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Dunmore Lakes Sand Project

Annual Review

1 July 2018 – 30 June 2019

Table 1 Document Control Tables

Document Control				
Version	Prepared by	Approved by	Date	Distribution
1.0 (Draft)	Ben Williams Environmental Co-ordinator Dunmore Quarry	Matthew Banks Quarry Manager Dunmore Sand and Soil.	September 2019	Internal distribution for review
1.1 (Final)	Ben Williams Environmental Co-ordinator Dunmore	Matthew Banks Quarry Manager Dunmore Sand and Soil.	30 September 2019	• Department of Planning, Industry and Environment • Environmental Protection Agency • Shellharbour City Council • Dunmore Sand and Soil CCC • Online at https://www.boral.com.au/locations/boral-dunmore-operations

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Commonly Used 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
CAA	Controlled Activity Approval
CCC	Community Consultative Committee
CHA	Compensatory Habitat Area
DA 195-8-2004	The development application for the Dunmore Hard Rock Quarry operated by Boral Resources (NSW) Pty Ltd
DO	Dissolved Oxygen
DPIE	Department of Planning, Industry and Environment
EPA	Environmental Protection Authority
EPA&A Act	Environmental Planning and Assessment Act 1979
EPL 77	Environmental Protection Licence for the Dunmore Hard Rock Quarry operated by Boral Resource (NSW) Pty Ltd
FFMP	Flora and Fauna Management Plan
FY19	Financial Year 2019 (1 July 2018 – 30 June 2019)
HVAS	High Volume Air Sampler
LOR	Limit of Reporting
ML	Megalitres
NATA	National Association of Testing Authorities
NMP	Noise Management Plan
NRAR	Natural Resource Access Regulator
NTU	Nephelometric Turbidity Units
PIRMP	Pollution Incident Response Management Plan
PM10	Particulate Matter (10 microns in diameter)
POEO Act	Protection of the Environment Operations Act 1997
S5.C9	Used to refer to a particular condition in DA-195-8-2004 (in this case Schedule 5, Condition 9).
TSS	Total Suspended Solids
WAL	Water Access Licence

WMP	Water Management Plan
WQO	Water Quality Objectives
µg/m3	Micrograms per cubic metre

1. Purpose and Scope

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

S5.C9 and all other relevant conditions required to be addressed as part of the AR are outlined in Table 4 with reference to the section of this report where each has been addressed. The timeframe for the annual review is the 2019 Financial Year which is 1 July 2018 – 30 June 2019.

Table 2 Annual Review Reference Table

Condition of Approval	Condition Requirements	Where addressed in this report
5(9)	By the end of September each year, or other timing as may be agreed by the Secretary, the Applicant must review the environmental performance of the development to the satisfaction of the Secretary. This review must: (a) Describe the development (including rehabilitation that was carried out in the previous financial year, and the development that is proposed to be carried out over the current financial year, (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(a) of Schedule 2; (c) Identify any non-compliances over the last year, and describe what actions were (or are being) taken to ensure compliance; (d) Identify any trends in the monitoring data over the life of the development; (e) Identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and (f) Describe what measures will be implemented over the current financial year to improve the environmental performance of the development. The Applicant must ensure that copies of the Annual Review are submitted to Council and are available to the Community Consultative Committee (see condition 6 of schedule 5) and any interested person upon request.	Section 9 Section 5-8 Section 13 Section 5-8 Sections 5-12 Section 14.2
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 7.7
3(57)	The Applicant must maximise the use of rail transport for delivery/despatch outside the Illawarra Region, to the satisfaction of the	Section 2.6

	Secretary. Details of transportation modes and measures to assess and encourage rail transport must be provided in the Annual Review.	
3(72)	The Applicant must: (a) Provide annual production data to the DPI using the standard form for that purpose; and (b) Include a copy of this data in the Annual Review.	Section 2.6

The AR has also been prepared in line with the DPIE Annual Review Guidelines. Copies of the AR will be submitted to the DPIE and made available to the public at on the Boral Dunmore website.

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

Key contacts associated with the management of the Dunmore Sand and Soil operations, environment, safety and stakeholder relationships are provided in Table 3.

Table 3 Key Personnel Contacts List

Contact	Position	Contact Details
Matthew Banks	Dunmore Sand and Soil Manager	Tel: (02) 4237 8414 Email: matthew.banks@boral.com.au
Ben Williams	Environmental Co-ordinator	Tel: (02) 4237 8414 Email: ben.williams@boral.com.au
Paul Jackson	Stakeholder Relations Manager	Tel: (02) 9033 5215 Email: paul.jackