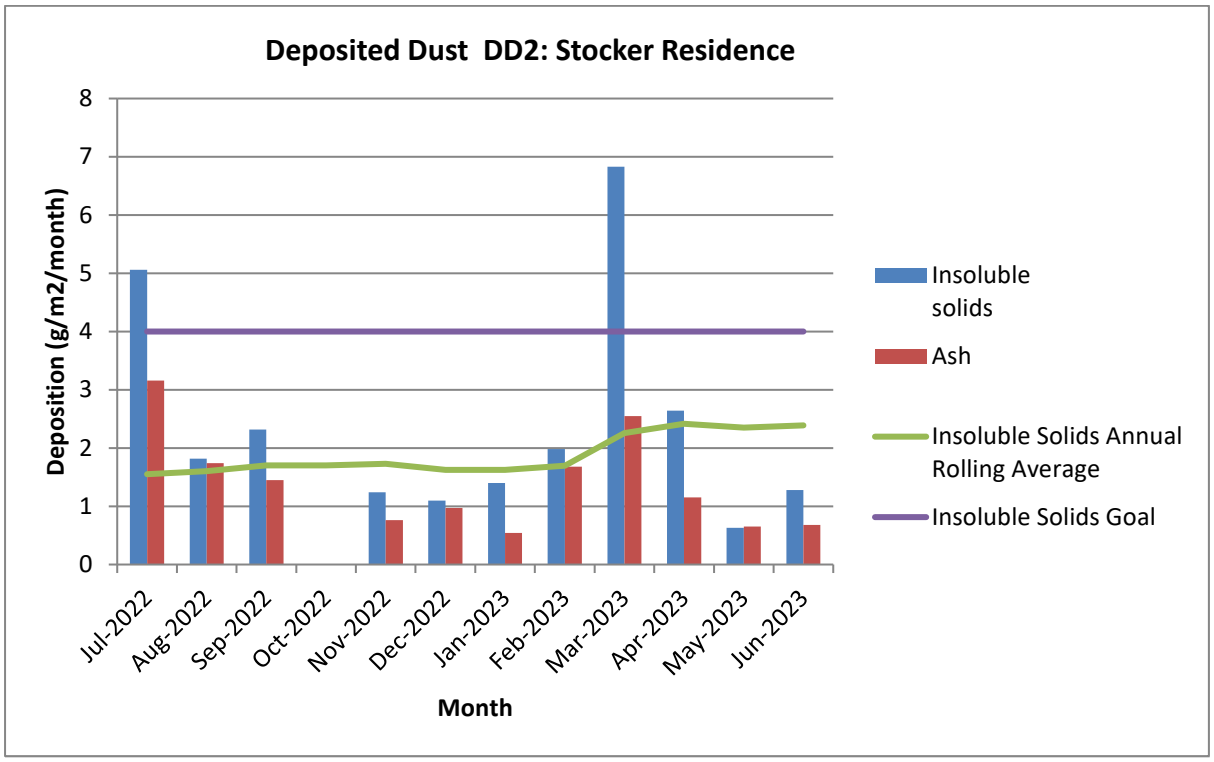


Figure 3 DD-2 Deposited Dust Monitoring Summary

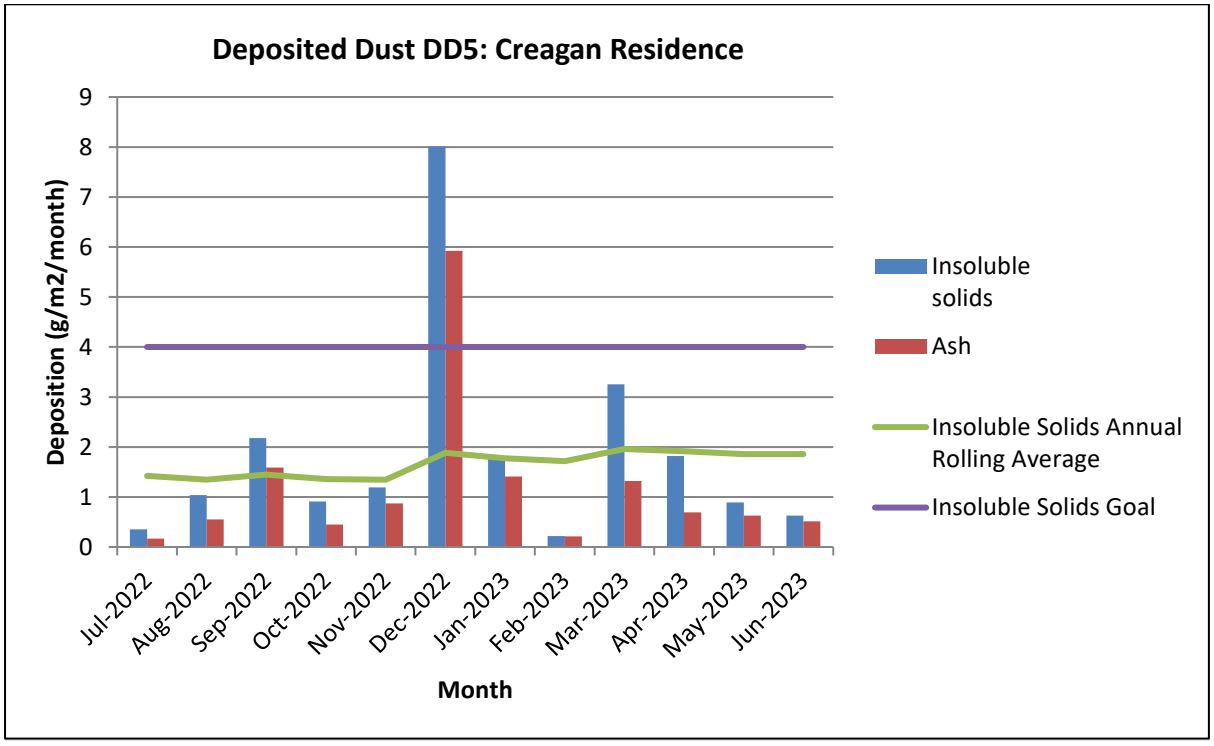


Figure 4 DD-5 Deposited Dust Monitoring Summary

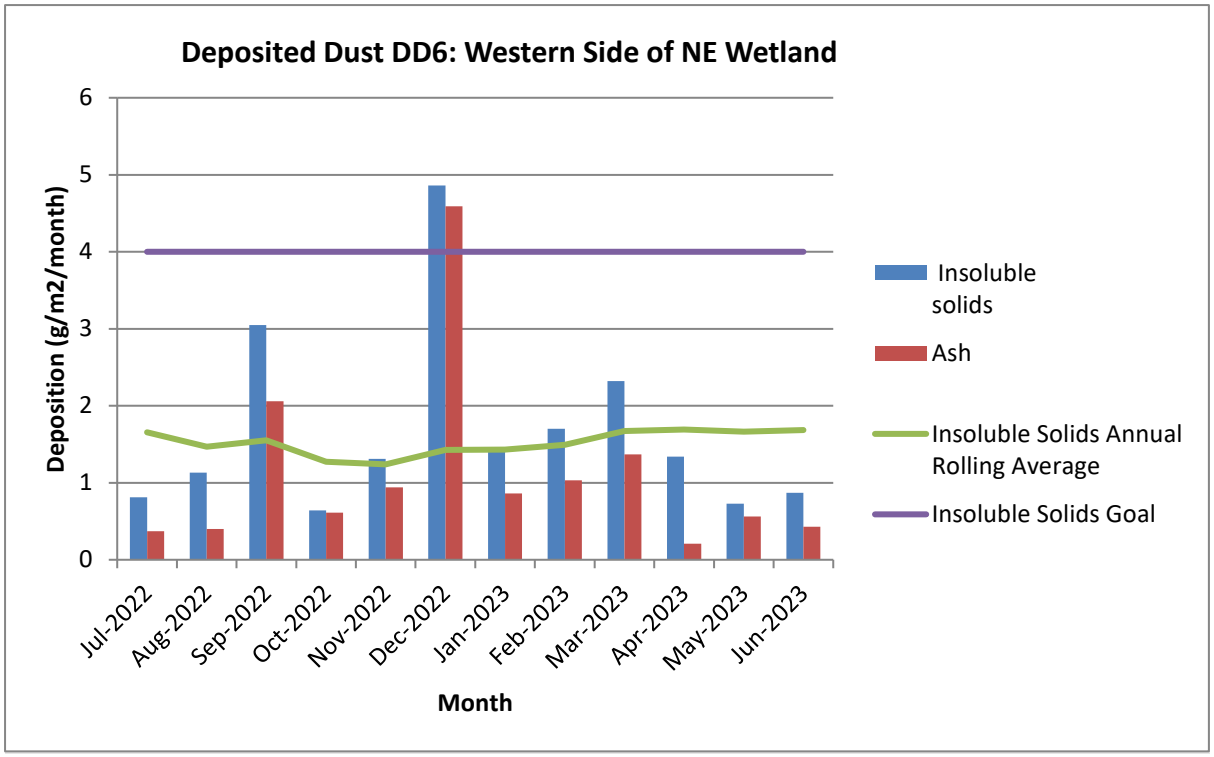


Figure 5 DD-6 Deposited Dust Monitoring Summary

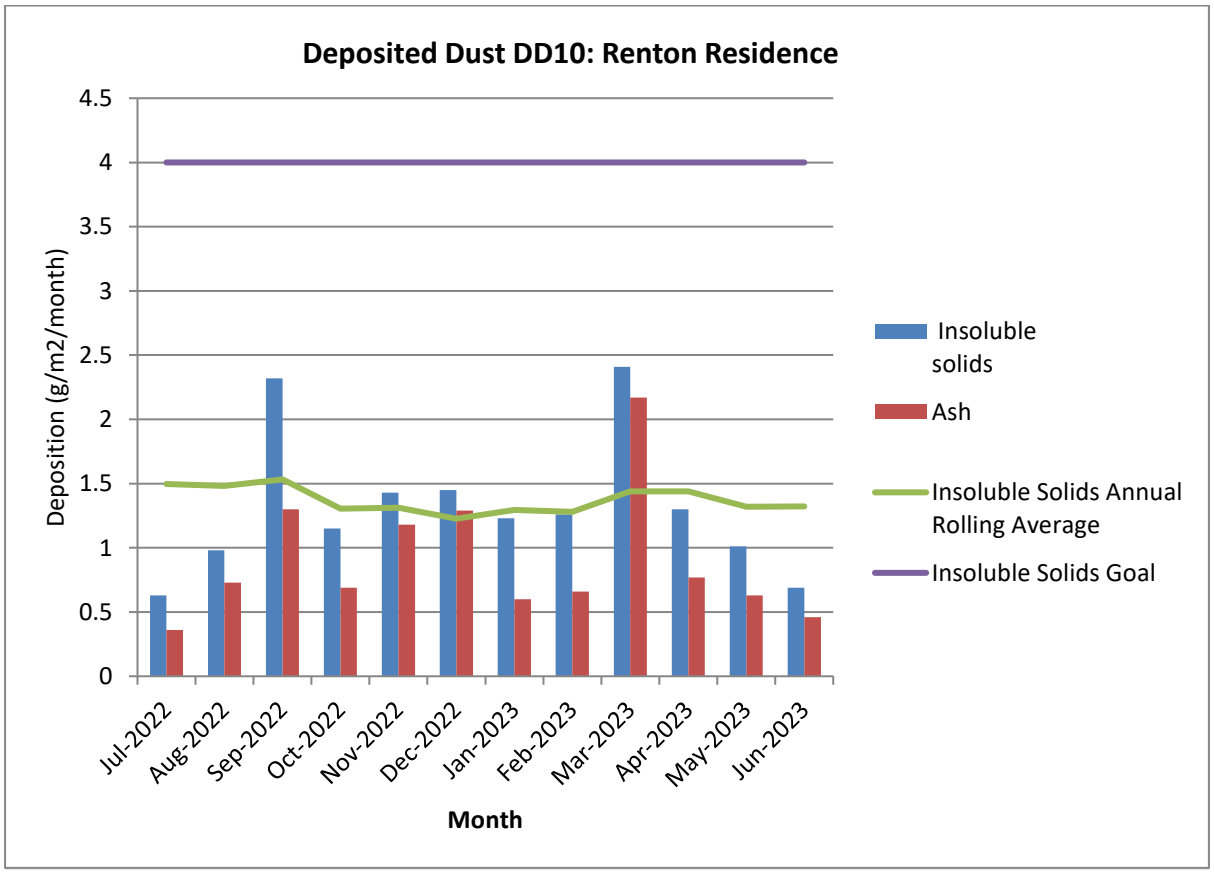


Figure 6 DD-10 Deposited Dust Monitoring Summary

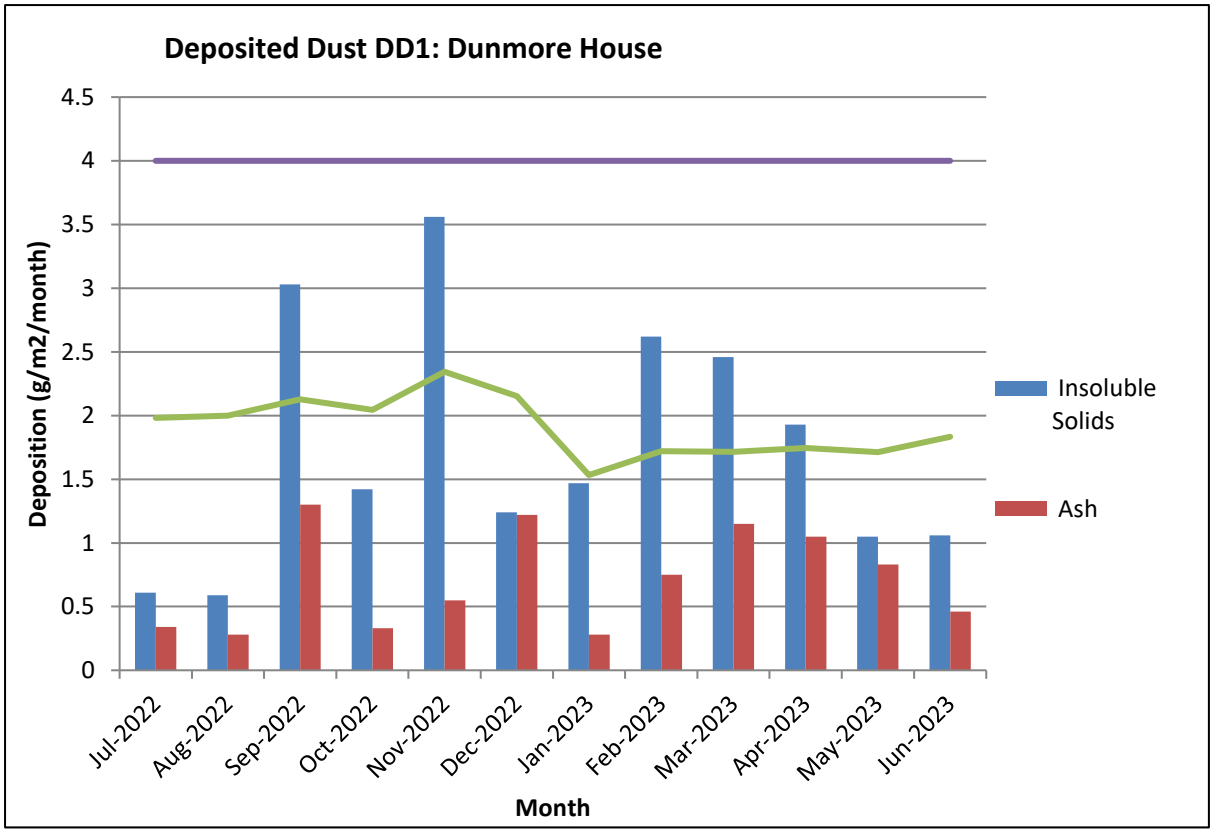


Figure 7 DD-1 Deposited Dust Monitoring Summary

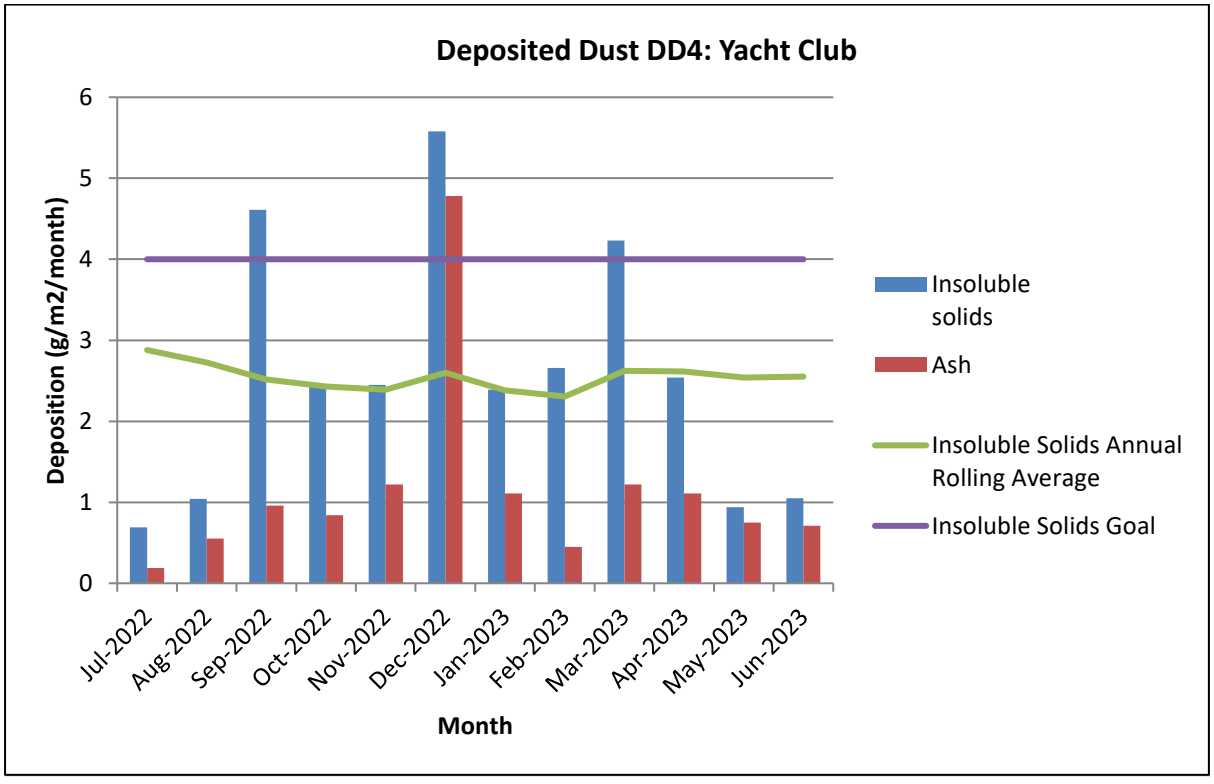


Figure 8 DD-4 Deposited Dust Monitoring Summary

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 12.

Table 12 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

a Cumulative impacts (ie increases in concentration due to development plus all other sources) b Incremental impact (ie increases in concentration alone, with zero allowable exceedances of criteria over the life of the development. d Excludes extraordinary events such as bushfires, prescribed burning, dust storms, sea fog, fire incidents or any other activity as agreed by the Secretary

4.2.4. Particulate Monitoring Performance Review

PM_{10} readings from the current reporting period can be seen in Figure 9 below.

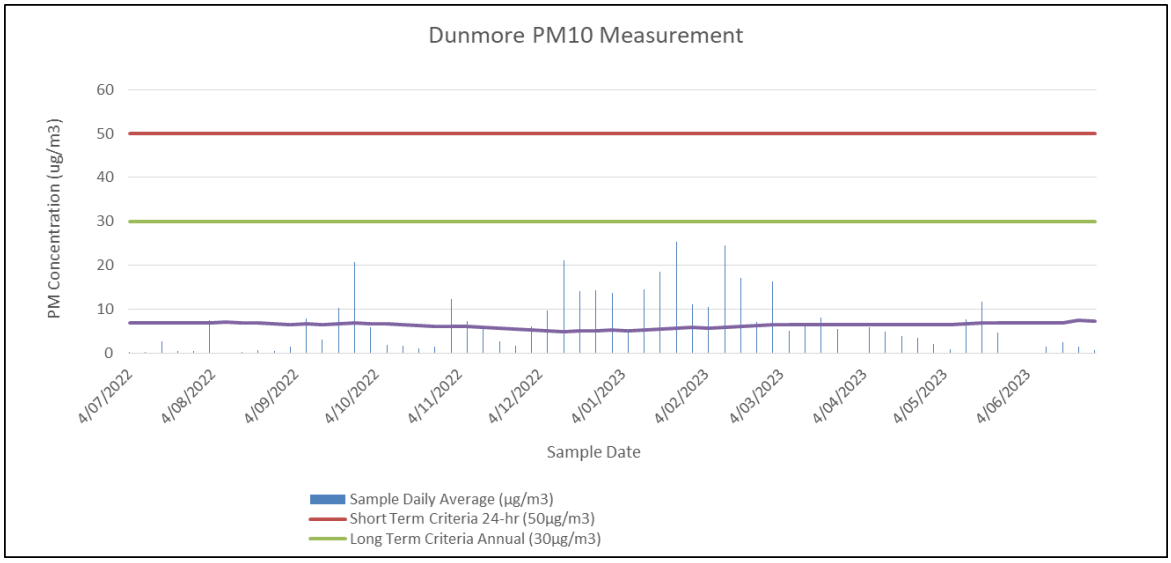


Figure 9 Dunmore PM_{10} Monitoring Summary

The annual average PM_{10} measurement for the reporting period was below the long term impact assessment criteria of 30 µg/m³ for PM_{10} and 90 µg/m³ for TSP. The PM_{10} measurements were also similar to the Albion Park South air quality monitoring station's annual averages.

There were no readings above the short term criteria for PM_{10} of 50 µg/m³.

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 13 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 HVAS PM_{10}	7.06	10.9	12.29
Derived TSP	17.65	27.25	30.725

4.2.5. Air Quality Monitoring Long Term Analysis and Trends

A graph of long term trends can be found in Figure 10 below and typically shows that deposited dust observed at the site has decreased over time.

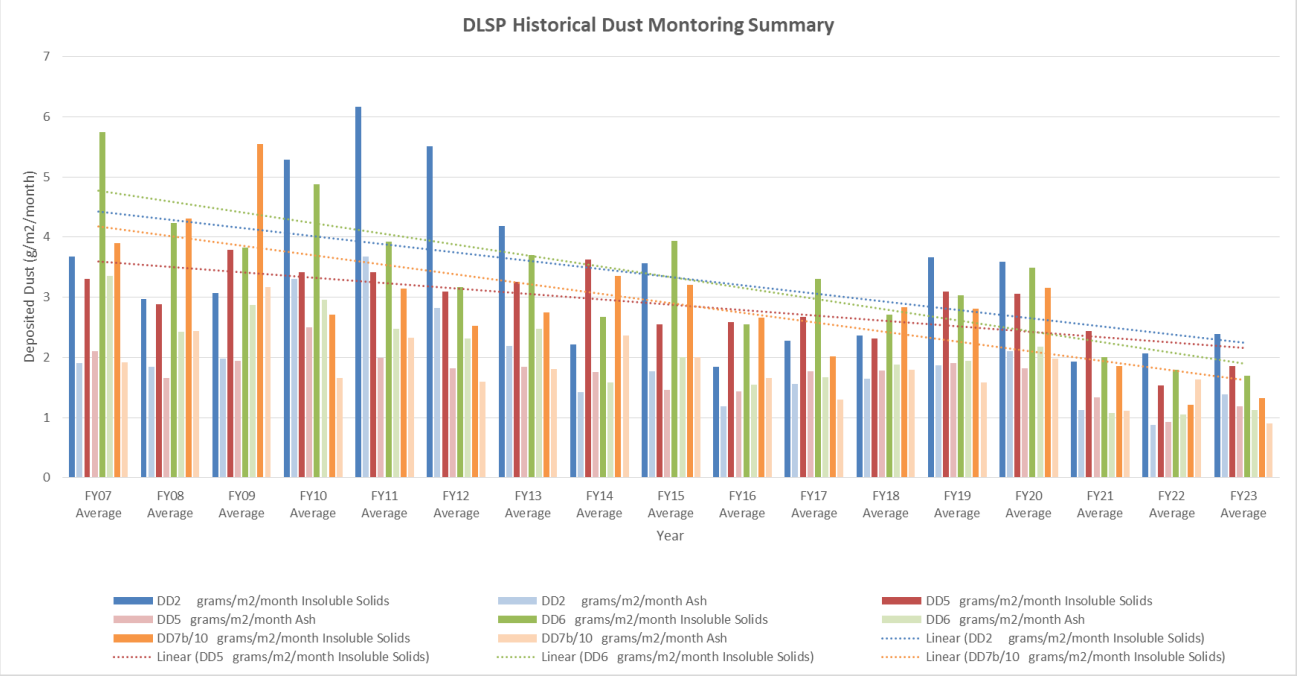


Figure 10 Historical Deposited Dust Trends

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 by the PM_{10} measurements and is generally reflective of regional conditions as a whole.

Figure 11 shows a 90 day average in black, which illustrates a seasonal fluctuation of measured PM_{10} values. A trend can be observed whereby 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} monitor available on the OEH website (https://www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility).

These trends indicate the measured PM_{10} and deposited dust values are typically influenced by ambient local conditions rather than development operations at DLSP.

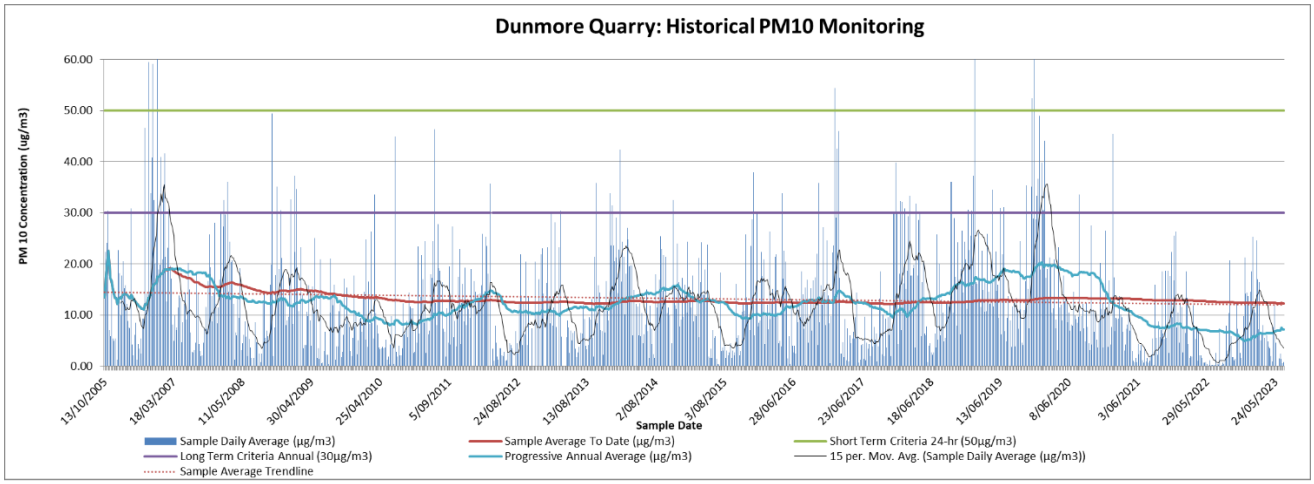


Figure 11 PM_{10} Historical Monitoring Trends

4.2.6. Air Quality Monitoring Summary and Opportunities for Improvement

Deposited dust measurements were observed to occur below the impact assessment criteria for all compliance monitoring points. Derived TSP and PM_{10} measurements were generally observed to be below the impact assessment criteria for all time periods. 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.

As part of the updated AQMP, DLSP will utilise the real time dust monitoring network from the adjacent Boral Dunmore Quarry operations. A monitor has been located adjacent to the Stage 5 extraction area. This will allow a proactive approach in identifying and reacting to adverse meteorological and air quality conditions as per the approved trigger action response plan which forms part of the Air Quality Management Plan.

4.3. Noise Monitoring

Annual Noise Monitoring is undertaken during winter each year to determine the contribution by DLSP to noise impacts experienced at nearby private residences. 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 EPL 11147 and S3.C13 from DA 195-8-2004 are reproduced below in Table 14.

Table 14 Summary of Noise Monitoring Data

Table 4 Attended Monitoring Locations and Consent Criteria

ID[2]	Description[3]	Day[1]	Evening[1]	Night[1]	Morning Shoulder[1]
		dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)	dB LAeq(15min)
DN-6	Renton	46	43	37	46
DN-7	Dunmore Village	49	44	41	47
DN-8	Stocker (R20)	49	44	38	47
DN-9	R17	48	43	38	48
DN-10	R14	48	43	38	48
DN-11	R11	48	43	38	48
DN-12	R3	48	43	38	48
DN-13	R4	47	43	38	43

Note 1: 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.

Note 2: Referenced from DLSP NMPv7 Figure 3 and Figure 4.

Note 3: Referenced from DLSP NMPv7 Table 7.

Table 5 Attended Monitoring Locations and Maximum Noise Trigger Levels

ID[2]	Description[3]	Night (10pm - 12am)	Morning Shoulder (6am - 7am)
		dB LAmax	dB LAmax
DN-9, DN-10, DN-11 and DN-12	R1, R2, R3, R11, R12, R13, R14, R15, R16, R17 and R18	61	
DN-13	R4, R5, R6, R7, R8, R9, R10	53	
DN6, DN7 and DN-8	Renton, Dunmore Village and Stocker	N/A	

Note 1: Referenced from DLSP NMPv7 Table 8.

Note 2: Referenced from DLSP NMPv7 Figure 1, Figure 2, Figure 3 and Figure 4.

Note 3: Referenced from DLSP NMPv7 Table 7.

4.3.2. Noise Monitoring Performance Review

Noise monitoring was conducted in accordance with the Noise Management Plan (V5) and in general accordance with the NSW Environment Protection Authority (EPA), Noise Policy for

Industry (NPfI). The results of the monitoring are summarised within the Annual Noise Monitoring Assessment 2022, prepared by Muller Acoustic Consulting Pty Ltd and included in Appendix C.

The report includes a compliance assessment summary for each monitoring location (refer table 14) which is excerpted in Table 15. It illustrates that annual noise monitoring data complied with project noise limits described all times.

Table 15 Annual Compliance Noise Monitoring Report

Table 14 Noise Compliance Assessment Summary

Location	Estimated Noise Contribution dB LAeq(15min)			Criteria dB LAeq(15min)		Compliant		
	Day (Round 1)	Day (Round 2)	Evening	Day	Evening	Day (Round 1)	Day (Round 2)	Evening
DN-6	<40	<41	<43	46	43	✓	✓	✓
DN-7	<47	<47	<44	49	44	✓	✓	✓
DN-8	<40	<41	<36	49	44	✓	✓	✓
DN-9	<39	<38	<35	48	43	✓	✓	✓
DN-10	<36	<38	<35	48	43	✓	✓	✓
DN-11	<45	<45	<33	48	43	✓	✓	✓
DN-12	<36	<36	<32	48	43	✓	✓	✓
DN-13	<35	<35	<34	47	43	✓	✓	✓

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.

Table 15 Noise Compliance Assessment Summary

Location	Estimated Noise Contribution				Criteria				Compliant			
	Night		Morning Shoulder		Night		Morning Shoulder		Night		Morning Shoulder	
	dB LAeq(15min)	dB LAmax	dB LAeq(15min)	dB LAmax	dB LAeq(15min)	dB LAmax	dB LAeq(15min)	dB LAmax	dB LAeq(15min)	dB LAmax	dB LAeq(15min)	dB LAmax
DN-6	<37	N/A	<40	N/A	37	N/A	46	N/A	✓	N/A	✓	N/A
DN-7	<41	N/A	<47	N/A	41	N/A	47	N/A	✓	N/A	✓	N/A
DN-8	<35	N/A	<37	N/A	38	N/A	47	N/A	✓	N/A	✓	N/A
DN-9	<30	<40	<36	<40	38	61	48	61	✓	✓	✓	✓
DN-10	<36	<36	<36	<40	38	61	48	61	✓	✓	✓	✓
DN-11	<30	<40	<42	<42	38	61	48	61	✓	✓	✓	✓
DN-12	<30	<40	<39	<40	38	61	48	61	✓	✓	✓	✓
DN-13	<30	<40	<39	<40	38	53	43	53	✓	✓	✓	✓

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 12 below. Noise monitoring results were generally higher in the current reporting period, despite 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.

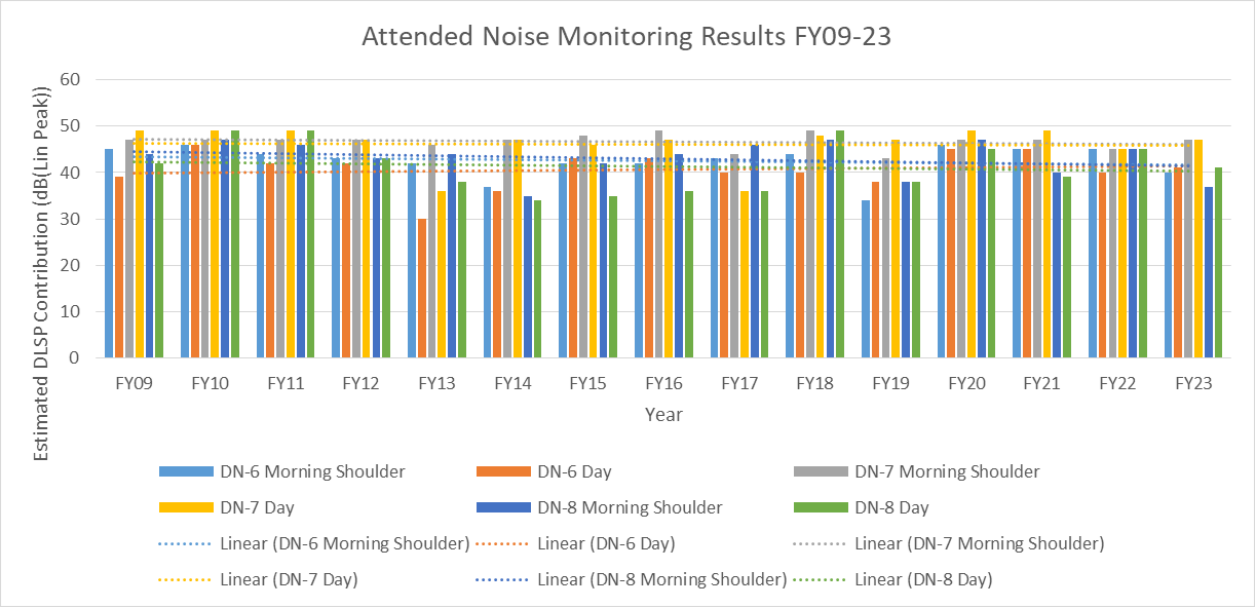


Figure 12 Noise Monitoring Historical Noise Monitoring Trends

4.3.4. Noise Monitoring Summary and Opportunities for Improvement

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

Immediate access to weather data facilitated by the weather station has allowed the site to improve their processes in reacting to adverse meteorological conditions, which may affect noise impacts on nearby sensitive receptors, such as temperature inversions.

4.4. Surface Water Monitoring

Project related water monitoring locations are shown in shown in Figure 13. Monitoring locations denoted by "*" have a variable location due to dredging operations. Monitoring is undertaken on a monthly basis, consistent with EPL 11147 requirements.

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 this is the only monitoring location that has been activated for this frequency.

Discharge water quality monitoring indicated compliance with the impact criteria at the licenced discharge point of the site at DW20b (EPL9), during all periods. Additionally, 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 were of better quality than those at upstream locations with the exception of salinity and associated parameters.

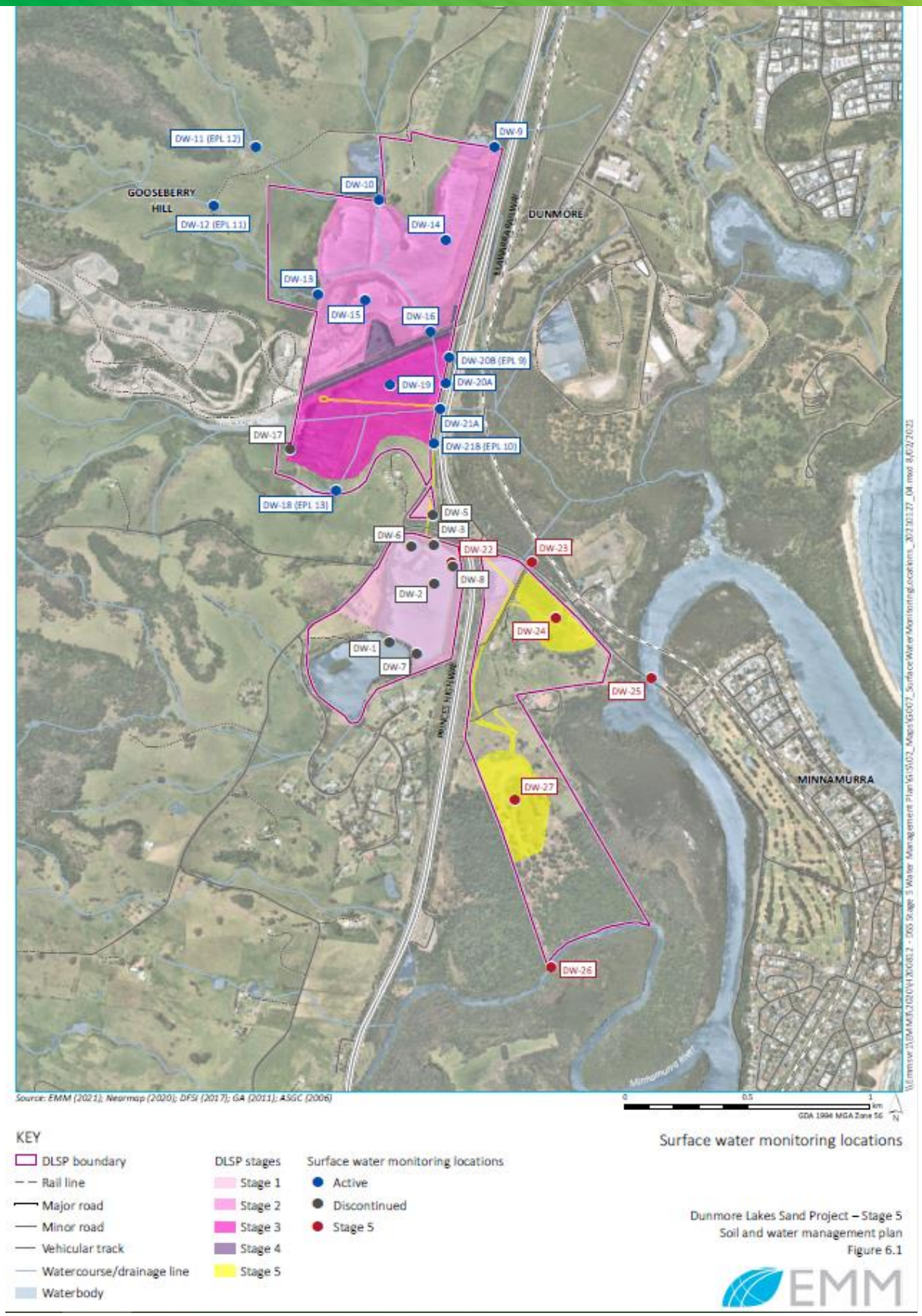


Figure 13 Surface Water Monitoring Locations

4.4.1. Surface Water Quality Impact Criteria

There are 5 compliance monitoring points listed in EPL 11147 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 reproduced below in Table 16.

Table 16 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)

With the commencement of Stage 5A operations There are now three water quality compliance operational monitoring points at DLSP. These are the dredge ponds in Stage 2 (DW-14), Stage 3 (DW-19) and Stage 5A (DW24) The Water Quality Objectives (WQO) associated with the dredge ponds is detailed below in Table 17.

Table 17 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

Pollutant	Unit of Measure	Water Quality Objective
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

DPIE has acknowledged 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

4.4.2.1. Ambient Monthly Monitoring

A summary of the water quality monitoring points is shown below in Table 18. The dredge pond (DW-24) and discharge point (DW20b) are shown in grey. Parameters outside of the water quality objectives are highlighted orange. Monitoring sites in white are upstream monitoring locations and are monitored for background purposes only.

Table 18 Surface Monitoring Summary (red denotes an exceedance of the relevant criteria)

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)	Sodium (mg/L)	Total Phosphorus (µg/L)	Ammonia -N (mg/L)	Bicarbonate Alkalinity (mg/L)	Total Nitrogen (mg/L)	Dissolved Oxygen (mg/L)	Faecal Coliforms (CFU/100mL)	Enterococci (CFU/100mL)	Total Algae (cells/ml)	Chlorophyll-a (mg/m3)*
DW9	7.7	64.3	61.4	373	29	49	1	7	9	35	95	0.15	81	686	8	595	7	2280	6
DW10	6.9	15.1	17.2	306	26	49	1	6	7	24	86	0.08	73	478	8	2151	14	366	4
DW11	7.7	14.5	24.0	811	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
DW12	7.0	16.1	14.0	240	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
DW13	7.0	11.7	9.4	558	31	60	1	6	13	49	148	0.07	162	478	8	599	/	147	2
DW14	7.9	30.0	17.2	439	63	41	1	4	10	33	110	0.15	123	847	8	162	/	982	5
DW15a	7.7	325.4	318.1	506	82	56	1	6	9	44	110	0.08	122	937	8	124	9	4637	12
DW16	7.6	26.4	19.7	464	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
DW18	7.0	29.4	43.7	488	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
DW19	7.5	35.2	19.3	375	36	58	1	8	7	30	180	0.05	93	919	8	38	/	2164	6
DW20b	7.6	27.2	16.2	426	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
DW21a	7.2	13.0	20.1	5050	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
DW22	7.3	6.7	8.5	158	9	24	0	3	4	12	0	0	44	100	8	43	/	15979	18
DW23	7.1	3.8	27.5	26723	1369	10167	0	239	373	9262	0	0	158	200	8	96	/	933	21
DW24	7.7	78.8	42.25	367	52	49	3	6	14	54	0	0	85	100	8	26	/	3897	12
DW25	8.0	4.1	46.5	42050	2237	17768	1	544	874	7156	0	0	121	1400	8	3	/	59	2
DW26	7.5	8.7	20.5	12470	618	4489	0	132	285	1365	0	0	82	100	8	159	/	700	11

Stage 2 and Stage 3 ponds (DW-14 and DW-19 sampling points respectively) are no longer operational dredge ponds however the Water Quality Objectives are still applied as part of ongoing water management of the site.

There was only one active dredge pond (Stage 5A) monitoring site (DW24) within the reporting period.

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.

As recommended during the EIS process, water quality monitoring of the Stage 3 pond area has continued in order to determine if there are any long term salinity issues arising. The concern related to the dredge ponds intersecting with saline tidal groundwater aquifers which could result in surface water quality deterioration and potential risk to rehabilitation sustainability.

Data from the 2022 reporting period exhibited that Stage 3 has not caused a direct linkage with saline groundwater and that salinity levels have tended to vary in accordance with prevailing climatic conditions.

4.4.2.2. Discharge Water Quality Monitoring

Discharge water quality monitoring undertaken during the reporting period was within limits prescribed in condition S3.C23 of the consent during all instances of sampling except for the discharge event sampled on 09/02/2023, when a TSS reading of 346 was recorded in the lab. A breakdown of discharge water quality monitoring results at DW20b is summarised below in Table 19.

Table 19 Discharge Surface Water Monitoring Results

Sample Type	Date Sampled	48 hr Rainfall (mm)	pH	TSS (mg/L)
Jul Monthly	21/07/2022	14	7.6	11
Jul 50mm	**06/07/2022**	**476**	**7.2**	**20**
Aug Monthly	25/08/2022	13	7.7	21
Sept Monthly	27/09/2022	3	8	19
Sept 50mm	**30/09/2022**	**51**	**7.9**	**30**
Oct Monthly	25/10/2022	64	7.4	17
Oct 50mm	**07/10/2022**	**57**	**7.8**	**44**
Oct 50mm	**10/10/2022**	**70**	**7.7**	**36**
Oct 50mm	**22/10/2022**	**52**	**7.3**	**50**
Nov Monthly	23/11/2022	0	7.7	13
Dec Monthly	/	/	/	/
Jan Monthly	19/01/2023	9	7.2	7
Feb Monthly	23/02/2023	22	7.7	13
Feb 50mm	**09/02/2023**	**177**	**7.3**	**346**

Mar Monthly	23/03/2023	1	7.6	22
Mar 50mm	**15/03/2021**	**64**	**7.4**	**31**
Apr Monthly	20/04/2023	1	7.5	17
May Monthly	18/05/2023	11	7.7	22
Jun Monthly	/	/	/	/
FY21 Average	/	/	7.6	42

Seven (7) rainfall events throughout the reporting period triggered Special Frequency 1 water monitoring to be undertaken as per EPL 11147. Special Frequency 1 requires sampling to be undertaken within 24 hours of 50mm or more of rainfall within a 48 hour period. These events are highlighted in bold on Table 19 and were:

- 2-5 July 2022 (476.4mm in 96 hours)
- 28-30 September 2022 (51.2mm in 72 hours)
- 6-7 October 2022 (56.8mm in 48 hours)
- 7-9 October 2022 (70.1mm in 72 hours)
- 21 October 2022 (52.2mm in 24 hours)
- 8-10 February 2023 (177.2mm in 72 hours)
- 13-15 March 2023 (63.6mm in 72 hours)

4.4.2.3. Water Monitoring after Placement of PASS

Special Frequency 2 water monitoring is required in ponds where Potential Acid Sulphate Soils (PASS) has been placed as per E1.8 note of EPL 11147. Special Frequency 2 is required to be conducted daily during the PASS placement into water and thereafter daily during operational hours for a period of one month from the date the last load of PASS was placed under water. The pH of the water must be monitored weekly at all other times.

During the reporting period, PASS was placed in the Stage 2 pond DW 14 (placement commenced 26 June 2018) and the Fines Pond 2 DW15a (placement commenced 13 February 2020). No PASS has been placed in Stage 3.

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. There were two campaigns in the reporting period – one between July and September 2022 and one small campaign in November 2022.

A summary of the water quality monitoring after placement of PASS in the Stage 2 dredge pond is shown below in Figure 14 and 15.

An increase in the pH in June 2023 has been noted and will be managed in the current reporting period.

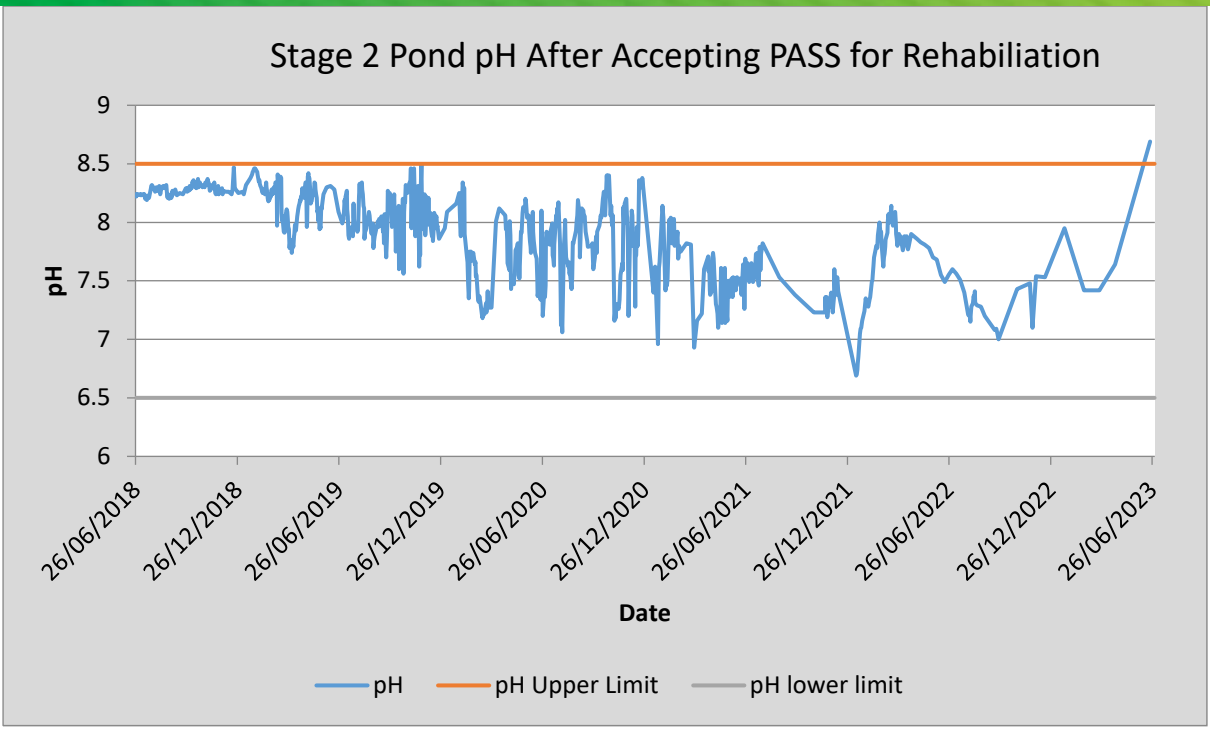


Figure 14 Stage 2 Pond pH After Accepting PASS

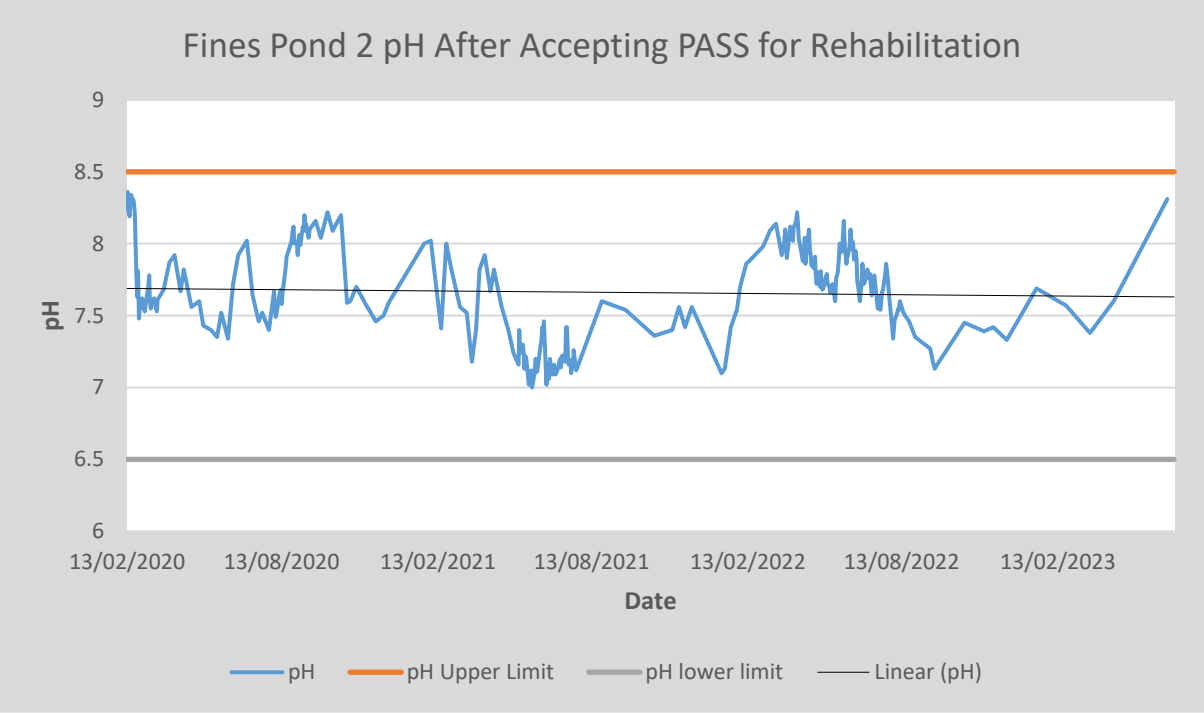


Figure 15 Fines Pond 2 After Accepting PASS for Rehabilitation

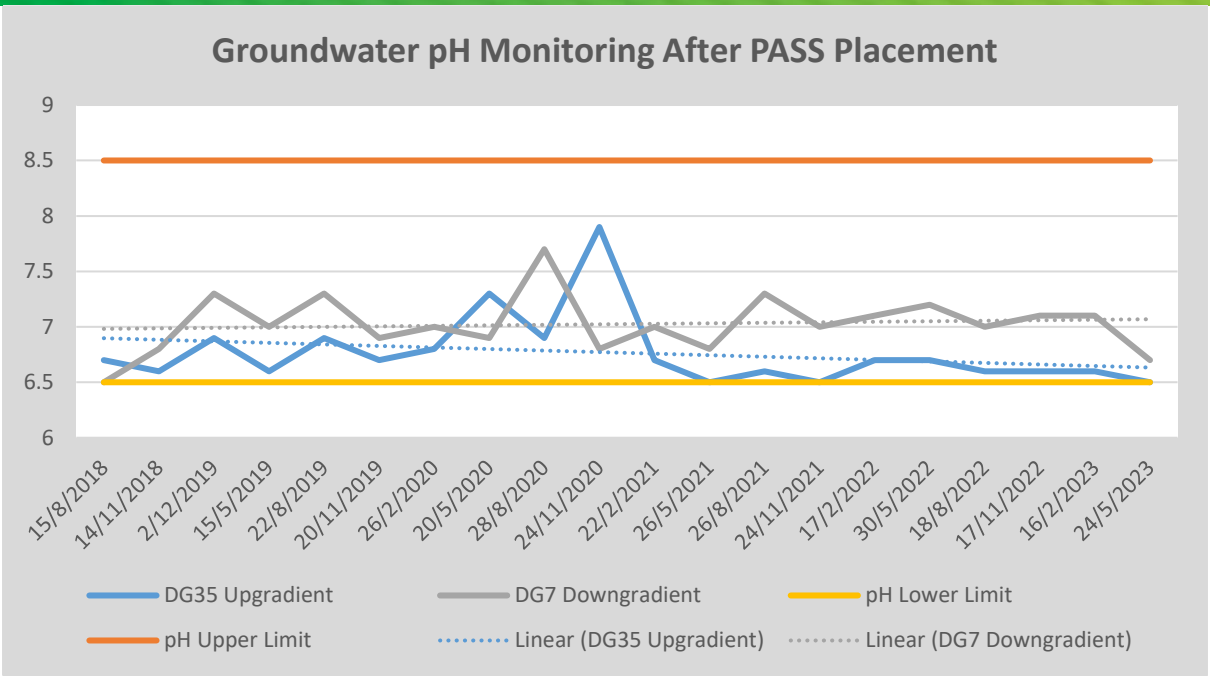


Figure 16 Groundwater pH After Accepting PASS for Rehabilitation

4.4.3. Surface Water Monitoring Long Term Assessment and Analysis

Graphs of Water Quality over time can be seen below in Figure 17 to Figure 20.

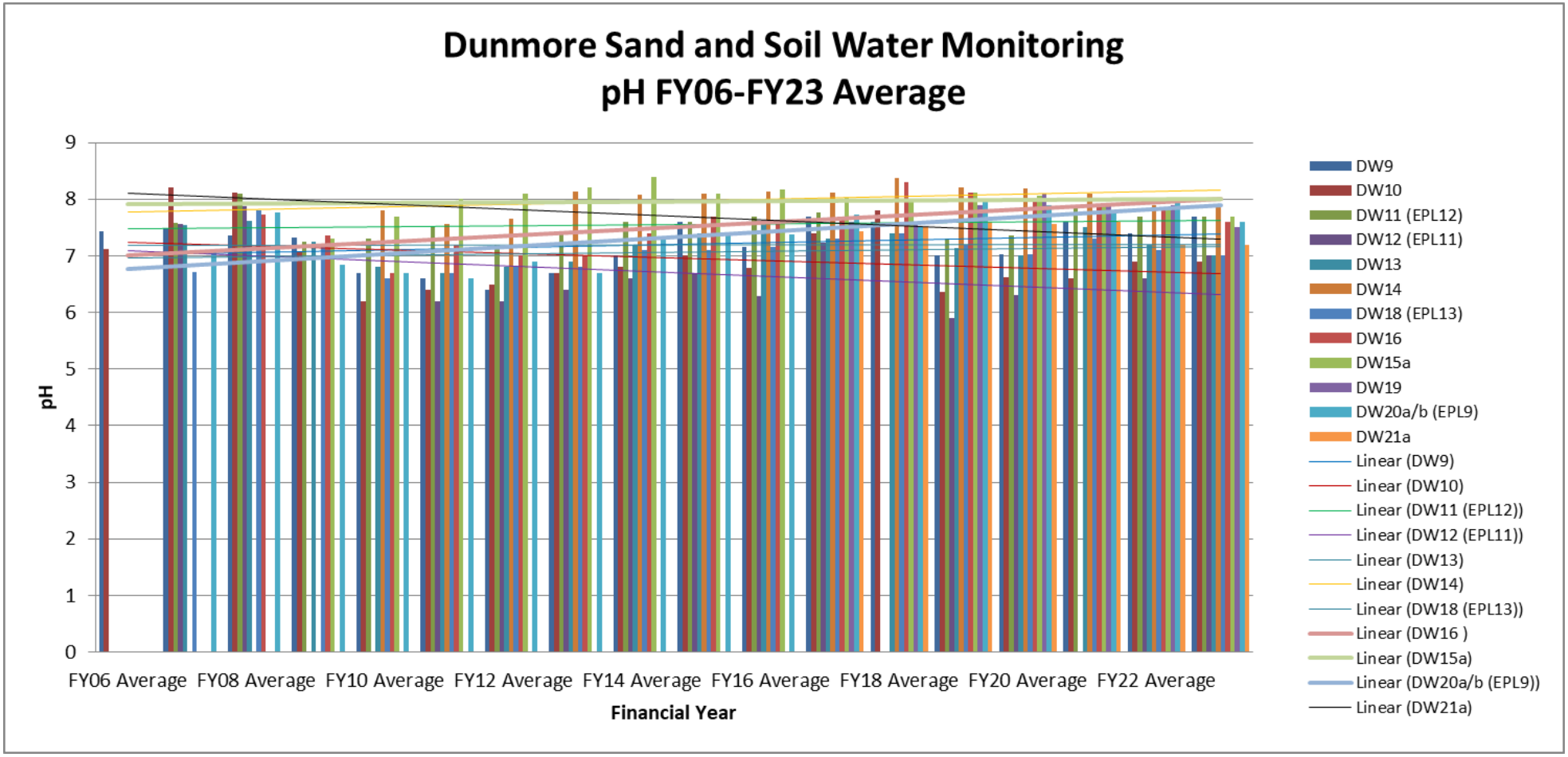


Figure 17 Surface Water pH Historical Monitoring Trends

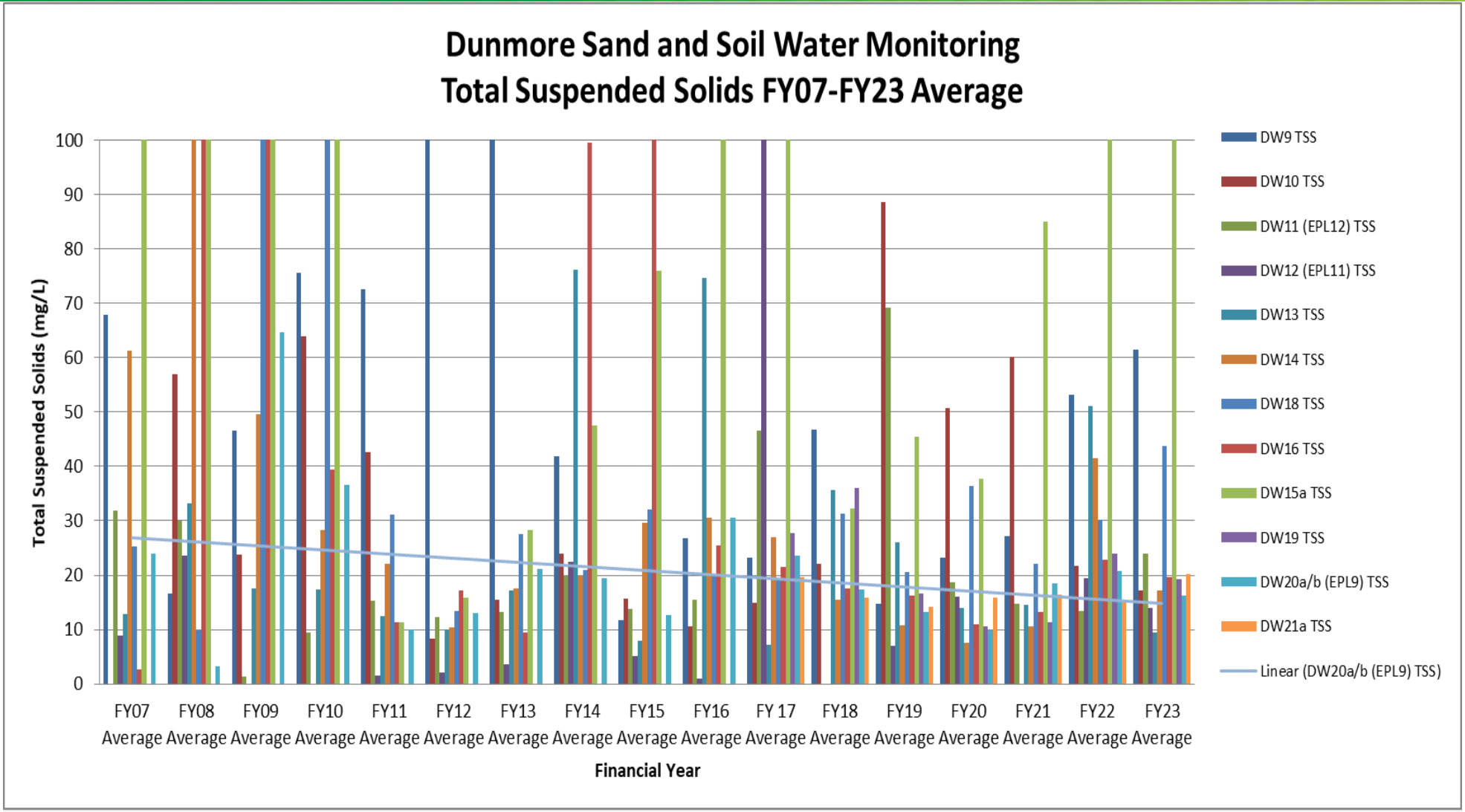


Figure 18 Surface Water TSS Historical Monitoring Trends

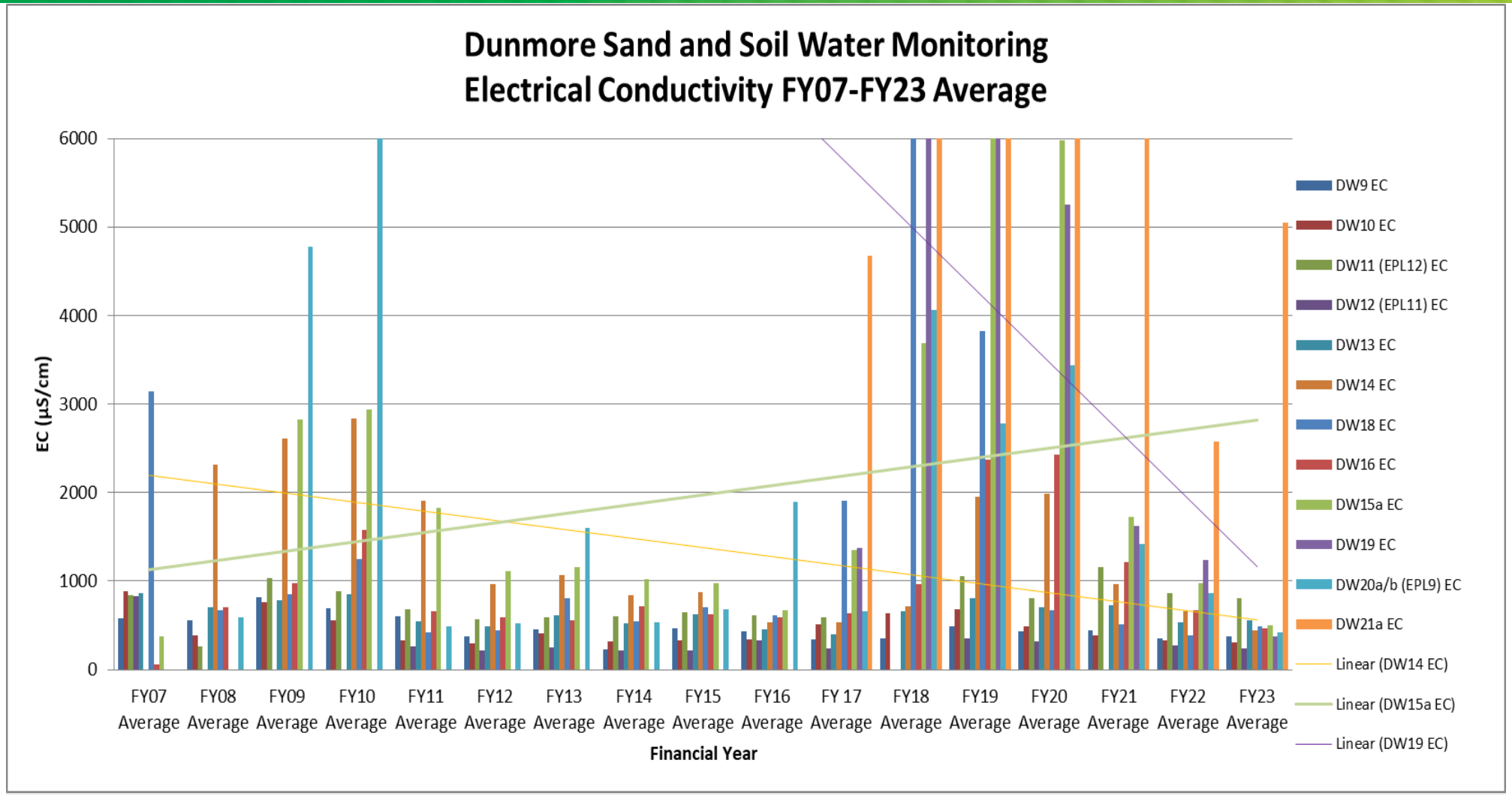


Figure 19 Surface Water Conductivity Historical Monitoring Trends

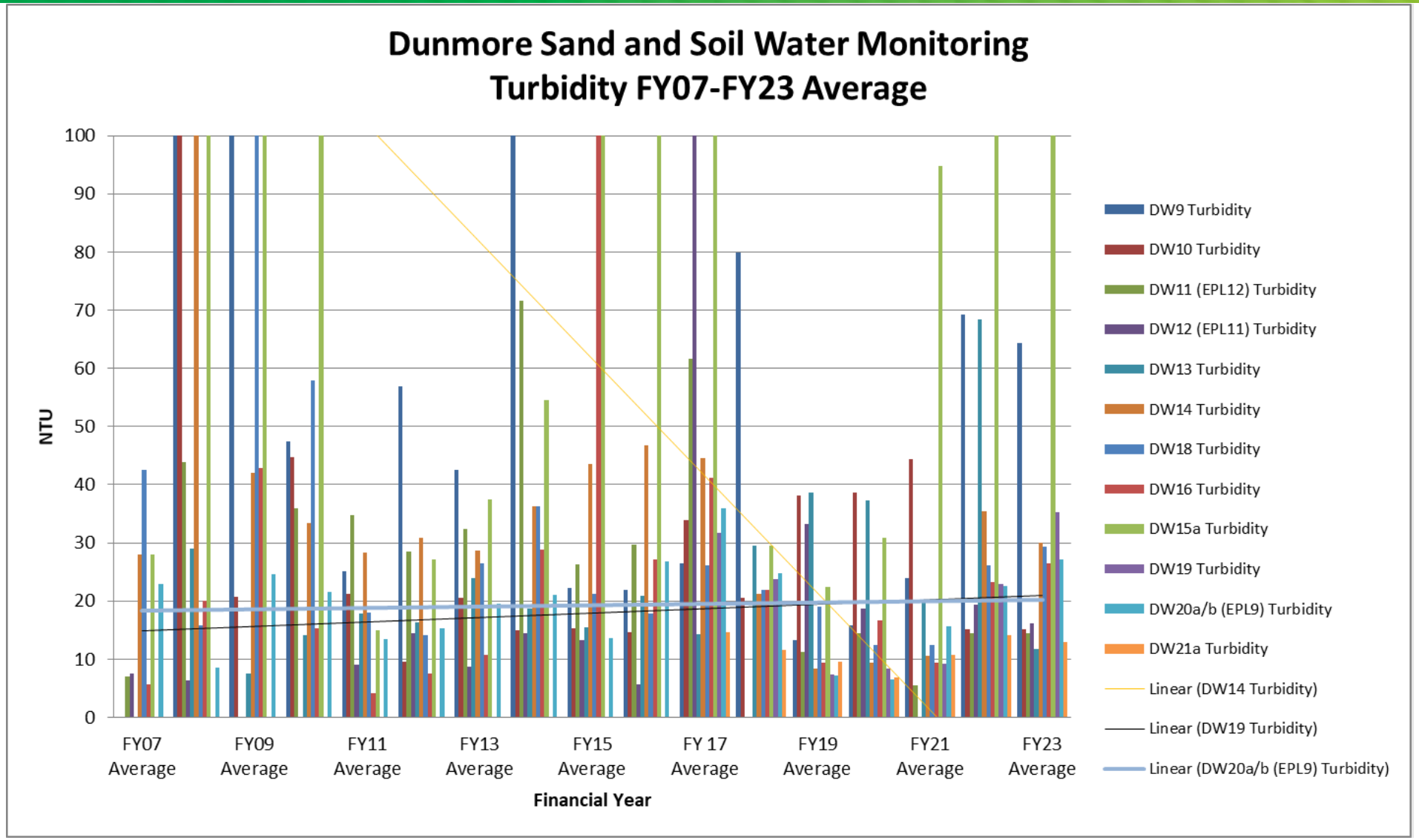


Figure 20 Surface Water Turbidity Monitoring Historical Trends

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 (DW-19) and Rocklow Creek (DW21a), 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.

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.

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 of Stage 5A is expected to commence in the next 12 months to allow the site to move toward its final landform in accordance with the progressive rehabilitation requirements.

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 runoff from three upstream catchments is generally captured in farm dams and bunding around the Stage 2 area. High flow events and floodwaters however enter Stage 2 and ultimately flow into the Stage 3 area. The main channel of Rocklow Creek has been diverted around the Stage 3 area which is joined by controlled discharge waters from the Stage 3 pond spillway. The system allows for the return of environmental flows into the Rocklow Creek catchment below the site. During flood events, sand extraction ceases. During the reporting period, flooding occurred a number of times. 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

Water contained within the extraction ponds is used for all raw water demand, including processing and dust control. A 30,000 L water cart operates on site on all operational nonrain days to reduce dust from unsealed roads, particularly the roads used by trucks delivering VENM. During the reporting period, the number of rain-days decreased from 162 to 124 which, coupled with the days when the site was flooded, increased the volume used for dust suppression to approximately 20ML.

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 177,343 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).

The calculated total water use 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. Given the proximity of groundwater to the surface there is 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 fines pond is bunded to a minimum 3.7m AHD as shown in the surveyed points in Figure 21 below.

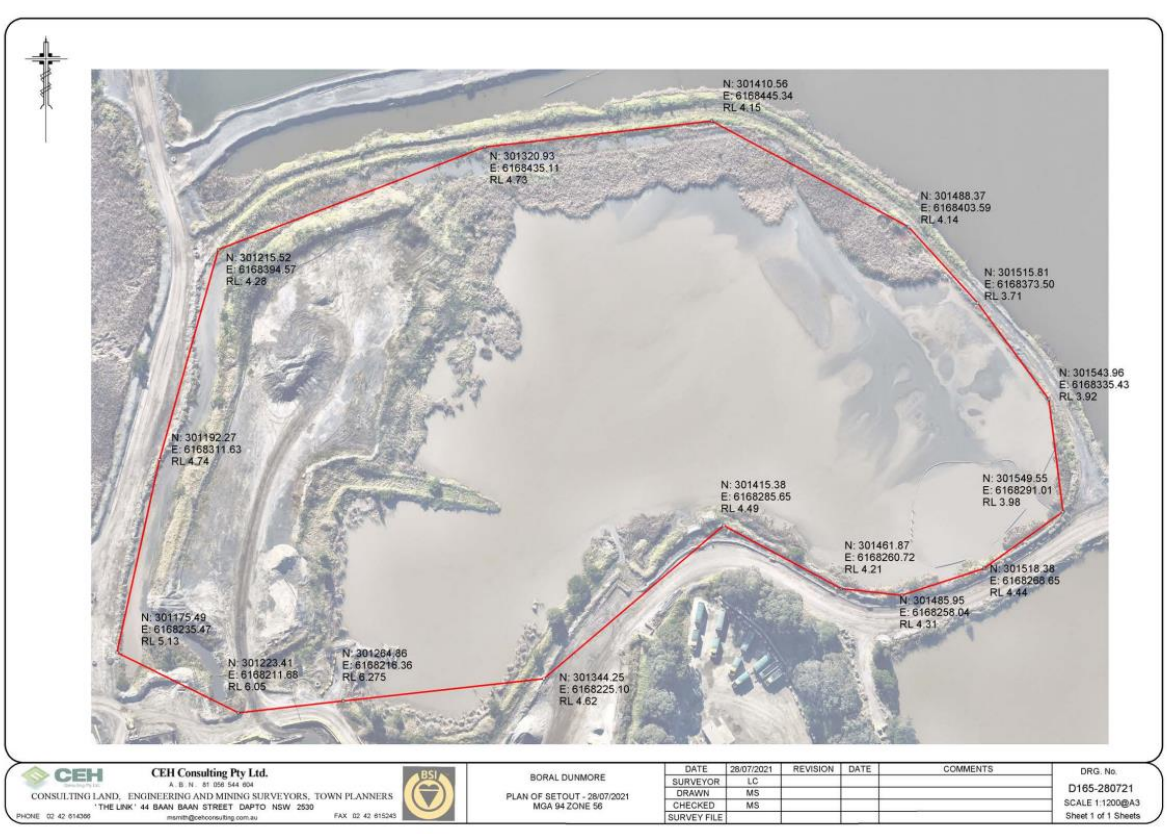


Figure 21 Surveyed Fines Pond Bund

The majority of the access road off Tabbita Road is also above 3.6 metres AHD; however, the ramp abutting Tabbita Road was constructed by RMS below 3.6 metres AHD due to the presence of overhead powerlines and potential safety risks to heavy vehicles.

Condition S3.C27 of the consent requires that the flood storage capacity of the site is no less than the pre-existing flood storage capacity at all stages of the development, unless otherwise approved in writing by the Planning Secretary. Total historic extraction volumes within both Stage 2 and Stage 3 area are significantly higher than total backfilling volumes to date which has created an overall increase in flood storage capacity. During the reporting period, extraction moved to the new Stage 5 area while backfilling continued in Stage 2 and 3 which will result in a gradual reduction in flood capacity. However, the final site rehabilitation plan includes unfilled pond area and freshwater wetlands which provide an overall increase in flood retention capacity compared to the pre-mining floodplain.

4.7. Groundwater Monitoring

Environment Earth Sciences (EES) have been commissioned to undertake analysis of the groundwater aquifer at Dunmore Lakes since 2003. They have been commissioned to prepare the Groundwater Monitoring Report for 2022-2023, and when it is completed it will be publicly available on our website.

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 for Stages 2-4 is shown in Figure 22. Stage 5 doesn't have enough monitoring points to derive a meaningful indication of flow direction.

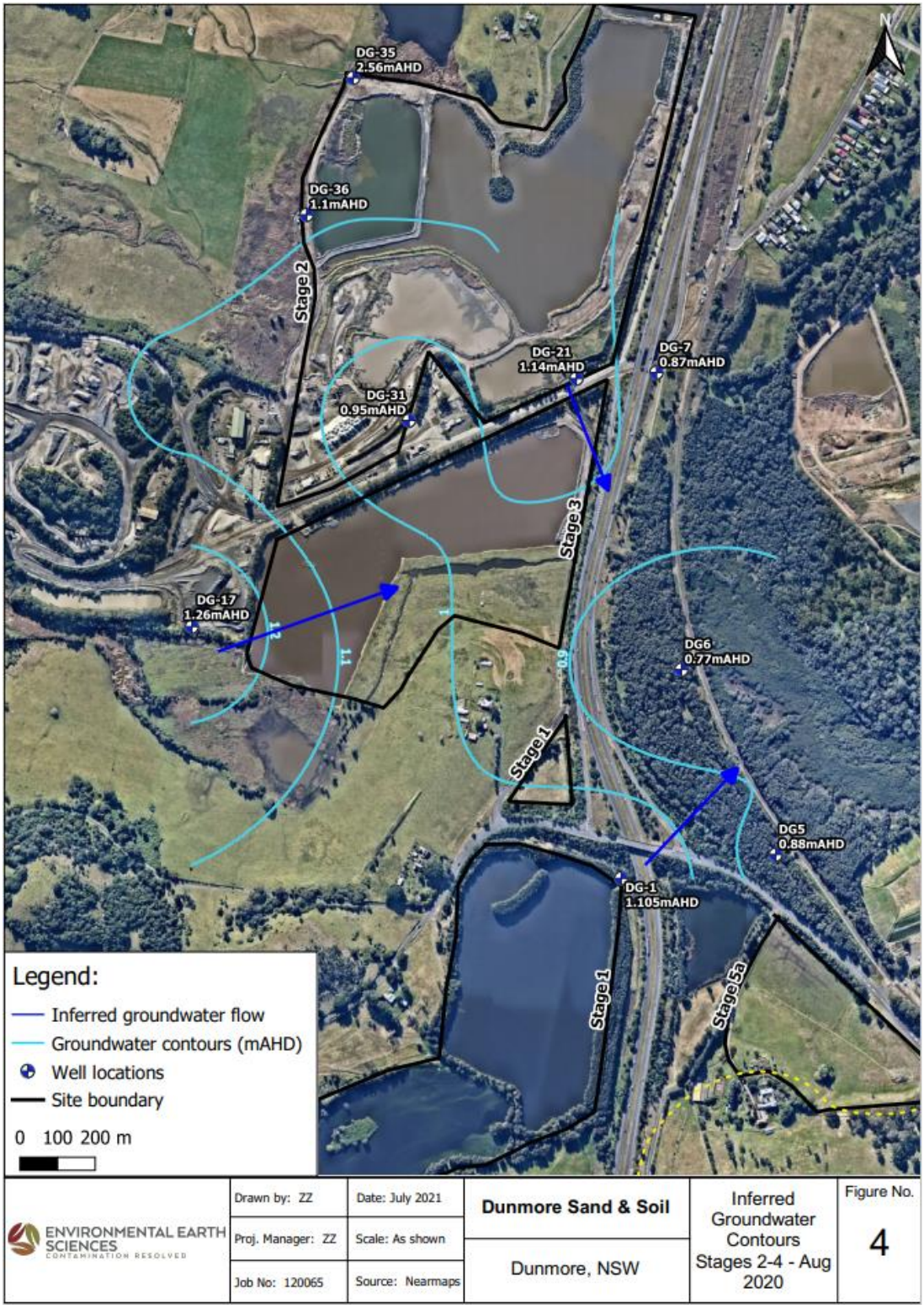


Figure 22 Groundwater Monitoring Locations and Derived Flow

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 is shown Table 22 and Table 23, respectively.

Table 22 Groundwater Monitoring Summary West of Princes Highway

Analyte	Units	Trigger Value		DG1S				DG17				DG21				DG31S				DG35				DG36			
		DA	GMMP	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23
pH	-	6.5 - 8.5	6.5 - 8.5	7.4	7.6	7.4	7.4	7.1	7	7	6.9	6.5	6.6	6.5	6.4	6.9	6.9	6.8	6.6	6.6	6.6	6.6	6.5	6.9	6.9	6.9	6.8
EC	*µS/cm*	<1500	1500	537	486	538	450	2420	2630	1669	2650	1052	880	802	810	294	414	352	571	1029	1035	1005	1037	1043	1029	976	880
TDS	*mg/L*	-	-																								
Total N	*mg/L*	100-500	-	1.23	0.66	1.34	0.87	0.49	1.02	0.76	1.61	0.3	0.21	0.45	0.84	0.12	0.15	0.35	0.5	1.72	1.08	1.44	2.72	0.15	0.15	0.34	0.43
Na	*mg/L*	400	560	39	31	17	29	313	329	131	332	106	100	42	106	4.7	20	9.1	22	92	86	36	85	83	87	34	67
K	*mg/L*	50	50	7.2	5.8	2.1	2	42	41	20	43	6.1	3.9	1.1	1.8	6.6	4.1	1.3	1.8	12	11	7.6	7.8	18	18	13	13
Mg	*mg/L*	50	90	9.8	8.1	9	7.2	107	121	58	104	14	14	14	17	7.2	8.9	6.5	13	36	40	33	32	39	40	31	28
Cl	*mg/L*	300	1400	46	39	50	44	410	355	216	388	88	69	92	80	20	5.5	14	22	56	45	47	51	91	89	78	65
Ca	*mg/L*	-	-	65	46	93	38	84	53	67	73	36	32	37	29	33	51	42	69	68	66	73	49	76	73	95	50
F	*mg/L*	-	-	0.2	0.27	0.28	0.2	0.93	0.62	0.43	0.78	0.2	0.12	0.1	<0.05	0.1	0.065	0.12	<0.05	0.1	0.18	0.1	<0.05	0.4	0.51	0.46	0.46
Fe	*mg/L*	6	3	0.32	0.21	0.7	0.44	0.17	0.05	0.4	0.02	0.7	0.13	0.1	0.04	0.36	0.08	0.2	0.47	0.24	0.15	0.2	0.05	0.14	0.19	0	0.02
NO3	*mg/L*	-	-	0.81	0.66	1.09	0.61	0.21	0.98	0.69	0.67	0.17	0.19	0.35	0.56	0.12	0.15	0.35	0.34	0.91	1.07	1.25	1.22	0.15	0.14	0.28	0.37
SO4	*mg/L*	250	300	2.9	7.4	13	12	35	13	39	19	56	35	50	39	58	107	81	176	279	193	188	173	116	107	112	83
PO4	*mg/L*	5-50	4	0.04	0.09	0.7	0.21	2.88	2.34	2.22	3.36	0.36	0.27	0.24	0.29	0.02	0.01	0.04	0.07	0.1	0.01	0.04	0.07	0.04	0.03	0.04	0.07
HCO3	*mg/L*	750	400	222	180	251	162	815	790	567	839	251	259	239	275	79	113	106	102	255	594	260	279	364	288	294	290
NH3N	*mg/L*	20	1	<0.01	<0.01	<0.01	0.06	<0.01	<0.01	0.11	0.06	<0.01	<0.01	<0.01	0.06	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	0.09	0.03

NOTE:

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 Alkalinity; Fe = Dissolved Iron; NH3N – Ammonia

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).

GMMP Criteria are site-specific criteria for groundwater quality and a sub-plan to the WMP (Arcadis, 2016).

Elevated concentrations to site-specific GMMP criteria are shown in Red.

Table 23 Groundwater Monitoring Summary East of Princes Highway

Analyte	Units	Trigger Value		DG5-S				DG5-D				DG6-S				DG6-D				DG7			
		DA	GMMP	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23
pH	-	6.5 - 8.5	6.5 - 8.5	7.4	7.3	7.3	7.2	7.5	7.5	7.6	7.3	6.5	6.4	6.5	6.3	6.8	6.8	6.7	6.6	7	7.1	7.1	6.7
EC	*µS/cm*	<1500	33000	1065	1069	1089	1076	14860	15210	15640	15030	13920	12750	13900	14930	27100	8400	29000	29300	607	578	716	720
TDS	*mg/L*	-	-																				
Total N	*mg/L*	100-500	-	0.23	0.31	1.11	0.69	2.76	3.76	4.25	4.74	1.53	1.66	2.84	3.02	14.38	2.67	4.13	19.71	1.2	0.91	0.61	2.04
Na	*mg/L*	400	5500	74	68	31	75	2185	2391	2688	2638	2161	2016	2425	2800	4579	1883	4981	4771	56	50	24	60
K	*mg/L*	50	170	10	8	5.7	5.6	137	113	163	149	146	112	166	170	264	248	217	333	6.8	4.7	1.4	1.8
Mg	*mg/L*	50	420	20	21	18	19	372	380	377	300	364	329	348	326	661	713	713	514	11	12	15	17
Cl	*mg/L*	300	6900	136	107	124	120	5660	5145	4420	5135	6122	4050	1536	5135	11285	10253	12415	10970	54	24	39	45
Ca	*mg/L*	-	-	115	143	136	114	243	240	238	249	150	183	144	174	391	411	319	389	41	41	35	47
F	*mg/L*	-	-	0.2	0.25	0.18	0.13	1.07	0.33	0.9	0.5	0.64	0.2	<0.05	0.4	1.21	<0.01	<0.05	<0.05	0.5	0.51	0.46	0.34
Fe	*mg/L*	6	4	0.46	0.16	1	0.06	1.7	0.06	<0.05	0.02	1.5	0.8	1.7	0.2	0.56	2	0.2	0.03	0.75	0.73	0	0.04
NO3	*mg/L*	-	-	0.13	0.31	0.7	0.41	0.85	1.94	1.48	3.65	1.1	1.62	2.68	2.45	13.3	2	3.4	18.4	0.94	0.78	0.41	1.55
SO4	*mg/L*	250	1170	192	126	130	132	832	677	688	638	805	638	638	727	1562	1369	1537	1494	52	31	70	67
PO4	*mg/L*	5-50	1	0.06	0.08	0.05	0.04	0.31	0.15	0.14	0.21	0.23	0.21	0.08	0.17	0.24	0.01	0.04	0.07	0.24	0.16	0.08	0.11
HCO3	*mg/L*	750	420	242	272	268	268	288	309	349	298	339	418	379	362	397	443	447	388	192	326	264	247
NH3N	*mg/L*	20	3	<0.01	<0.01	<0.01	0.04	0.78	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	0.59	<0.01	<0.01	<0.01	0.07	<0.01	<0.01	<0.01	0.03

NOTE:

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 Alkalinity; Fe = Dissolved Iron; NH3N – Ammonia

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).

GMMP Criteria are site-specific criteria for groundwater quality and a sub-plan to the WMP (Arcadis, 2016).

Elevated concentrations to site-specific GMMP criteria are shown in Red.

Table 24 Groundwater Monitoring Summary Stage 5

Analyte	Units	Trigger Value	MW5A1				MW5A3				MW5B1				MW5B2-S				MW5B2-D				MW5B3				MW5B4			
		DA	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23	Aug-22	Nov-22	Feb-23	May-23
pH	-	6.5-8.5	6	6.1	6.6	6.5	7	6.8	6.7	6.5	6.6	6.4	6.4	6.4	7.2	6.9	6.8	6.7	7.4	7.4	7.6	7.2	7.5	7.7	7.8	7.5	7.6	7.7	7.6	7.4
EC	*µS/cm*	<1500	176	478	405	393	788	712	1216	1226	311	378	466	401	581	616	788	845	612	634	649	686	552	530	473	510	378	476	420	538
SO4	*mg/L*	250	28	21	47	44	12	6.6	12	13	4.9	2.1	7	4.5	48	21	29	22	33	12	25	21	14	4.5	20	14	16	9.5	5.8	17
Cl	*mg/L*	300	17	40	56	55	143	56	271	298	30	18	25	18	50	38	65	75	52	45	52	52	37	28	31	36	21	12	17	14
Ca	*mg/L*	-	10	18	20	24	70	50	135	72	81	47	163	42	74	90	126	104	85	422	119	79	92	61	91	69	56	72	90	68
Fe	*mg/L*	6	0.56	0.34	0.30	0.32	3.6	2.2	3.4	2.30	4.5	4.8	3.2	1.70	2.3	2.5	4.6	5.50	1.5	1.0	2.0	0.08	0.99	0.15	0.10	0.02	0.35	0.42	3.1	0.05
K	*mg/L*	50	18	35	10	14	9.9	7.6	6.9	8.9	11	11	13	12	8.4	5.9	4.5	5.4	9.9	7.1	4.5	5.8	6.6	4.3	1.6	2.2	6.1	4.1	2	3
Mg	*mg/L*	50	3	5.4	4.6	6.4	17	11	15	18	5.4	5.3	5.9	5.4	9.6	8.4	11	14	12	10	11	13	8.8	6.9	6.2	7.5	5.4	6.1	5.7	8.9
Na	*mg/L*	400	11	31	17	30	55	50	47	131	17	16	9.6	15	39	26	18	54	37	28	16	34	21	17	9.7	20	14	13	8.5	16
PO4	*µg/L*	5-50	80	50	60	70	250	170	170	180	70	70	130	150	200	150	190	130	80	30	30	60	140	90	90	80	140	80	120	150
NH3N	*mg/L*	20	<0.01	<0.01	<0.01	0.07	<0.01	<0.01	0.3	0.05	<0.01	<0.01	<0.01	0.38	<0.01	<0.01	0.27	0.06	<0.01	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	0.05
HCO3	*mg/L*	750	21	50	111	94	205	201	128	145	125	251	247	170	226	247	320	294	230	263	268	256	259	230	192	249	171	234	196	255
ORP	*mv*	-	378	429	402	411	286	369	372	402	432	384	378	415	425	378	391	360	428	356	385	383	442	358	364	374	429	362	356	390
NO2	*mg/L*	-	<0.01	<0.01	0.01	<0.01	0.58	0.58	0.01	0.01	0.31	0.01	0.89	0.01	<0.01	0.01	0.05	0.16	<0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
NO3	*mg/L*	-	2.81	0.53	0.25	0.55	0.84	0.73	1.2	1.66	0.29	1.21	0.39	1.96	0.34	0.3	0.57	0.79	0.64	0.53	0.68	0.98	0.31	0.26	0.61	0.80	0.2	0.45	0.84	1.32
TKN	*mg/L*	-	0.14	<0.01	< 0.01	0.2	0.25	<0.01	0.56	0.66	0.87	<0.01	0.42	0.52	<0.01	<0.01	0.48	0.35	0.13	<0.01	0.26	0.14	<0.01	<0.01	<0.01	0.08	<0.01	0.06	0.01	0.35
Total N	*µg/L*	100-500	2950	530	260	750	1670	1310	1770	2330	1470	1220	1700	2490	340	310	1100	1300	770	540	950	1120	310	260	610	880	200	510	860	1670
DO	*mg/L*	-	8.6	8.7	7.8	7.7	8.1	8.1	7.7	7.6	8.4	7.9	7.6	6.5	8.7	8.1	7.6	7.1	8.7	8.2	7.8	7.3	8.6	8.4	7.9	7.3	8.7	8.5	7.8	7.1
Fl	*mg/L*	-	<0.05	<0.05	0.051	<0.05	0.1	0.16	0.096	<0.05	<0.05	<0.05	<0.05	0.31	0.1	0.16	0.062	<0.05	0.1	0.17	0.1	0.054	0.2	0.24	0.2	0.17	0.2	0.22	0.2	0.13
Ecoli	*MPN/100mL*	-	<1	<1	< 1	< 1	<1	<1	< 1	< 1	2	<1	< 1	< 1	<1	<1	< 1	< 1	<1	<1	< 1	< 1	<1	<1	< 1	< 1	<1	<1	< 1	< 1
FC	*MPN/100mL*	<1000	<1	<1	11	< 1	<1	<1	4	120	3	260	11	3	<1	<1	< 1	< 1	<1	<1	< 1	< 1	<1	<1	< 1	16	<1	<1	< 1	28
Ent.	*MPN/100mL*	<230	<1	< 10	< 1	< 1	<1	< 10	< 1	< 1	<1	< 10	< 1	< 1	<1	< 10	< 1	< 1	<1	< 10	< 1	< 1	<1	< 10	< 1	< 1	<1	< 10	< 1	< 1

NOTE:

EC = Electrical Conductivity; SO4 = Sulfate; Cl = Chloride; Ca = Calcium; Fe = Dissolved Iron; K = Potassium; Mg = Magnesium; Na = Sodium; PO4 = Phosphorous; NH3N = Ammonia; HCO3 = Bicarbonate Alkalinity; ORP = Oxidising Reduction Potential; NO2 = Nitrite; NO3 = Nitrate; TKN = Total Kjeldahl Nitrogen; Total N = Total Nitrogen; DO = Dissolved Oxygen; F = Fluoride; Ecoli = E. coli; FC = Faecal coliforms; Ent. = Enterococci.

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).

There are not yet any site-specific GMMP Criteria for Stage 5, and therefore the DA criteria are used as the criteria for water quality. However, where there are exceedances, it is likely that GMMP will be developed outlining that they are due to the natural mineralogy of the area rather than mining impacts, which will be reflected in the Water Management Plan.

Elevated concentrations to site-specific GMMP criteria are shown in Red.

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, 2020, 2021, 2022).

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;
- GMMP figures should be devised for the Stage 5 bores, as the levels of Magnesium and Nitrogen reflect that there are naturally higher levels that are not related to DSS operations, especially given that no extraction was undertaken at Stage 5B over the reporting period ;
- 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;

The final landform planned for the DLSP will exceed these areas. This is in order to provide suitable visual screening and to adequately integrate a compensatory habitat with existing similar habitats located on or near the site.

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 14 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.

Additionally, 143 nest boxes were installed in the surrounding Bangalow forest at Stage 5B to provide habitats for the fauna that may be impacted by the associated vegetation removal. These range from small bird boxes approximately 30cm tall and 25cm wide to Powerful Owl boxes that are over one meter tall and 90 centimetres wide.

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. Stage 2 and Stage 3 is currently being backfilled.

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)	Excavated Sand VENM received (t)
Jul-22	125	5337	0
Aug-22	0	7865	0
Sep-22	7519	37	0
Oct-22	261	0	0
Nov-22	1155	856	0
Dec-22	29	0	0
Jan-23	6207	0	0
Feb-23	2541	0	0
Mar-23	8386	0	0
Apr-23	0	0	0
May-23	15808	0	0
Jun-23	16202	0	0
Total	58233	14095	0

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 26 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 (t)	Effluent (t)	Solvent (t)
Jul-22	0.30	0.13	0	0	0	0
Aug-22	0.41	0.10	0.03	0		0
Sep-22	0.31	0.20	0	0	0	0
Oct-22	0.24	0	0	0	0	0
Nov-22	0.18	0.05	0	0	0	0
Dec-22	0.30	0	0	0	0	0
Jan-23	0.29	0.19	0	0	0	0
Feb-23	0.13	0.11	0	0	0	0
Mar-23	0.43	0	0	0	0	0
Apr-23	0.22	0.06	0	0		0
May-23	0.17	0.06	0	0	0	0
Jun-23	0.27	0.08	0	0	0	0
Total	3.23	0.98	0.03	0	0	0

4.9.3. Waste Minimisation Long Term Trends and Analysis

The long term analysis of the waste tracking over the last 5 years is shown below in Table 26.

Table 26 Historical Waste Tracking Summary

Waste Classification		FY19	FY20	FY21	FY22	FY23
Solid Waste	General Waste (t)	2.605	1.842	1.301	3.249	3.23
	Cardboard (t)	0.274	0.678	0.354	0.755	0.98
	Comingle (t)	0.33	0.208	0.114	0.189	0.03
Liquid Waste	Oil/Oily Water (t)	4.99	2.95	0.35	5.74	0
	Effluent Litres (t)	0.245	0.36	0.7	6.28	0
	Other (t)	0	0	0	0	0

*all liquid waste volumes have been converted to tonnages in the FY23 register.

General Waste volumes were similar to the previous reporting period. There was no oil or oily water waste, or effluent for this reporting period.

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.

4.10. Incident and Emergency Response Management.

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

- The Pollution Incident Response Management Plan was updated in May 2023. 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.

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 input and feedback being provided by the community regarding quarry operations and plans. The CCC is run as per condition S5.C6 and the Department of Planning, Industry and Environment's *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 2022 and February 2023).

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 were three community complaints during the reporting period, as follows:

- On July 27 2022, the EPA notified DSS of debris and sand built up on the bicycle track in the Ruth Devenney Reserve. An investigation into the incident determined that the source of sand was not DSS, however the sand was removed;
- On October 4 2022, DSS received a phone call regarding turbid water flowing through the Ruth Devenney Reserve. It was determined that the turbidity and water quality of the water leaving the site was similar to the water entering the site, and this water was considered incidental and not of concern;
- On May 25 2023, a phone call was made to the EPA regarding water flowing from the direction of EPL9 through the Ruth Devenney Reserve. It was determined that EPL9 was undergoing an allowed controlled discharge. The discharging water was sampled with the controlled discharge ceasing the following day.

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

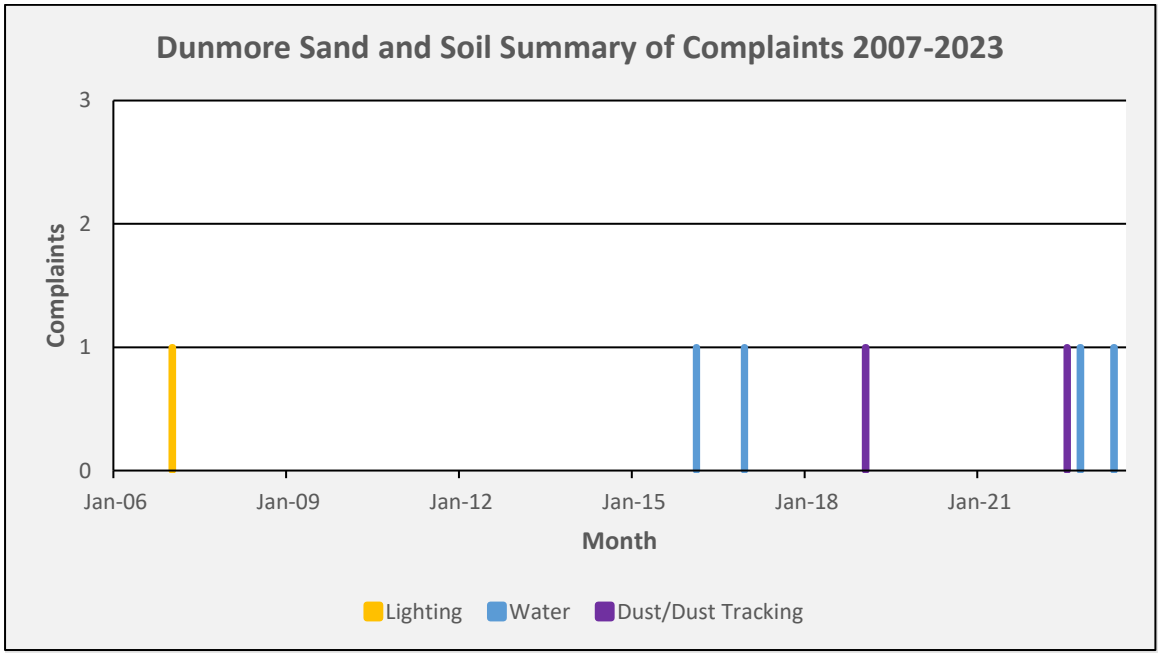


Figure 24 Summary of Historical Complaints

4.13. Independent Environmental Audit

The last Independent Environmental Audit (IEA) was completed in in accordance with Schedule 5, Condition 10 and 11 of DA 195-8-2004. The audit site visit was completed on 14 October 2020 and the audit report was finalised on 23 November 2020.

The audit report is available under the public reporting tab on the Dunmore operations website https://www.boral.com.au/locations/boral-dunmore-operations

The next Independent Audit is scheduled to occur in the next reporting period in November 2023.

4.14. Summary of Regulator Notifications

In July 2022 DSS staff were contacted by the EPA regarding a concern raised by the community of a deposition of sand downstream of the DSS Stage 2 and 3 ponds, into Ruth Deveny reserve.

As per Condition S5, C7, DSS advised DPE of the incident.

The EPA issued a Clean-up Notice on the 27th July 2022, requiring the removal of the sand, rehabilitation if required and an independent assessment of any environmental harm.

DSS undertake actions in response to the Clean Notice and at DPE's request provided additional information.

DSS undertook an investigation into the cause of the sand deposition and identified that the source of the sand was from the transport for NSW Road easement and not DSS operations or land.

On completion of the works and assessment, the EPA advised that the required works had been completed and no further action would be taken.

5. Conclusion

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

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. Dredging has commenced in Stage 5B, and backfilling will commence at Stage 5A to move toward the final landform.

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.

A list of actions to be completed by the next reporting period is provided below.

- Continue rehabilitation monitoring of planted sections of Swamp Oak Forest and Freshwater Wetland EEC in Stage 2 and Re-aligned Western Tributary;
- Continue Swamp Oak Forest planting along the edge of Stage 2;
- Continue backfilling and landform construction in Stage 2 and 3;
- Plant out a further section of Swamp Oak forest on the eastern edge of Stage 2;
- Continue assessing salinity in the southern section of Stage 3 as per the recommendations in the DLSP EIS;
- Proceed with Stage 5 operations as per the associated management plans;
- Undertake Independent Audit as per condition of consent
- Update Stage 2-4 Water Management for the use of site specific trigger values as per the independent auditor recommendations and to align with Stage 5 Soil and Water Management Plan. The updated plans will be combined into a one Soil and Water Management Plan;
- Establish ecological assessment program in relation to the use of nest boxes as per Rehabilitation management plan. Expand Dunmore Quarry real time monitoring alert system once established to include DSS operations.

7. Appendix A Meteorological Monitoring

The location of the onsite weather station is shown below.

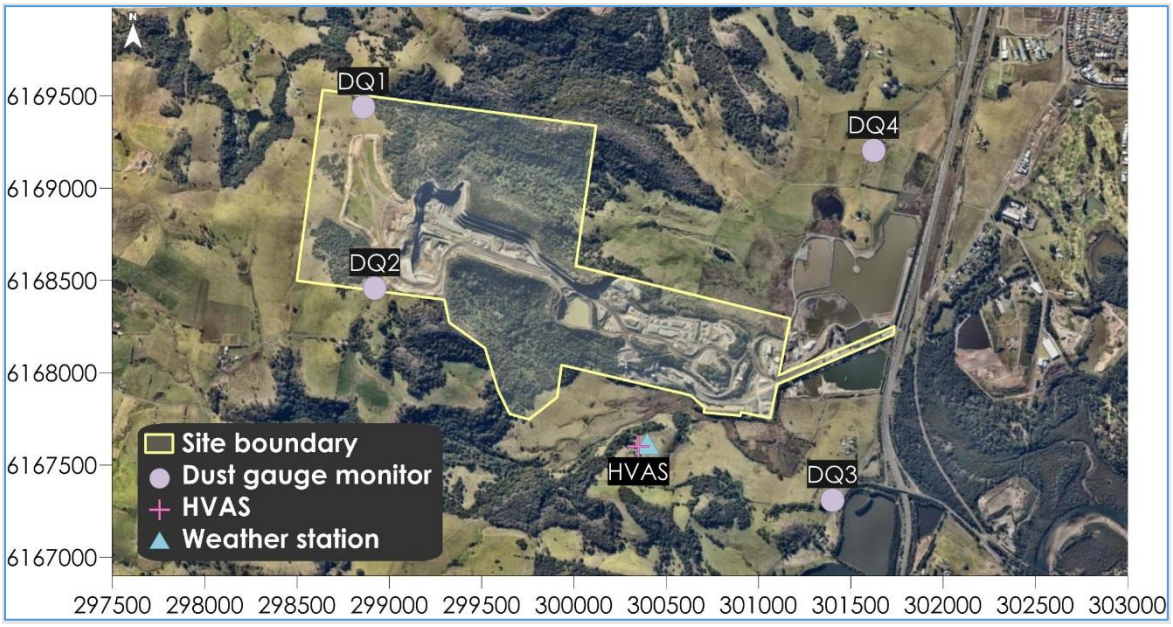


Figure 25 Weather Station Location

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 28. Historical trends are shown in Table 29 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	450	79.4	49
August	39.4	64.5	53.5
September	145.2	52.3	42.7
October	243.8	80.1	64.5
November	61.2	91.7	83.1
December	41.8	82.0	67
January	125	90.4	72.9
February	225.4	155.7	140.5
March	153	166.7	122.3
April	140.4	93.3	73.8
May	77.6	78.7	55.8
June	12.6	104.5	93.7
Total	1715.4	1070.4	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**	**FY21**	**FY22**	**FY23**	**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	264.2	14.8	450	79.4	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	187.1	73.4	39.4	64.5	53.5
September	14	7.5	40.6	33	101	39	56	19.5	145.5	58.5	11.5	85.5	48.7	82	51	1	41.5	59.5	11.3	46.37	145.2	52.3	42.7
October	6.5	49	245.4	48	0	17	79	125.5	126	124.5	83.5	6.5	102.5	36.5	32	14.5	128	38.5	114.4	61.85	243.8	80.1	64.5
November	17	149.5	126.8	144.5	39.5	161.5	46.5	65	198	163.5	25	173	24	48	33	85	92	25.5	83	164.1	61.2	91.7	83.1
December	70	40.5	136.2	36.5	54	120	112.5	80.5	147.5	63	32	70.5	233.5	116.5	58	53	90.5	2.5	83.8	78.36	41.8	82.0	67
January	68	30.5	128.8	90	0	65.5	9.5	79	59.5	50.5	183	43.5	192.5	155.5	32.5	36	143.5	65	189.3	151	125	90.4	72.9
February	112	70	180.4	87.1	186.5	351.5	107.5	197.5	48	257.5	142.5	59	112.5	29.5	283	128.5	35.5	272.5	88.4	295.8	225.4	155.7	140.5
March	121	84	118	43.5	67.5	36.5	39	74	362.5	196	23.5	326	57	145	441	41.5	156.5	65.5	278.5	670.6	153	166.7	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	5.9	216.8	140.4	93.3	73.8
May	427.5	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	206.1	202.8	77.6	78.7	55.8
June	74.5	42	84.4	124	318.5	85.5	67	52	92	89	239	34	76	429	57	133.5	103	35	44	1.8	12.6	104.5	93.7
Total	1036	778.5	1248	724.1	1074	1064	745.5	872.5	1425	1379	1001	954.2	1462	1490	1253	627.1	889.5	760.5	1556	1978	1715	1144.3	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.

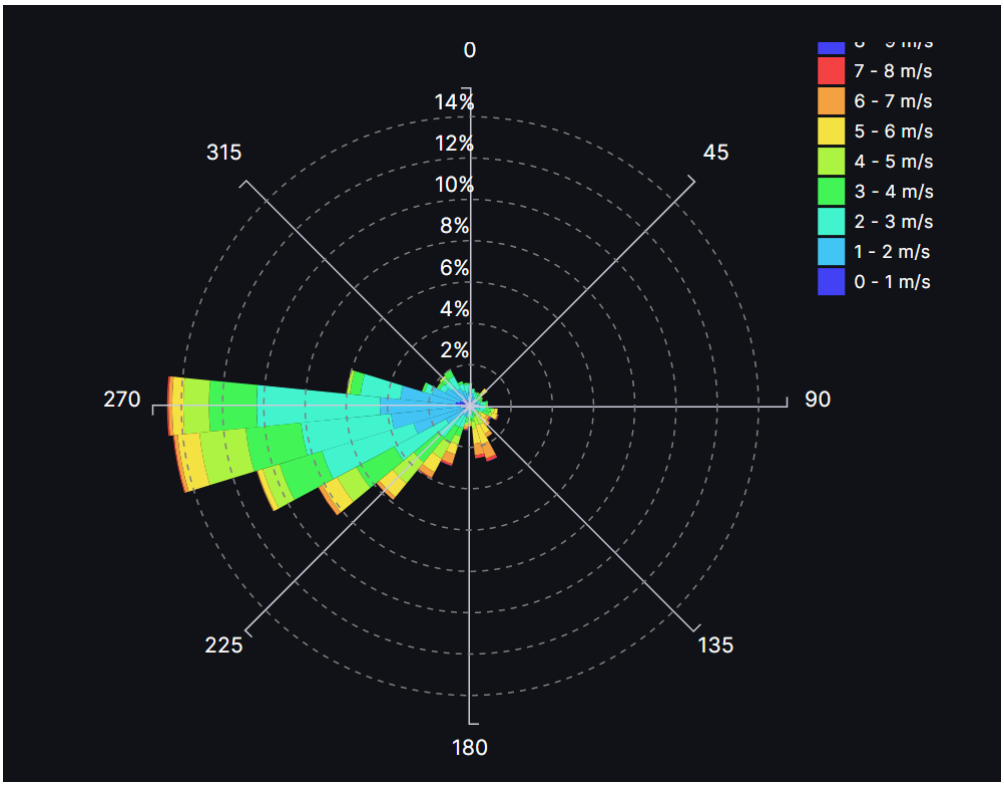


Figure 26 July 2022 Wind Rose

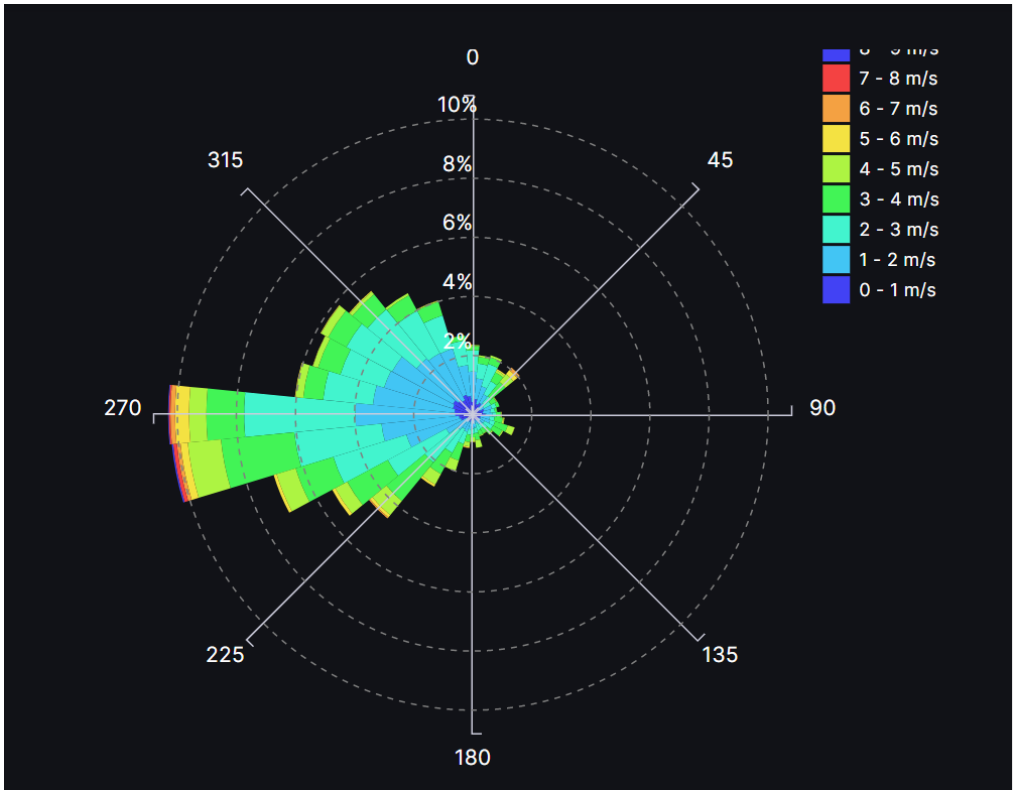


Figure 27 August 2022 Wind Rose

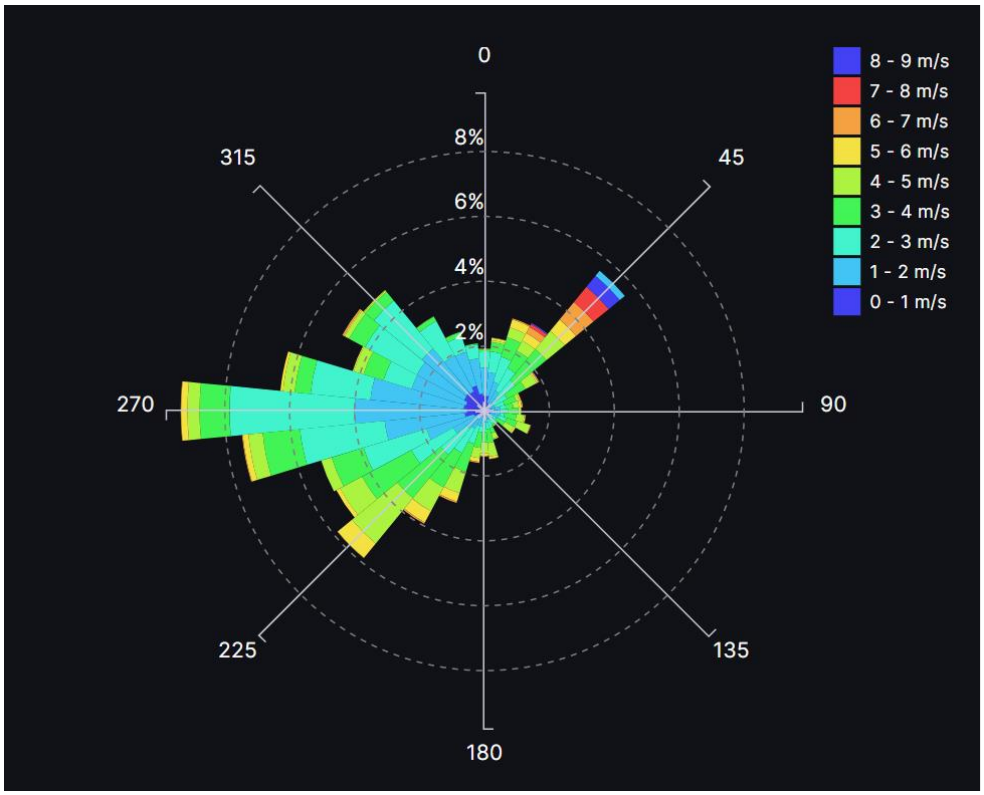


Figure 28 September 2022 Wind Rose

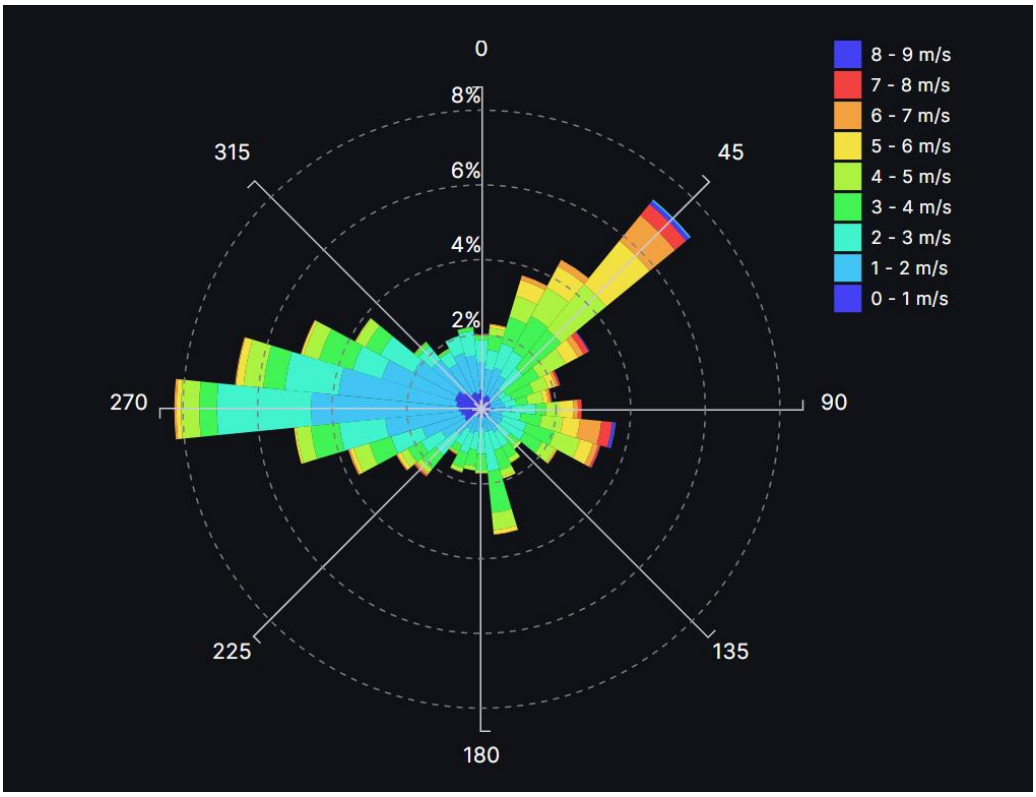


Figure 29 October 2022 Wind Rose

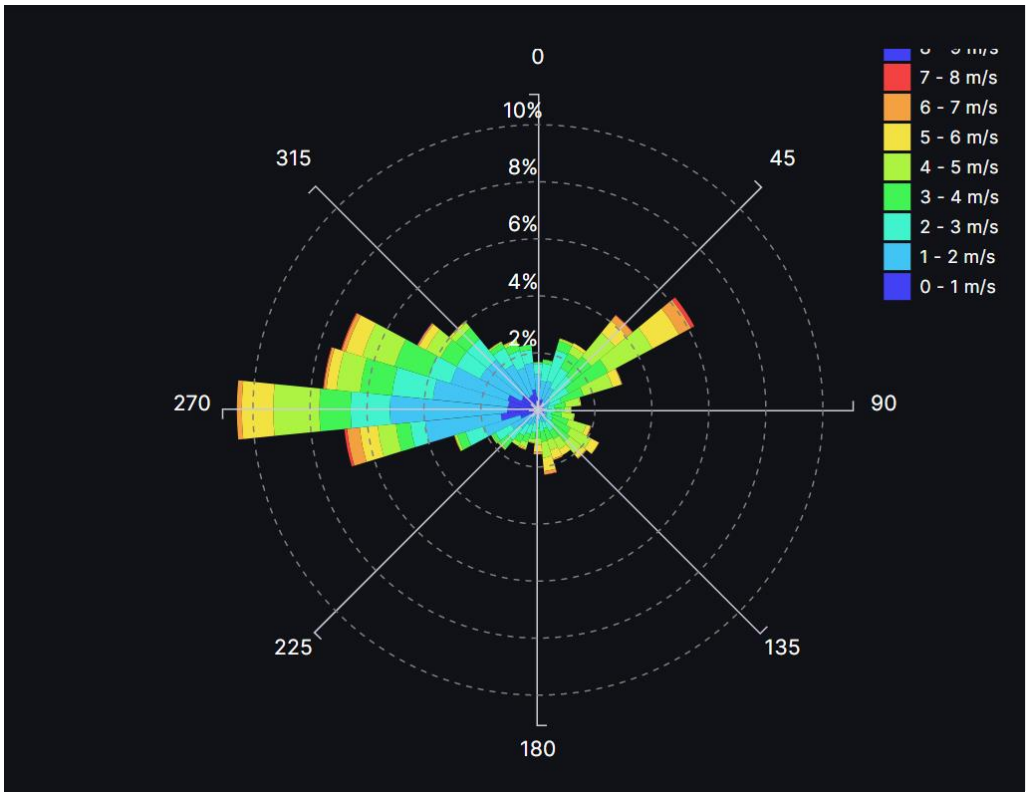


Figure 30 November 2022 Wind Rose

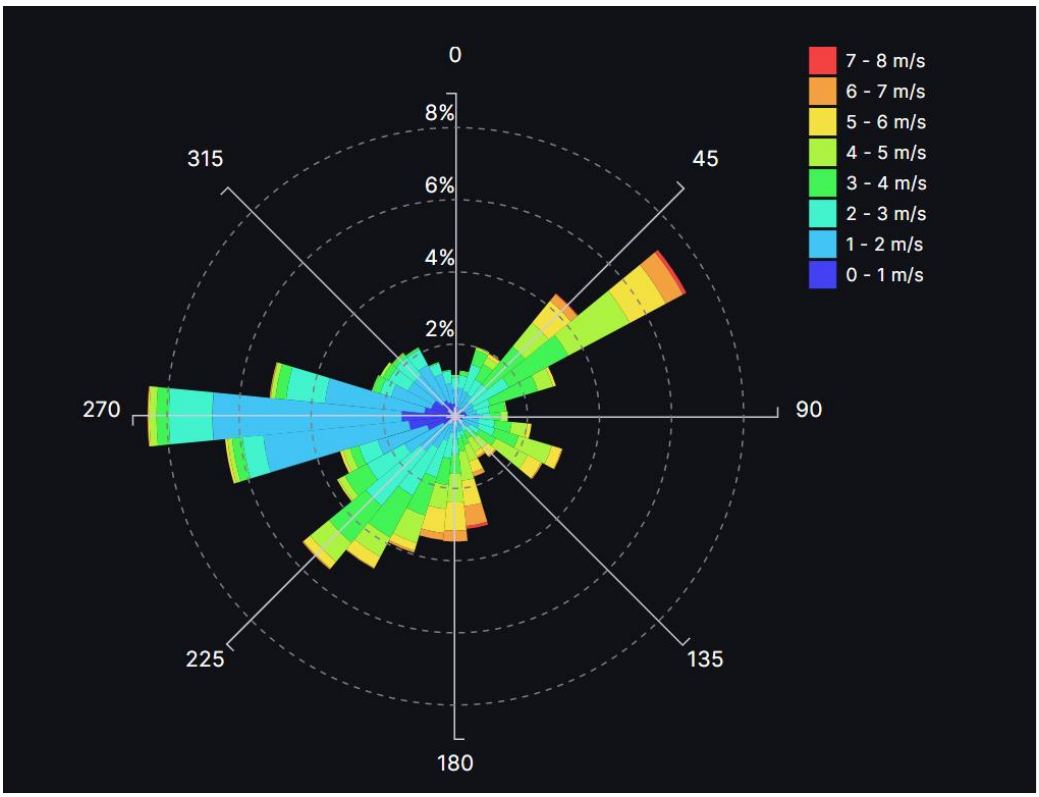


Figure 31 December 2022 Wind Rose

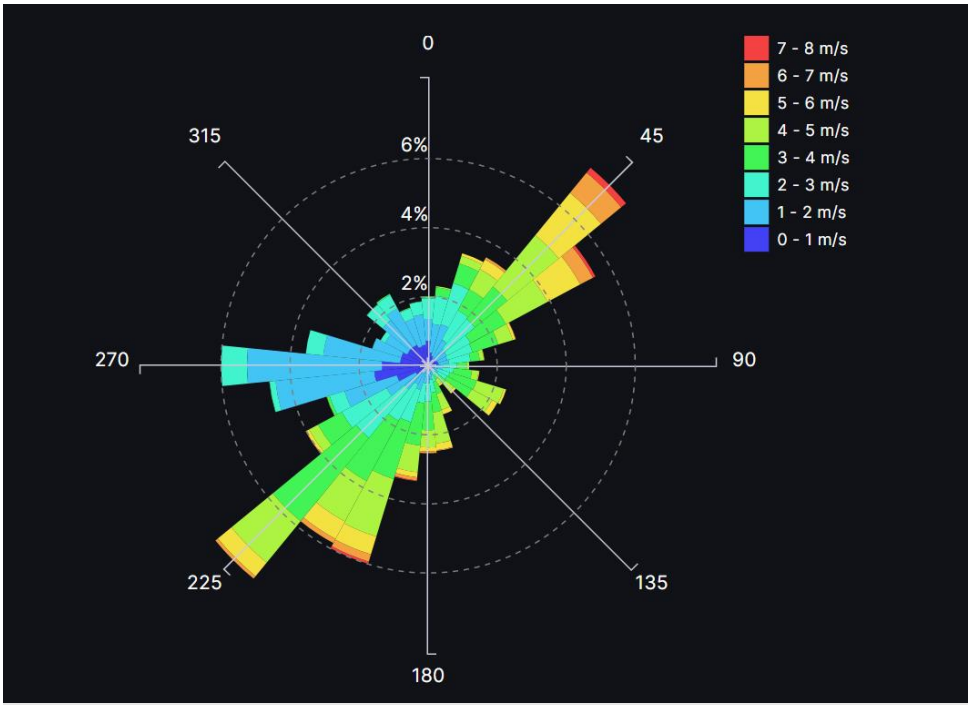


Figure 32 January 2023 Wind Rose

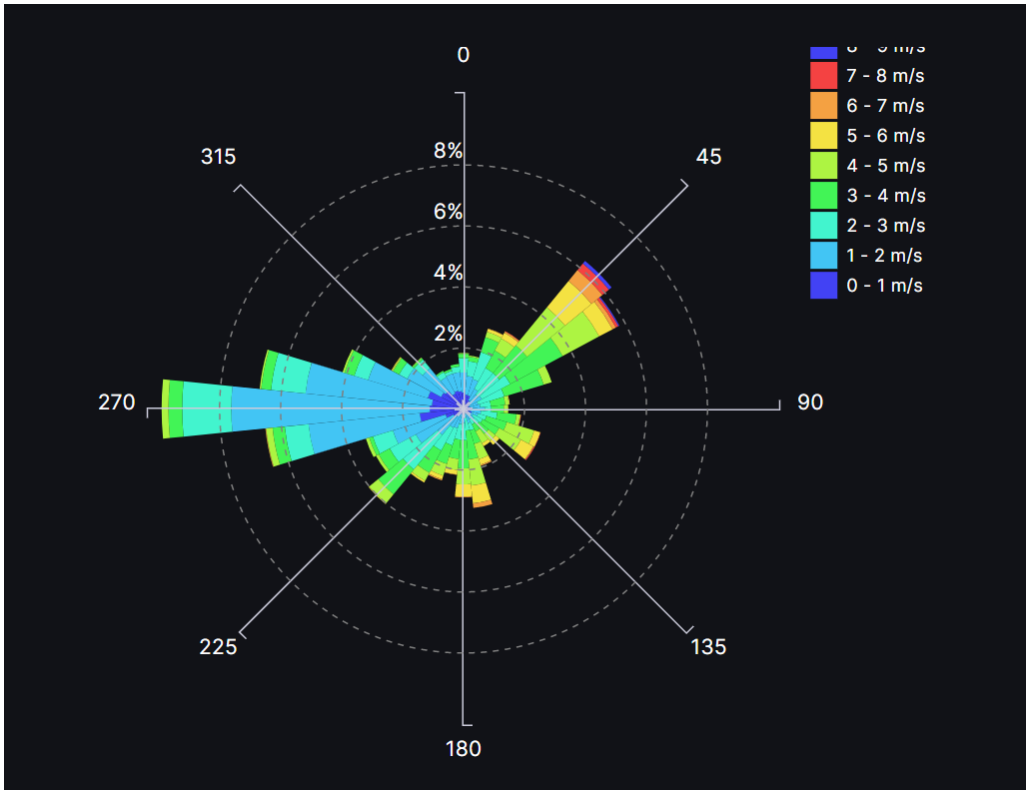


Figure 33 February 2023 Wind Rose

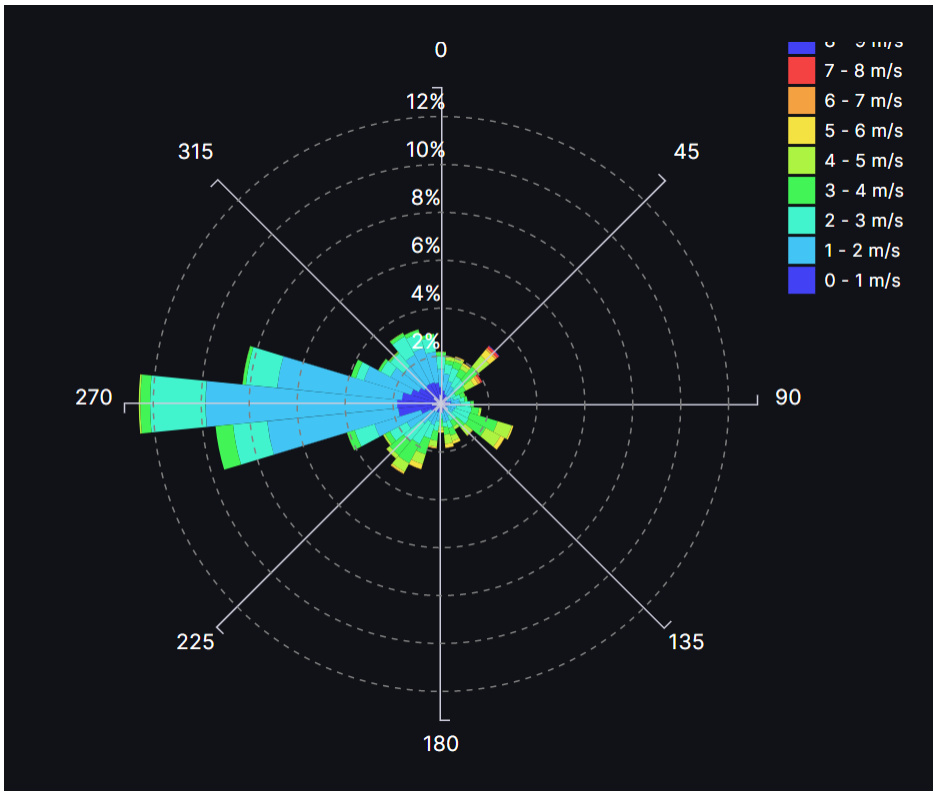


Figure 34 March 2023 Wind Rose

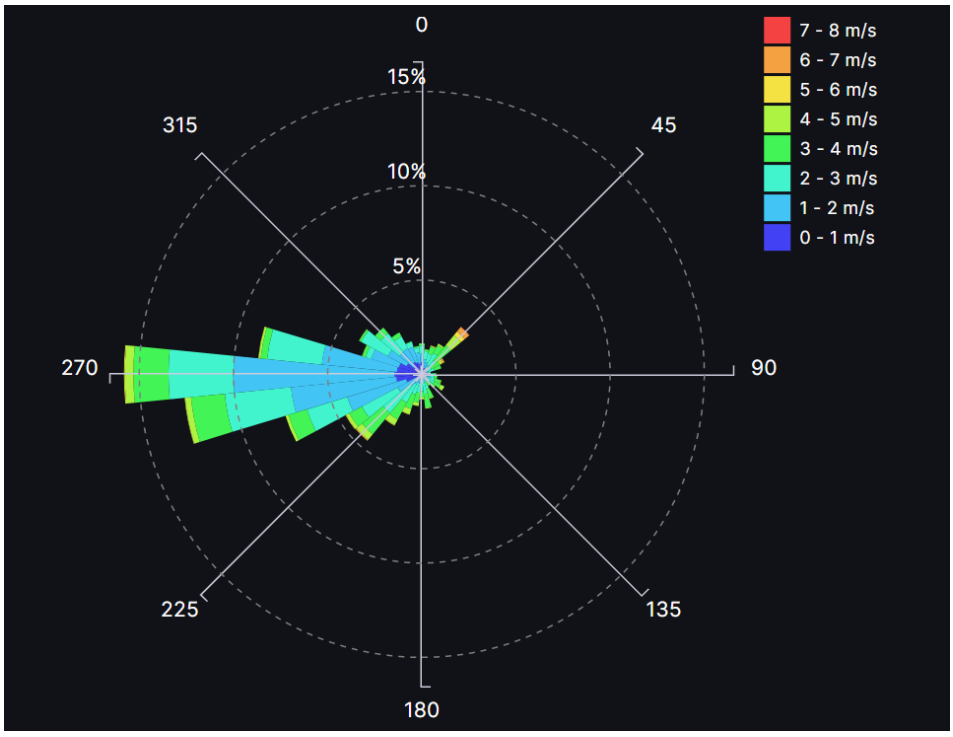


Figure 35 April 2023 Wind Rose

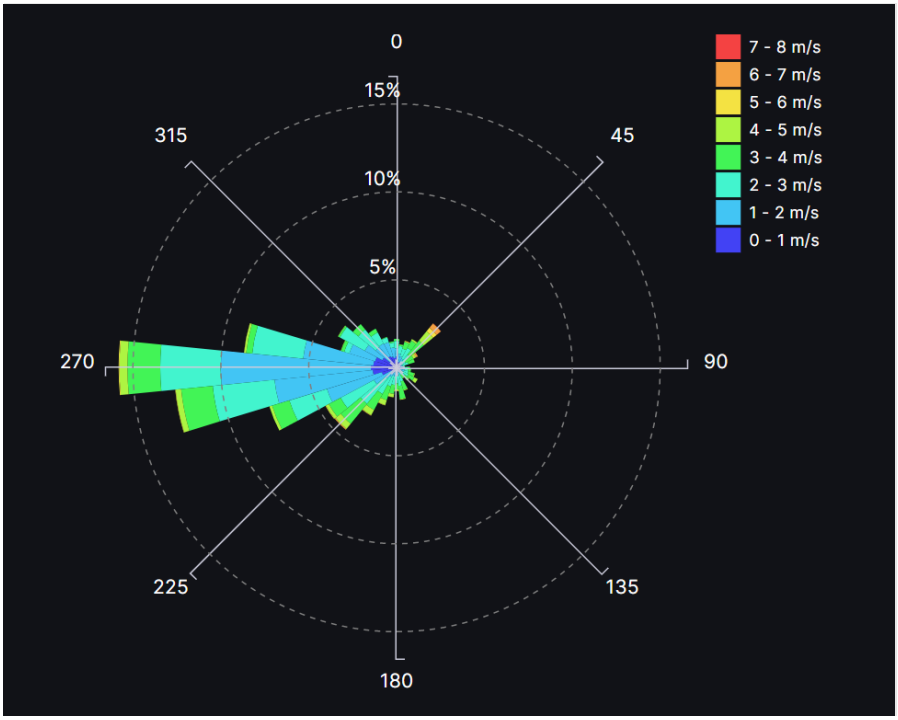


Figure 36 May 2023 Wind Rose

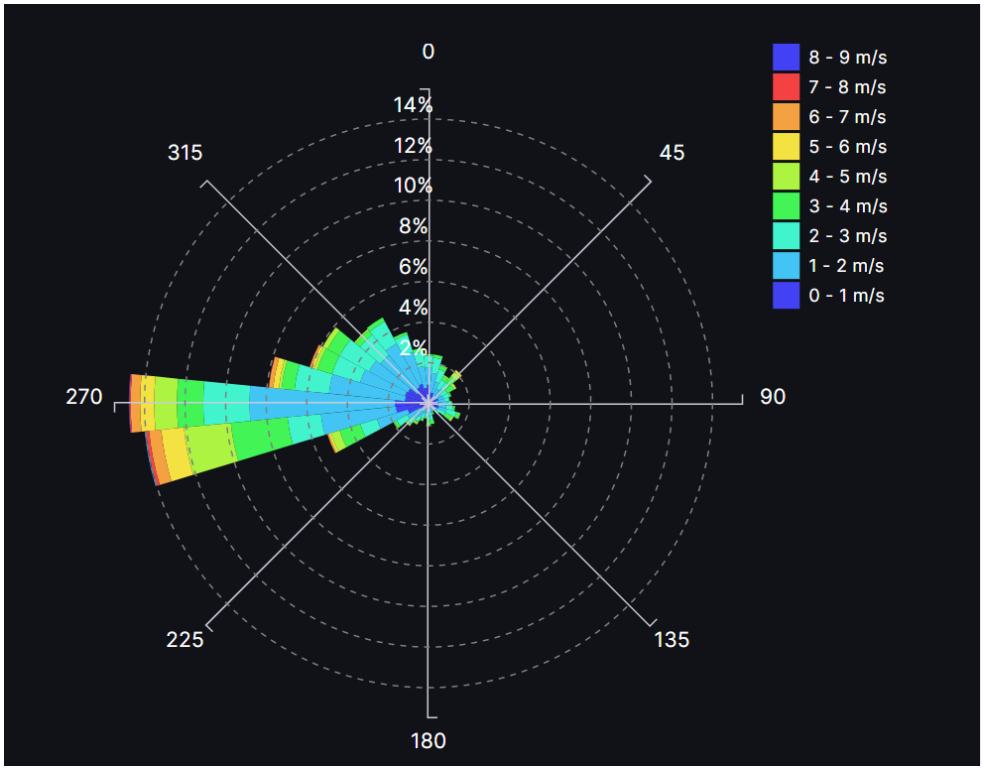


Figure 37 June 2023 Wind Rose

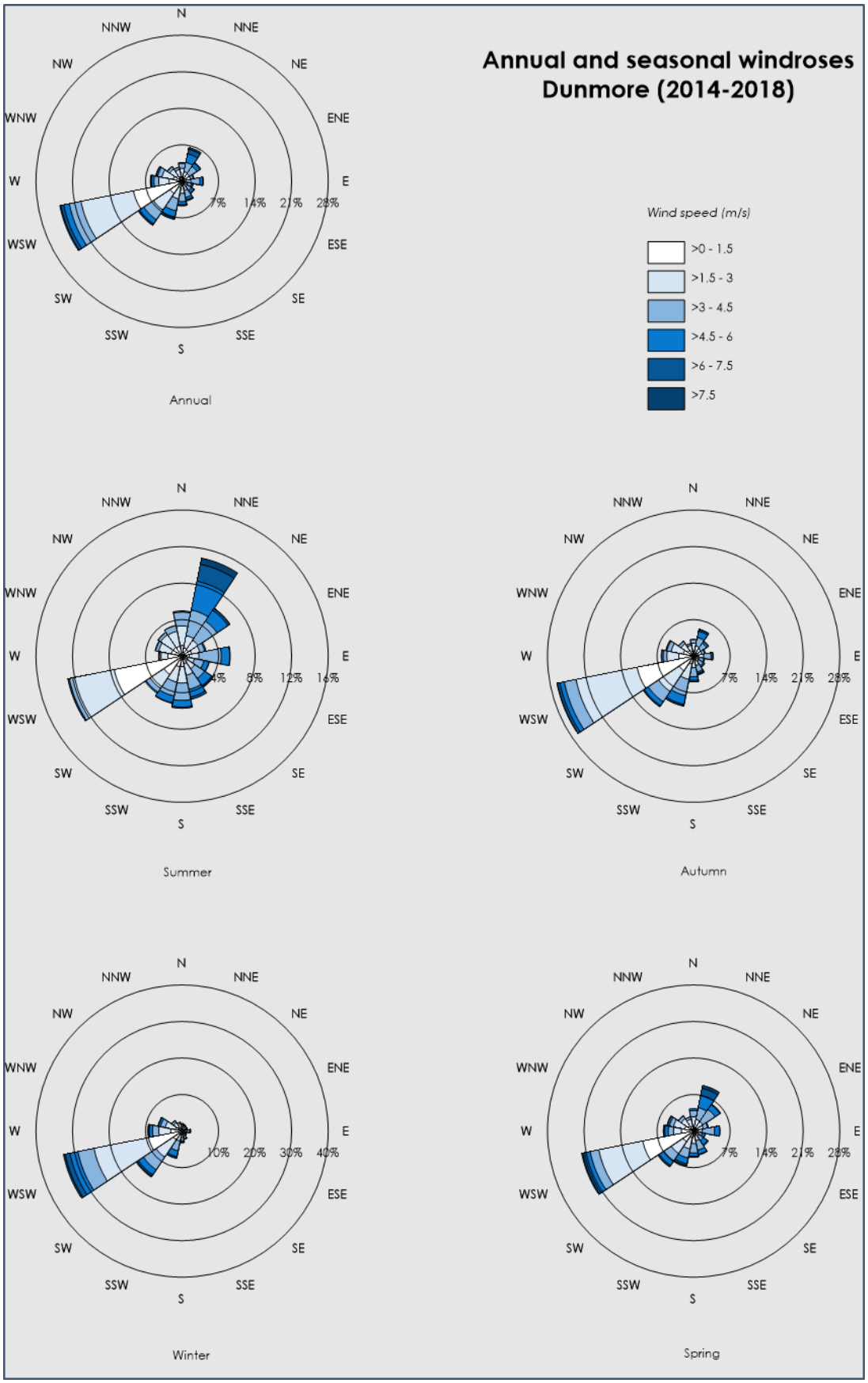


Figure 38 Dunmore Seasonal Wind Rose Data

8. Appendix B Air Quality Additional Data and Graphs

A monthly breakdown of deposited dust monitoring is shown in the Table 30 below. Dominant wind directions and production data are also shown within Table 30.

Table 29 Detail Summary of Historical Dust Data

Month	Site 1 grams/m^2/month		Site 2 grams/m^2/month		Site 3 grams/m^2/month		Site 4 grams/m^2/month		Dominant Wind Direction	Direction of Strongest Winds	Production Tonnes
	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash			(t)
05/06 Average	5.85	2.66	4.48	1.67	4.85	2.22	3.9	1.92			
06/07 Average	5.4	2.13	2.48	1.53	2.79	1.89	4.31	2.44			
07/08 Average	3.26	1.67	2.37	1.3	3.89	2.9	5.55	3.17			
08/09 Average	6.6	2.63	3.01	2.1	3.12	2.17	2.71	1.66			
09/10 Average	4.65	3.03	4.41	2.6	5.02	3.49	3.15	2.33			
10/11 Average	3.35	1.43	5.86	3.92	3.43	2.09	2.53	1.6			
11/12 Average	3.74	1.92	3.28	1.7	5.03	3.44	2.75	1.81			
12/13 Average	3.73	1.65	2.61	1.65	5.87	3.6	3.36	2.36			
13/14 Average	9.56	4.94	3.63	1.79	4.61	3.28	3.2	2			
14/15 Average	5.63	2.72	2.38	1.44	7.36	4.42	3.1	1.98			
15/16 Adjusted Average	3.46	1.66	3.12	1.77	7.2	4.45	3.01	1.84			
16/17 Average	2.2	1.42	3.36	1.96	2.28	1.56	2.01	1.3			
17/18 Average	2.93	2	4.2	3.14	2.36	1.65	2.84	1.79			
18/19 Average	3.05	1.84	2.95	1.92	3.66	2.01	2.81	1.59			
19/20 Average	2.61	1.76	3.45	2.43	2.66	1.94	2.1	1.51			
20/21 Average	1.88	1.16	1.70	1.08	1.94	1.12	1.89	1.12			
20/22 Average	1.42	0.61	1.71	0.69	1.25	0.65	1.64	0.93			
Jul-2022	0.14	0.11	0.69	0.46	5.06	3.16	0.63	0.36	W (14%)	W	83,734
Aug-2022	0.82	0.43	0.32	0.24	1.82	1.74	0.98	0.73	W (10%)	WSW	115,703
Sep-2022	2.10	1.14	2.49	1.4	2.32	1.45	2.32	1.30	W (8%)	NE	139,399
Oct-2022	1.59	0.54	2.05	0.37	*	*	1.15	0.69	W (8%)	NE	121,184
Nov-2022	1.32	0.94	0.87	0.69	1.24	0.76	1.45	1.29	W (10%)	NE	173,839
Dec-2022	11.74	6.72	3.27	1.51	1.10	0.97	1.45	1.29	W (12%)	NE	90,741
Jan-2023	2.26	0.77	0.67	0.56	1.4	0.54	1.23	0.6	SW (7%)	NE	96,382
Feb-2023	2.20	0.66	1.89	0.66	1.98	1.68	1.26	0.66	W (9%)	NE	132,544
Mar-2023	0.77	0.59	1.64	1.19	6.83	2.55	2.41	2.17	W (12%)	NE	159,561
Apr-2023	0.89	0.88	1.02	0.7	2.64	1.15	1.3	0.77	W (16%)	NE	97,181
May-2023	*	*	0.5	0.48	0.65	0.63	1.01	0.63	W (21%)	WSW	216,961
Jun-2023	1.02	0.43	0.45	0.05	1.28	0.68	0.69	0.46	WSW (17%)	WSW	144,627
22/23 Average	2.26	1.20	1.32	0.69	2.39	1.39	1.32	0.91			

A detailed breakdown of the particulate monitoring via the HVAS can be seen in Table 31 below. Cells shaded in grey depict the monitoring time periods that were affected by the Currowan bushfire.

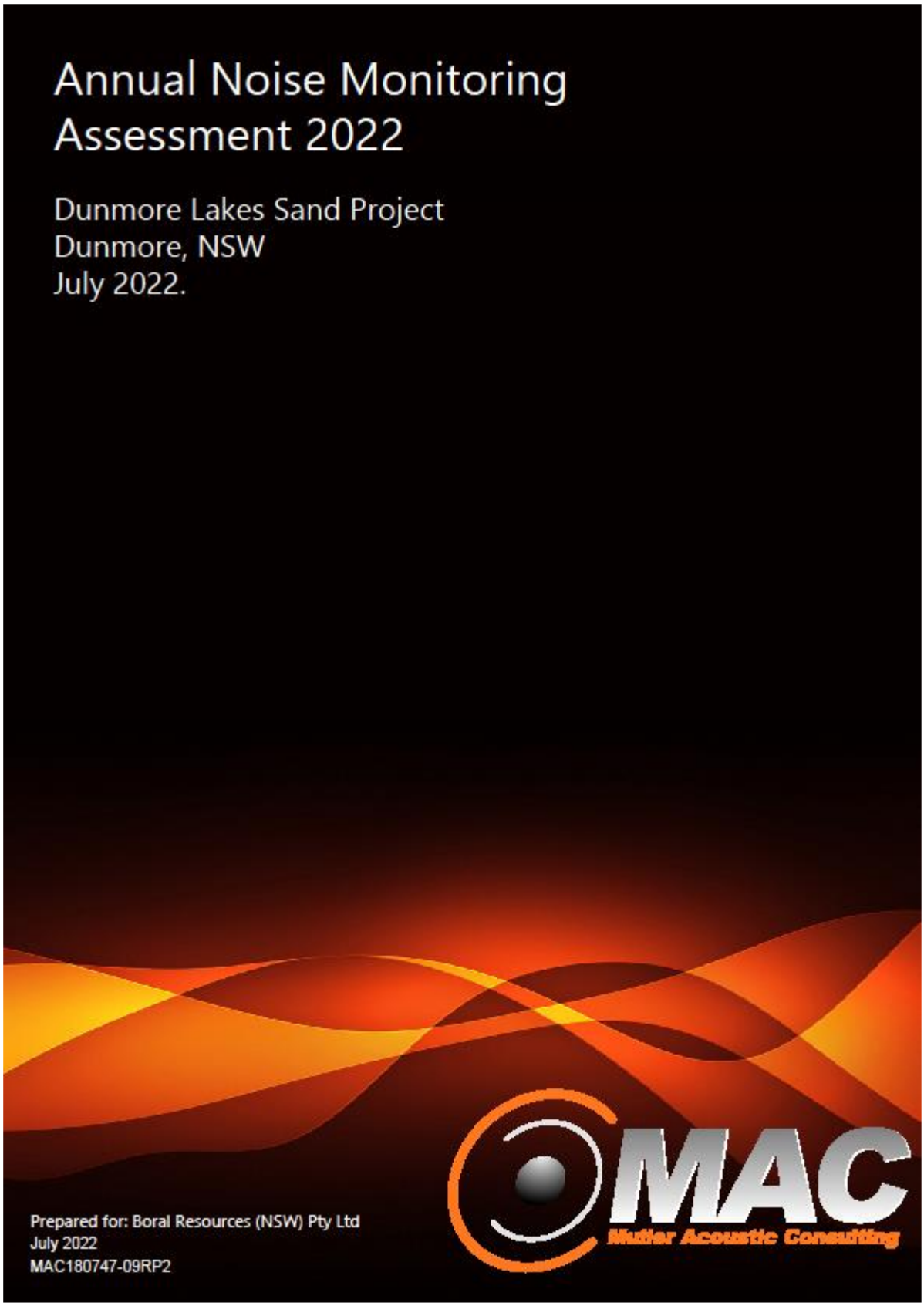
Table 30 Detailed Summary of PM_{10} Monitoring Data

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)
4/07/2022	0.18	50	30	6.80
10/07/2022	0.18	50	30	6.78
16/07/2022	2.55	50	30	6.80
22/07/2022	0.48	50	30	6.80
28/07/2022	0.36	50	30	6.79

3/08/2022	7.42	50	30	6.88
9/08/2022		50	30	6.96
15/08/2022	0.21	50	30	6.87
21/08/2022	0.65	50	30	6.88
27/08/2022	0.48	50	30	6.62
2/09/2022	1.49	50	30	6.55
8/09/2022	7.84	50	30	6.64
14/09/2022	3.03	50	30	6.55
20/09/2022	10.33	50	30	6.63
26/09/2022	20.68	50	30	6.86
2/10/2022	5.88	50	30	6.64
8/10/2022	1.78	50	30	6.57
14/10/2022	1.72	50	30	6.51
20/10/2022	1.13	50	30	6.21
26/10/2022	1.37	50	30	6.14
1/11/2022	12.23	50	30	6.03
7/11/2022	7.3	50	30	6.11
13/11/2022	5.8	50	30	5.91
19/11/2022	2.61	50	30	5.58
25/11/2022	1.6	50	30	5.45
1/12/2022	6.06	50	30	5.26
7/12/2022	9.74	50	30	5.00
13/12/2022	21.2	50	30	4.91
19/12/2022	14.13	50	30	5.02
25/12/2022	14.37	50	30	5.09
31/12/2022	13.66	50	30	5.24
6/01/2023	5.23	50	30	5.12
12/01/2023	14.55	50	30	5.17
18/01/2023	18.53	50	30	5.44

24/01/2023	25.28	50	30	5.74
30/01/2023	11.05	50	30	5.82
5/02/2023	10.51	50	30	5.68
11/02/2023	24.58	50	30	5.87
17/02/2023	17.04	50	30	6.09
23/02/2023	7.13	50	30	6.18
1/03/2023	16.39	50	30	6.43
7/03/2023	4.99	50	30	6.48
13/03/2023	6.2	50	30	6.38
19/03/2023	8.03	50	30	6.39
25/03/2023	5.52	50	30	6.40
31/03/2023		50	30	6.37
6/04/2023	5.94	50	30	6.46
12/04/2023	4.81	50	30	6.42
18/04/2023	3.8	50	30	6.45
24/04/2023	3.5	50	30	6.47
30/04/2023	2.02	50	30	6.48
6/05/2023	0.89	50	30	6.49
12/05/2023	7.66	50	30	6.61
18/05/2023	11.76	50	30	6.80
24/05/2023	4.61	50	30	6.87
30/05/2023		50	30	6.89
5/06/2023		50	30	6.93
11/06/2023	1.48	50	30	6.94
17/06/2023	2.49	50	30	6.94
23/06/2023	1.37	50	30	7.48
29/06/2023	0.6	50	30	7.18

9. Appendix C Annual Noise Monitoring Compliance Report



Document Information

Annual Noise Monitoring Assessment 2022

Dunmore Lakes Sand Project, Dunmore, NSW

July 2022

Prepared for: Boral Resources (NSW) Pty Ltd

Prepared by: Muller Acoustic Consulting Pty Ltd
PO Box 678, Kotara NSW 2289
ABN: 36 602 225 132
P: +61 2 4920 1833
www.mulleracoustic.com

Document ID	Date	Prepared By	Signed	Reviewed By	Signed
MAC180747-09RP2	29 July 2022	Nicholas Shipman		Rod Linnett	

CONTENTS

1 Introduction

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Boral for Dunmore Lakes Sand Project (DLSP), at Dunmore, NSW.

The monitoring has been conducted in accordance with the Dunmore Lakes Sand Project Noise Management Plan V7 (NMP, 2021) and in general accordance with the Noise Policy for Industry (NPI). This assessment has been undertaken during July 2022 and forms the annual noise monitoring program to address conditions outlined in the Development Consent (DA 195-8-2004) with the commencement of Stage 5A.

This report summarises the operator-attended noise monitoring results measured at eight receivers in comparison to the relevant noise limits contained in the Development Consent and NMP.

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

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPI), 2017;
- Dunmore Lakes Sand Project Noise Management Plan V7 (NMP), 2021;
- Dunmore Lakes Sand Quarry Environmental Protection Licence No. 11147;
- Discussion Paper - Validation of Inversion Strength Estimation Method (EPA) 2014; and
- Australian Standard AS 1055:2018 - Acoustics - Description and measurement of environmental noise.

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

2 Noise Criteria

The DLSP Noise Management Plan (NMP), outlines the applicable noise criteria for residential receivers surrounding the operation, and are presented in **Table 1** and **Table 2**.

Table 1 Consent Criteria

Receiver Location	Day (7am - 6pm) dB $L_{Aeq(15min)}$	Evening (6pm - 10pm) dB $L_{Aeq(15min)}$	Night (10pm - 12am) dB $L_{Aeq(15min)}$	Morning Shoulder (6am - 7am) dB $L_{Aeq(15min)}$
Dunmore Village residences – 31 Shellharbour Road	49	44	41	47
R20	49	44	38	47
R3, R11, R12, R13, R14, R15, R16, R17, R18, 79 Fig Hill Lane	48	43	38	48
R19	47	43	38	46
R4, R5, R6, R7, R8, R9, R10	47	43	38	43
Renton (183 James Road, Dunmore)	46	43	37	46
All other residences	40	35	35	35

Note 1: Referenced from DLSP NMPv7 Table 7.

Table 2 Maximum Noise Trigger Levels

Receiver Location	Night (10pm - 12am) dB L_{Amax}	Morning Shoulder (6am - 7am) dB L_{Amax}
R1, R2, R3, R11, R12, R13, R14, R15, R16, R17 and R18	61	
R4, R5, R6, R7, R8, R9, R10	53	
R19	56	

Note 1: Referenced from DLSP NMPv7 Table 8.

The DLSP Environmental Protection Licence (EPL), outlines the applicable noise limits for residential receivers surrounding the operation, and are presented in Table 3.

Table 3 EPL Noise Limits

Description	Address	Day (7am - 6pm) dB $L_{Aeq(15min)}$	Evening (6pm - 10pm) dB $L_{Aeq(15min)}$	Night (10pm - 6am) dB $L_{Aeq(15min)}$	Morning Shoulder (6am - 7am) dB $L_{Aeq(15min)}$
Renton	James Road	46	43	37	46
Dunmore Village	31 Shellharbour Road	49	44	41	47
Stocker	Swamp Road	49	44	38	47

The EPL noise limits presented in **Table 4** apply under the following meteorological conditions:

- Wind speeds up to 3m/s at 10 metres above ground level; or
- Temperature inversion conditions of up 6°C/100m and wind speeds up to 2m/s at 10 metres above ground level.

3 Methodology

3.1 Locality

DLSP is located at Dunmore near Shellharbour, NSW. Receivers in the locality surrounding DLSP are primarily rural and residential. Highway traffic is a dominant noise source for receivers as they are situated within 500m of the Princes Highway. The representative monitoring locations with respect to DLSP are presented in the locality plan in **Figure 1**. **Table 4** and **Table 5** presents the relevant noise criteria for each assessed receiver.

Table 4 Attended Monitoring Locations and Consent Criteria

ID[2]	Description[3]	Day[1]	Evening[1]	Night[1]	Morning Shoulder[1]
		dB $L_{Aeq(15min)}$	dB $L_{Aeq(15min)}$	dB $L_{Aeq(15min)}$	dB $L_{Aeq(15min)}$
DN-6	Renton	46	43	37	46
DN-7	Dunmore Village	49	44	41	47
DN-8	Stocker (R20)	49	44	38	47
DN-9	R17	48	43	38	48
DN-10	R14	48	43	38	48
DN-11	R11	48	43	38	48
DN-12	R3	48	43	38	48
DN-13	R4	47	43	38	43

Note 1: 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.

Note 2: Referenced from DLSP NMPv7 Figure 3 and Figure 4.

Note 3: Referenced from DLSP NMPv7 Table 7.

Table 5 Attended Monitoring Locations and Maximum Noise Trigger Levels

ID[2]	Description[3]	Night (10pm - 12am)	Morning Shoulder (6am - 7am)
		dB L_{Amax}	dB L_{Amax}
DN-9, DN-10, DN-11 and DN-12	R1, R2, R3, R11, R12, R13, R14, R15, R16, R17 and R18	61	
DN-13	R4, R5, R6, R7, R8, R9, R10		53
DN6, DN7 and DN-8	Renton, Dunmore Village and Stocker		N/A

Note 1: Referenced from DLSP NMPv7 Table 8.

Note 2: Referenced from DLSP NMPv7 Figure 1, Figure 2, Figure 3 and Figure 4.

Note 3: Referenced from DLSP NMPv7 Table 7.

3.2 Assessment Methodology

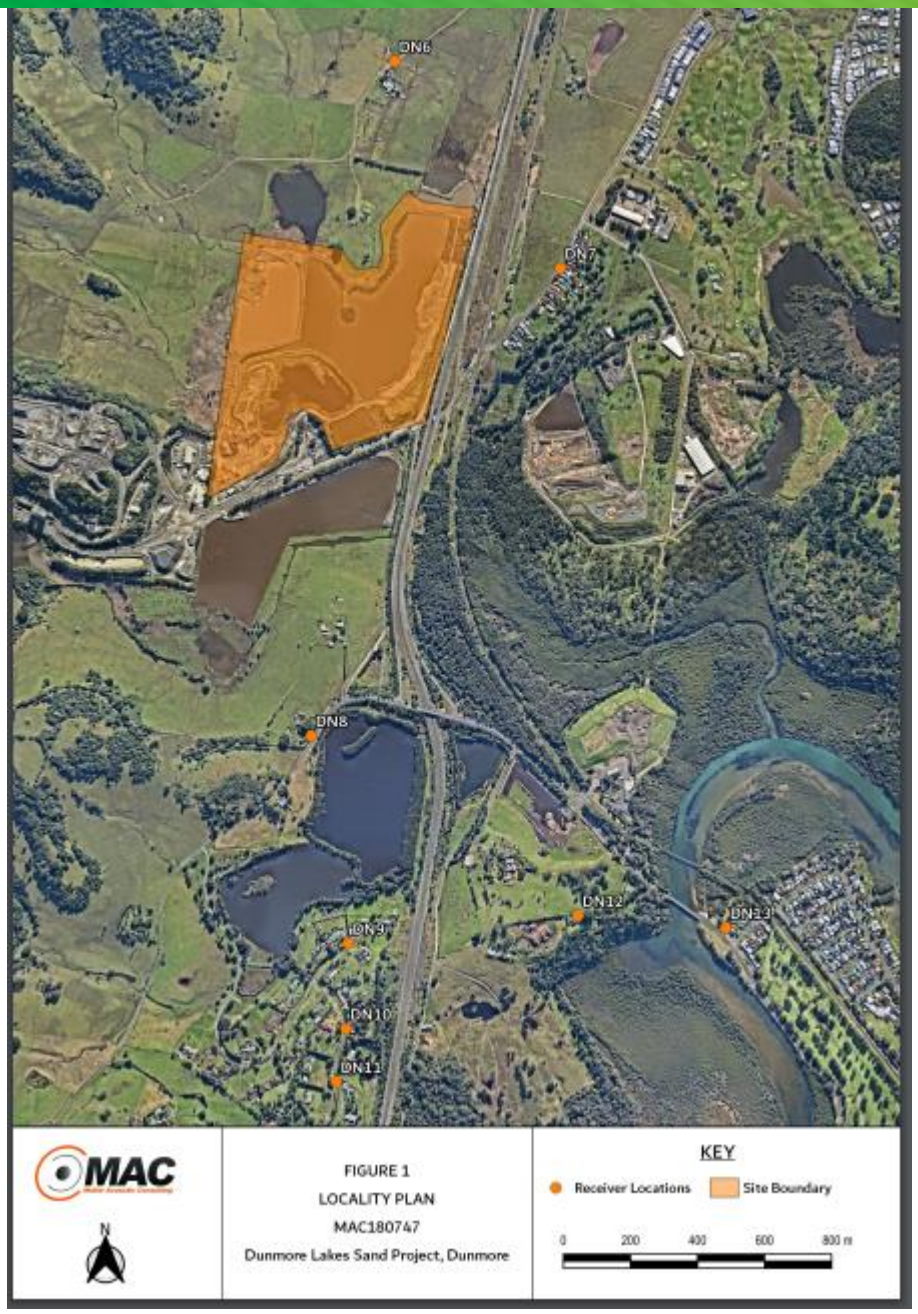
The attended noise measurements were conducted in general accordance with the procedures described in Australian Standard AS 1055:2018, "Acoustics - Description and Measurement of Environmental Noise" and the DLSP NMP. Noise measurements of two 15 minutes in duration during the day period and one 15 minute duration during the remaining periods were conducted at eight locations (DN-6, DN-7, DN-8, DN-9, DN-10, DN-11, DN-12, DN-13) using Svantek Type 1, 971 noise analysers between Tuesday 12 July 2022 and Thursday 14 July 2022 to satisfy the requirements of the NMP. The acoustic instrumentation used carries current NATA calibration and complies with AS IEC 61672.1-2019- Electroacoustics - Sound level meters - Specifications. Calibration of all instrumentation was checked prior to and following measurements. Drift in calibration did not exceed ±0.5dBA.

To understand meteorological conditions during the evening and night periods, direct measurement of temperature profile was undertaken at Trevethan Reserve, Minnamurra at 2m above ground level and at 50m above ground level using a weather balloon on Tuesday 12 July 2022. It is noted that due to high wind speeds during the morning shoulder periods between Wednesday 13 July 2022 and Thursday 14 July 2022 temperature measurements were unable to be obtained.

The results of the temperature measurements were used to determine the temperature lapse rate in general accordance with the Validation of Inversion Strength Estimation Method (2014). These measurements, in combination with the on site weather station provide a reference to validate the relevant meteorological conditions under which compliance is assessed.

Extraneous noise sources were excluded from the analysis to determine the dB $LA_{eq(15min)}$ DSLP noise contribution for comparison against the relevant criteria. In the event of quarry attributed noise being above criteria, prevailing meteorological conditions for the monitoring period are sourced from the onsite meteorological station and analysed in accordance with Fact Sheet A4 of the NPI to determine the stability category present at the time of each attended measurement.

Where the quarry is inaudible, the contribution is estimated to be at least 10dBA below the ambient noise level.


DN6
DN7
DN8
DN9
DN10
DN11
DN12
DN13
MAC
N
FIGURE 1
LOCALITY PLAN
MAC180747
Dunmore Lakes Sand Project, Dunmore
KEY
Receiver Locations
Site Boundary
0
200
400
600
800 m

4 Results

A summary of the operator attended measurements at location DN-6 to DN-13 are presented **Table 6** to **Table 13** and provide the following information:

- Monitoring location.
- Date, time and assessment period.
- Observed Wind Speed (WS, m/s), Wind Direction (WD) and Temperature (Temp) in °C at 1.5m above the ground measured at the monitoring location.
- Measured Temperature (Temp) in °C at 2.0m and 60.0m above ground level at a representative location.
- Average Wind Speed (WS, m/s), Wind Direction (WD) and Temperature (Temp) in °C at 10m above ground level at the on-site weather station.
- Atmospheric stability class derived from the on-site weather station.
- Calculated temperature inversion strength.
- Ambient measured noise levels $LA_{eq(15min)}$ and $LA_{90(15min)}$ in dB re 20µPa.
- DLSP $LA_{eq(15min)}$ and LA_{max} noise level contribution.
- Noise Limit $LA_{eq(15min)}$ and LA_{max}.

Results of the attended noise survey identified that the DLSP was audible for short durations during the measurements, however extraneous sources such as distant traffic, insects, livestock and birds were audible during the survey period and dominated the acoustic environment. Temperature data indicated that inversion strengths calculated from on-site measurements during the evening and night periods on Tuesday 12 July 2022 were within the development consent conditions (ie lower than 6°C/100m), although DSLP noise contributions were within the consent noise criteria. It is noted that temperate inversion data was unavailable during the morning shoulder periods due to increased wind speeds and unstable conditions.

Table 6 DN-6 - Attended Noise Monitoring Summary

Date & Period	Time (hrs)	1.5m WS WD Temp	Descriptor		Consent Criteria	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}	$L_{Aeq(15min)}$/ L_{Amax}	WS (m/s)[1]	WD[1]	2m Temp°C	60m Temp°C	Delta Temp°C	Lapse Rate °C/100m[2]	Stability Class[1]	
14/07/2022 Morning Shoulder	06:27	2.9m/s SW 11°C	56	50	46	5.5	SW	N/A	N/A	N/A	N/A	D	Traffic 50-54 Wind in trees 56-66 Birds 53-57 DLSP inaudible
DLSP Contribution													<40dB $L_{Aeq(15min)}$
12/07/2022 Day	15:22	0.5m/s N 16°C	57	50	46	1.9	E	N/A	N/A	N/A	N/A	E	Traffic 49-76 DLSP inaudible
DLSP Contribution													<40dB $L_{Aeq(15min)}$
12/07/2022 Day	15:53	0.5m/s N 16°C	54	51	46	1.6	E	N/A	N/A	N/A	N/A	E	Traffic 47-68 DLSP inaudible
DLSP Contribution													<41dB $L_{Aeq(15min)}$
12/07/2022 Evening	21:45	0.2m/s N 9°C	56	53	43	2.4	W	8.9	7.5	-1.3	-2.9	F	Insects <50 Traffic 50-66 DLSP inaudible
DLSP Contribution													<43dB $L_{Aeq(15min)}$
12/07/2022 Night	22:00	0.1m/s N 9°C	67	58	37	2.3	W	8.1	7.6	-0.4	-1	F	Insects <47 Traffic 47-70 DLSP inaudible
DLSP Contribution													<37dB $L_{Aeq(15min)}$

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 60m temperature.

Table 7 DN-7 - Attended Noise Monitoring Summary

Date & Period	Time (hrs)	1.5m WS WD Temp	Descriptor		Consent Criteria	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}	$L_{Aeq(15min)}$/ L_{Amax}	WS (m/s)[1]	WD[1]	2m Temp°C	60m Temp°C	Delta Temp°C	Lapse Rate °C/100m[2]	Stability Class[1]	
14/07/2022 Morning Shoulder	06:02	2.8m/s SW 12°C	63	59	47	5	SW	N/A	N/A	N/A	N/A	D	Traffic 55-73 Wind in trees 50-70 Train 60-62 DLSP inaudible
DLSP Contribution													<47dB $L_{Aeq(15min)}$
12/07/2022 Day	14:42	0.3m/s E 16°C	61	57	49	2.5	E	N/A	N/A	N/A	N/A	E	Traffic 55-70 DLSP inaudible
DLSP Contribution													<47dB $L_{Aeq(15min)}$
12/07/2022 Day	15:12	0.3m/s E 16°C	61	57	49	1.9	ESE	N/A	N/A	N/A	N/A	D	Traffic 56-81 DLSP inaudible
DLSP Contribution													<47dB $L_{Aeq(15min)}$
12/07/2022 Evening	21:55	0.1m/s W 9°C	61	56	44	2.3	W	8.5	7.5	-1	-2	F	Traffic 55-71 DLSP inaudible
DLSP Contribution													<44dB $L_{Aeq(15min)}$
12/07/2022 Night	23:07	0.1m/s W 7°C	58	51	41	2.3	W	8.2	7.3	-0.9	-2	E	Traffic 52-72 DLSP inaudible
DLSP Contribution													<41dB $L_{Aeq(15min)}$

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 60m temperature.

Table 8 DN-8 - Attended Noise Monitoring Summary

Date & Period	Time (hrs)	1.5m WS WD Temp	Descriptor		Consent Criteria	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}	$L_{Aeq(15min)}$/ L_{Amax}	WS (m/s)[1]	WD[1]	2m Temp°C	60m Temp°C	Delta Temp°C	Lapse Rate °C/100m[2]	Stability Class[1]	
13/07/2022 Morning Shoulder	06:39	2.8m/s W 10°C	60	47	47	3.2	WSW	N/A	N/A	N/A	N/A	D	Traffic 46-78 Insects 40-52 Wind in trees 42-48 Birds 40-44 DLSP inaudible
DLSP Contribution													<37dB $L_{Aeq(15min)}$
12/07/2022 Day	13:45	0.8m/s E 16°C	62	50	49	2.9	ESE	N/A	N/A	N/A	N/A	E	Traffic 45-80 Local residential noise 50-56 DLSP inaudible
DLSP Contribution													<40dB $L_{Aeq(15min)}$
12/07/2022 Day	14:15	0.8m/s E 16°C	64	51	49	3.1	ESE	N/A	N/A	N/A	N/A	D	Traffic 45-83 DLSP inaudible
DLSP Contribution													<41dB $L_{Aeq(15min)}$
12/07/2022 Evening	21:34	0.2m/s W 9°C	54	46	44	2.2	W	8.6	7.5	-1.1	-2.3	F	Traffic 44-74 DLSP inaudible
DLSP Contribution													<36dB $L_{Aeq(15min)}$
12/07/2022 Night	22:26	0.1m/s N 8°C	48	45	38	2.3	W	8.2	7.1	-1	-2.2	F	Aircraft 43-46 Traffic 44-55 DLSP inaudible
DLSP Contribution													<35dB $L_{Aeq(15min)}$

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 60m temperature.

Table 9 DN-9 - Attended Noise Monitoring Summary

Date & Period	Time (hrs)	1.5m WS WD Temp	Descriptor		Consent Criteria	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}	$L_{Aeq(15min)}$/ L_{Amax}	WS (m/s)[1]	WD[1]	2m Temp°C	60m Temp°C	Delta Temp°C	Lapse Rate °C/100m[2]	Stability Class[1]	
13/07/2022 Morning Shoulder	06:18	2.8m/s W 10°C	49	46	48/61	3.2	W	N/A	N/A	N/A	N/A	E	Traffic 44-60 Aircraft 47-49 Wind in trees 44-54 DLSP inaudible
DLSP Contribution													<36dB $L_{Aeq(15min)}$ <40dB L_{Amax}
12/07/2022 Day	13:08	2.5m/s E 16°C	55	49	48	3	ESE	N/A	N/A	N/A	N/A	E	Traffic 40-75 DLSP inaudible
DLSP Contribution													<39dB $L_{Aeq(15min)}$
12/07/2022 Day	13:38	2.5m/s E 16°C	53	48	48	3.2	ESE	N/A	N/A	N/A	N/A	D	Traffic 40-65 DLSP inaudible
DLSP Contribution													<38dB $L_{Aeq(15min)}$
12/07/2022 Evening	21:14	0.1m/s W 9°C	51	45	43	2.4	W	9.1	7.8	-1.3	-2.7	F	Traffic 43-62 DLSP inaudible
DLSP Contribution													<35dB $L_{Aeq(15min)}$
12/07/2022 Night	22:46	0.1m/s N 8°C	46	37	38/61	2.4	W	8.6	7.3	-1.3	-2.7	E	Insects 34-36 Traffic 34-60 DLSP inaudible
DLSP Contribution													<30dB $L_{Aeq(15min)}$ <40dB L_{Amax}

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 60m temperature.

Table 10 DN-10 - Attended Noise Monitoring Summary

Date & Period	Time (hrs)	1.5m WS WD Temp	Descriptor		Consent Criteria	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}	$L_{Aeq(15min)}$/ L_{Amax}	WS (m/s)[1]	WD[1]	2m Temp°C	60m Temp°C	Delta Temp°C	Lapse Rate °C/100m[2]	Stability Class[1]	
13/07/2022 Morning Shoulder	06:00	2.8m/s W 10°C	49	46	48/61	2.7	W	N/A	N/A	N/A	N/A	D	Traffic 43-58 Wind in trees 44-48 DLSP inaudible
DLSP Contribution													<36dB $L_{Aeq(15min)}$ <40dB L_{Amax}
12/07/2022 Day	12:34	0.1m/s E 18°C	53	46	48	2	E	N/A	N/A	N/A	N/A	C	Traffic 44-75 DLSP inaudible
DLSP Contribution													<36dB $L_{Aeq(15min)}$
12/07/2022 Day	13:04	0.1m/s E 18°C	53	48	48	2.7	SE	N/A	N/A	N/A	N/A	D	Traffic 44-70 DLSP inaudible
DLSP Contribution													<38dB $L_{Aeq(15min)}$
12/07/2022 Evening	20:50	0.1m/s W 9°C	57	45	43	1.3	W	8.9	8.1	-0.7	-1.6	E	Dog barking 51-83 Traffic 40-65 DLSP inaudible
DLSP Contribution													<35dB $L_{Aeq(15min)}$
12/07/2022 Night	22:24	0.1m/s W 9°C	52	46	38/61	2.3	W	8.4	7.3	-1.1	-2.3	F	Traffic 50-49 Insects 50-52 DLSP inaudible
DLSP Contribution													<36dB $L_{Aeq(15min)}$ <40dB L_{Amax}

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 60m temperature.

Table 11 DN-11 - Attended Noise Monitoring Summary

Date & Period	Time (hrs)	1.5m WS WD Temp	Descriptor		Consent Criteria	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}	$L_{Aeq(15min)}$/ L_{Amax}	WS (m/s)[1]	WD[1]	2m Temp°C	60m Temp°C	Delta Temp°C	Lapse Rate °C/100m[2]	Stability Class[1]	
13/07/2022 Morning Shoulder	06:40	2m/s W 9°C	55	52	48/61	3.2	WSW	N/A	N/A	N/A	N/A	D	Traffic 49-75 Birds 49-56 DLSP inaudible
DLSP Contribution													<42dB $L_{Aeq(15min)}$ <42dB L_{Amax}
12/07/2022 Day	11:57	1.2m/s E 16°C	59	55	48	1	ESE	N/A	N/A	N/A	N/A	B	Traffic 55-70 DLSP inaudible
DLSP Contribution													<45dB $L_{Aeq(15min)}$
12/07/2022 Day	12:27	1.2m/s E 16°C	58	55	48	2	E	N/A	N/A	N/A	N/A	C	Traffic 55-68 Local residential noise 40-60 DLSP inaudible
DLSP Contribution													<45dB $L_{Aeq(15min)}$
12/07/2022 Evening	20:30	0.2m/s W 9°C	48	43	43	1.9	W	9	8.2	-0.7	-1.6	F	Traffic 49-62 DLSP inaudible
DLSP Contribution													<33dB $L_{Aeq(15min)}$
12/07/2022 Night	22:42	0.1m/s W 9°C	49	37	38/61	2.4	W	8.5	7.4	-1	-2.1	E	Traffic 40-63 DLSP inaudible
DLSP Contribution													<30dB $L_{Aeq(15min)}$ <40dB L_{Amax}

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 60m temperature.

Table 12 DN-12 - Attended Noise Monitoring Summary

Date & Period	Time (hrs)	1.5m WS WD Temp	Descriptor		Consent Criteria	Observed Meteorology						Description and SPL, dBA
			L_{Aeq}	L_{A90}	$L_{Aeq(15min)}$/ L_{Amax}	WS (m/s)[1]	WD[1]	2m Temp°C	60m Temp°C	Delta Temp°C	Lapse Rate °C/100m[2]	Stability Class[1]	
13/07/2022 Morning Shoulder	06:18	1.1m/s W 9°C	71	49	48/61	3.2	W	N/A	N/A	N/A	N/A	E	Traffic 45-87 DLSP inaudible
DLSP Contribution													<39dB $L_{Aeq(15min)}$ <40dB dB L_{Amax}
12/07/2022 Day	11:10	0.1m/s E 14°C	63	46	48	1	N	N/A	N/A	N/A	N/A	A	Traffic 65-79 Train 60-75 DLSP inaudible
DLSP Contribution													<36dB $L_{Aeq(15min)}$
12/07/2022 Day	11:40	0.1m/s E 14°C	63	46	48	2.1	ESE	N/A	N/A	N/A	N/A	A	Traffic 65-76 DLSP inaudible
DLSP Contribution													<36dB $L_{Aeq(15min)}$
12/07/2022 Evening	20:06	0.2m/s W 11°C	56	42	43	2.2	W	9.5	8.9	-0.6	-1.2	F	Traffic 40-74 Train 40-71 DLSP inaudible
DLSP Contribution													<32dB $L_{Aeq(15min)}$
12/07/2022 Night	23:31	0.1m/s W 7°C	47	33	38/61	1.6	WSW	7.7	7.6	-0.1	-0.2	D	Traffic 33-69 DLSP inaudible
DLSP Contribution													<30dB $L_{Aeq(15min)}$ <40dB L_{Amax}

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 60m temperature.

Table 13 DN-13 - Attended Noise Monitoring Summary

Date & Period	Time (hrs)	1.5m WS WD Temp	Descriptor		Consent Criteria	Observed Meteorology							Description and SPL, dBA
			L_{Aeq}	L_{A90}	$L_{Aeq(15min)}$/ L_{Amax}	WS (m/s)[1]	WD[1]	2m Temp°C	60m Temp°C	Delta Temp°C	Lapse Rate °C/100m[2]	Stability Class[1]	
13/07/2022 Morning Shoulder	06:00	1.6m/s W 9°C	58	49	43/53	2.7	W	N/A	N/A	N/A	N/A	D	Traffic 46-75 Train 46-58 DLSP inaudible
DLSP Contribution													<39dB $L_{Aeq(15min)}$ <40dB L_{Amax}
12/07/2022 Day	10:27	0.5m/s W 14°C	54	45	47	0.7	ENE	N/A	N/A	N/A	N/A	A	Traffic 40-71 Train 50-58 DLSP inaudible
DLSP Contribution													<35dB $L_{Aeq(15min)}$
12/07/2022 Day	10:57	0.5m/s W 14°C	54	45	47	0.8	NNE	N/A	N/A	N/A	N/A	D	Traffic 40-69 Train 50-58 DLSP inaudible
DLSP Contribution													<35dB $L_{Aeq(15min)}$
12/07/2022 Evening	19:37	0.2m/s W 11°C	54	44	43	2.1	W	10.7	8.9	-1.7	-3.6	F	Traffic 40-74 DLSP inaudible
DLSP Contribution													<34dB $L_{Aeq(15min)}$
12/07/2022 Night	23:10	0.1m/s N 9°C	48	36	38/53	2.3	W	8.1	7.2	-0.9	-1.9	E	Traffic 36-67 DLSP inaudible
DLSP Contribution													<30dB $L_{Aeq(15min)}$ <40dB L_{Amax}

Note 1: Data from on-site weather station.

Note 2: Calculated from 2m and 60m temperature.

5 Noise Compliance Assessment

The compliance assessment summary for each monitoring location (DN-6, DN-7, DN-8, DN-9, DN10, DN11, DN12, DN-13) is presented in **Table 14** for the day and evening periods and **Table 15** for the night assessment period.

Table 14 Noise Compliance Assessment Summary

Location	Estimated Noise Contribution dB $L_{Aeq(15min)}$			Criteria dB $L_{Aeq(15min)}$		Compliant		
	Day (Round 1)	Day (Round 2)	Evening	Day	Evening	Day (Round 1)	Day (Round 2)	Evening
DN-6	<40	<41	<43	46	43	✓	✓	✓
DN-7	<47	<47	<44	49	44	✓	✓	✓
DN-8	<40	<41	<36	49	44	✓	✓	✓
DN-9	<39	<38	<35	48	43	✓	✓	✓
DN-10	<36	<38	<35	48	43	✓	✓	✓
DN-11	<45	<45	<33	48	43	✓	✓	✓
DN-12	<36	<36	<32	48	43	✓	✓	✓
DN-13	<35	<35	<34	47	43	✓	✓	✓

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.

Table 15 Noise Compliance Assessment Summary

Location	Estimated Noise Contribution				Criteria				Compliant			
	Night		Morning Shoulder		Night		Morning Shoulder		Night		Morning Shoulder	
	dB LAeq(15min)	dB LAmax	dB LAeq(15min)	dB LAmax	dB LAeq(15min)	dB LAmax	dB LAeq(15min)	dB LAmax	dB LAeq(15min)	dB LAmax	dB LAeq(15min)	dB LAmax
DN-6	<37	N/A	<40	N/A	37	N/A	46	N/A	✓	N/A	✓	N/A
DN-7	<41	N/A	<47	N/A	41	N/A	47	N/A	✓	N/A	✓	N/A
DN-8	<35	N/A	<37	N/A	38	N/A	47	N/A	✓	N/A	✓	N/A
DN-9	<30	<40	<36	<40	38	61	48	61	✓	✓	✓	✓
DN-10	<36	<36	<36	<40	38	61	48	61	✓	✓	✓	✓
DN-11	<30	<40	<42	<42	38	61	48	61	✓	✓	✓	✓
DN-12	<30	<40	<39	<40	38	61	48	61	✓	✓	✓	✓
DN-13	<30	<40	<39	<40	38	53	43	53	✓	✓	✓	✓

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.

6 Discussion

6.1 Discussion of Results - Location DN-6

The noise monitoring survey identified that the acoustic environment at this location is dominated by road traffic noise from the Princes Highway, approximately 350m to the east. DLSP noise was inaudible during all measurement periods with the noise contribution calculated (during short breaks in traffic) to be below the relevant noise criteria for all periods. Extraneous sources audible during the survey included traffic, birds, wind in trees and insects.

6.2 Discussion of Results - Location DN-7

The noise monitoring survey identified that the acoustic environment at this location is dominated by road traffic noise from the Princes Highway, approximately 350m to the west. DLSP noise was inaudible during the measurement periods and the noise contributions were calculated (during short breaks in traffic) to be below the relevant noise criteria for all periods. Extraneous sources audible during the survey included traffic, train and wind in trees.

6.3 Discussion of Results - Location DN-8

The noise monitoring survey identified that the acoustic environment at this location is dominated by road traffic noise from the Princes Highway, approximately 350m to the east. DLSP noise was inaudible during the measurement periods with the noise contribution calculated (during short breaks in traffic) to be below the relevant noise criteria for all periods. Extraneous sources audible during the survey included traffic, birds, local residential noise, wind in trees and insects.

6.4 Discussion of Results - Location DN-9

The noise monitoring survey identified that the acoustic environment at this location is dominated by road traffic noise from the Princes Highway, approximately 160m to the east. DLSP noise was inaudible during the measurement periods with the noise contribution calculated (during short breaks in traffic) to be below the relevant noise criteria for all periods. Extraneous sources audible during the survey included traffic, wind in trees, aircraft and insects.

6.5 Discussion of Results - Location DN-10

The noise monitoring survey identified that the acoustic environment at this location is dominated by road traffic noise from the Princes Highway, approximately 140m to the east. DLSP noise was inaudible during the measurement periods with the noise contribution calculated (during short breaks in traffic) to be below the relevant noise criteria for all periods. Extraneous sources audible during the survey included traffic, dogs barking, wind in trees and insects.

6.6 Discussion of Results - Location DN-11

The noise monitoring survey identified that the acoustic environment at this location is dominated by road traffic noise from the Princes Highway, approximately 150m to the east. DLSP noise was inaudible during the measurement periods with the noise contribution calculated (during short breaks in traffic) to be below the relevant noise criteria for all periods. Extraneous sources audible during the survey included traffic, birds and local residential noise.

6.7 Discussion of Results - Location DN-12

The noise monitoring survey identified that the acoustic environment at this location is dominated by road traffic noise from the Princes Highway, approximately 470m to the west. DLSP noise was inaudible during the measurement periods with the noise contribution calculated (during short breaks in traffic) to be below the relevant noise criteria for all periods. Extraneous sources audible during the survey included traffic and trains.

6.8 Discussion of Results - Location DN-13

The noise monitoring survey identified that the acoustic environment at this location is dominated by road traffic noise from Riverside Drive, approximately 10m to the west. DLSP noise was inaudible during the measurement periods with the noise contribution calculated (during short breaks in traffic) to be below the relevant noise criteria for all periods. Extraneous sources audible during the survey included traffic and trains.

7 Conclusion

Muller Acoustic Consulting Pty Ltd (MAC) has completed a Noise Monitoring Assessment (NMA) on behalf of Boral for Dunmore Lakes Sand Project (DLSP), Dunmore, NSW.

Attended noise monitoring was undertaken between Tuesday 12 July 2022 and Thursday 14 July 2022 at eight representative monitoring locations. The assessment has identified that noise emissions generated by DLSP were inaudible during the assessment periods. DSLP contributed noise emissions were below the relevant criteria at all locations during all measurement periods thus satisfying the relevant consent conditions.

Appendix A - Glossary of Terms

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

Table A1 Glossary of Terms

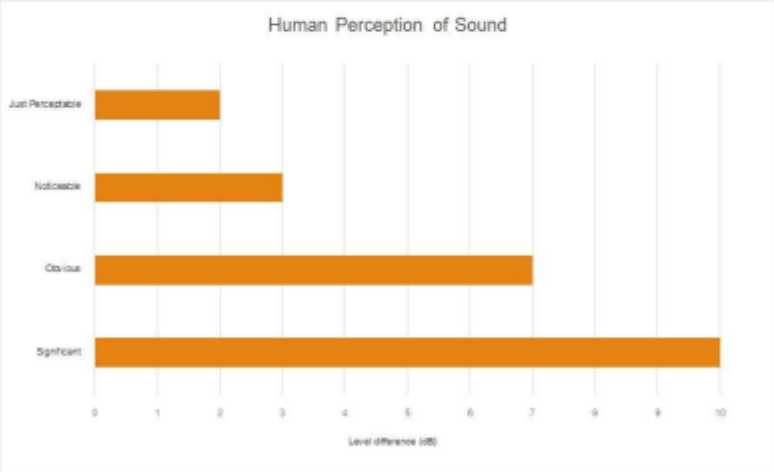
Term	Description
1/3 Octave	Single octave bands divided into three parts
Octave	A division of the frequency range into bands, the upper frequency limit of each band being twice the lower frequency limit.
ABL	Assessment Background Level (ABL) is defined in the NPI as a single figure background level for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

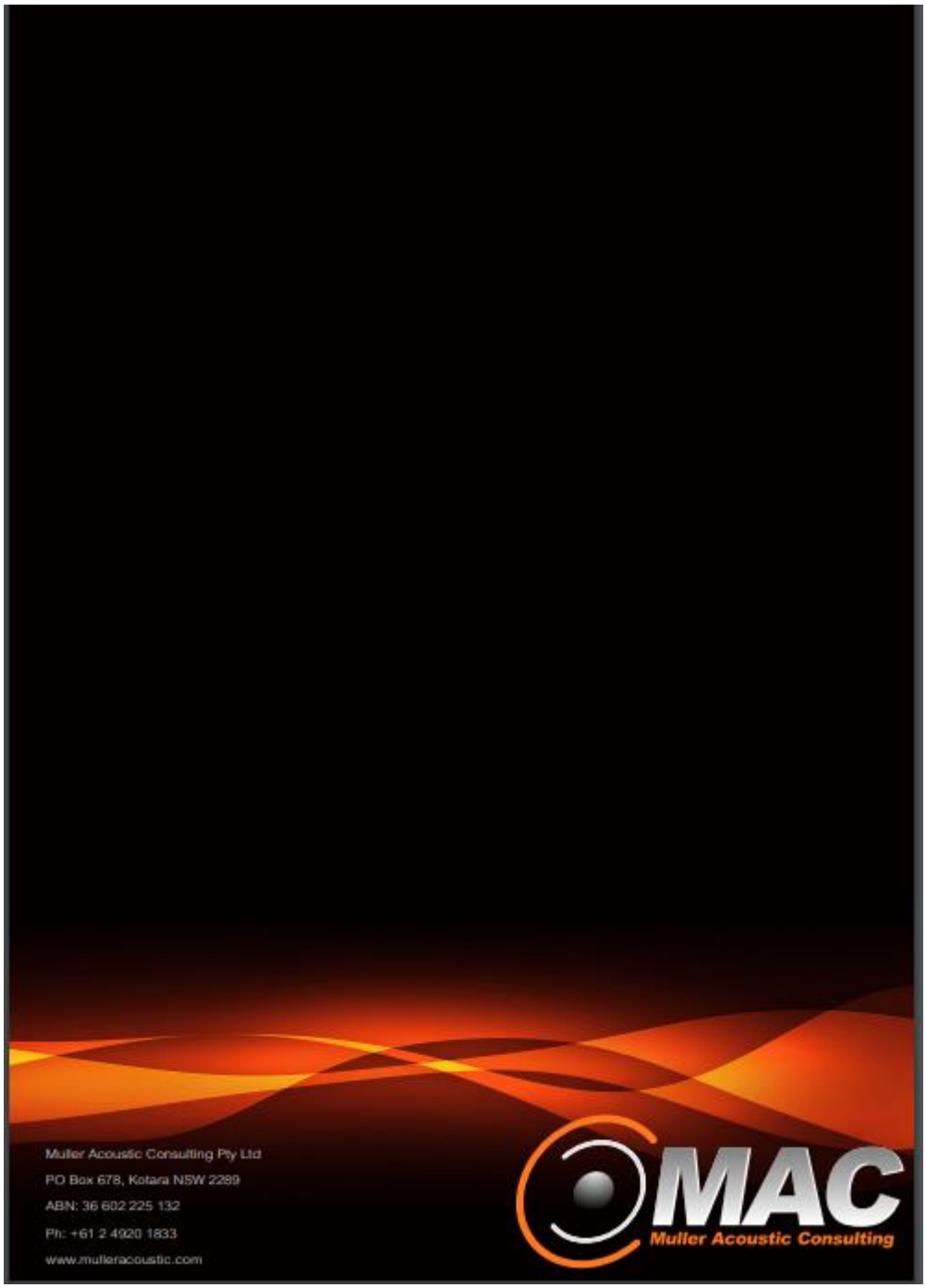
Table A2 provides a list of common noise sources and their typical sound level.

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

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

Figure A1 – Human Perception of Sound




Muller Acoustic Consulting Pty Ltd
PO Box 678, Kotara NSW 2289
ABN: 36 602 225 132
Ph: +61 2 4920 1833
www.mulleracoustic.com
MAC
Muller Acoustic Consulting

10. 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

FY21 Re-aligned Western Tributary Rehabilitation Progress

FY17 NW Stage 2 Swamp Oak Forest Rehabilitation Progress

FY18 NW Stage 2 Swamp Oak Forest Rehabilitation Progress

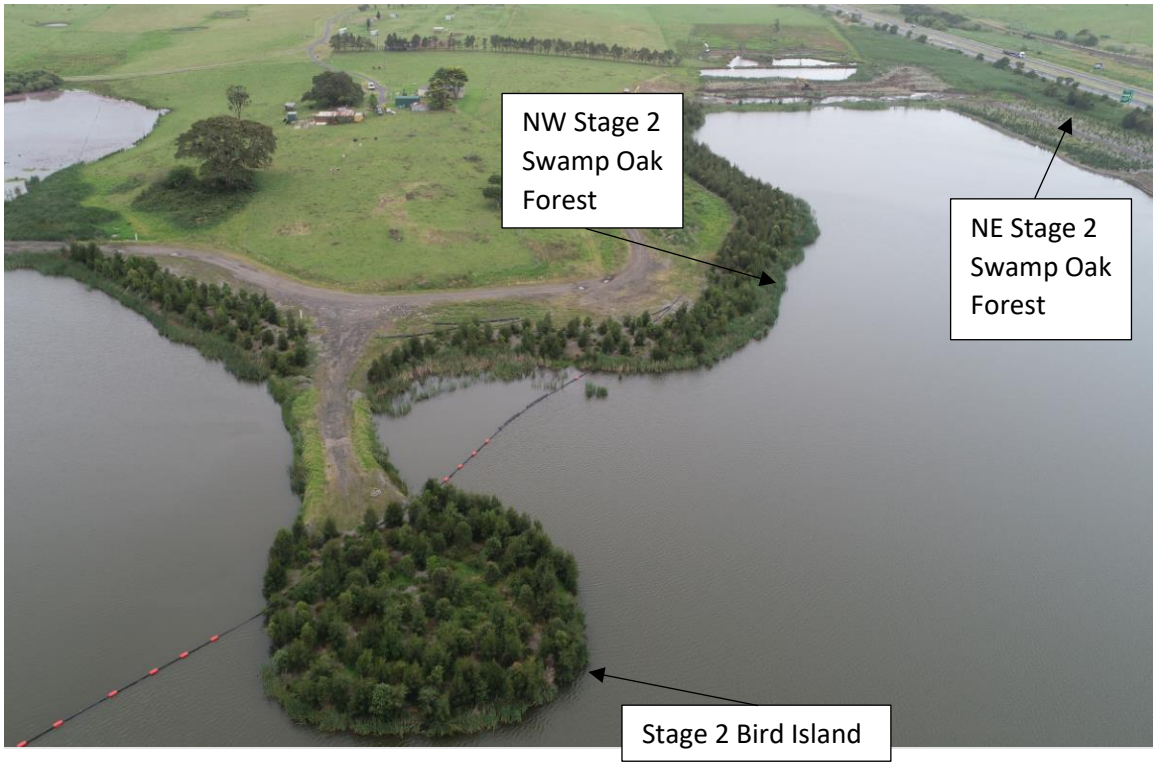
FY19 NW Stage 2 Swamp Oak Forest Rehabilitation Progress

FY20 NW Stage 2 *Swamp Oak Forest Rehabilitation Progress*

FY21 NW Stage 2 Swamp Oak Forest Rehabilitation Progress

FY20 NE Stage 2 Swamp Oak Forest Rehabilitation Progress

FY21 NE Stage 2 Swamp Oak Forest Rehabilitation Progress



Dunmore Bird Island and Stage 2 Rehabilitation Area December 2020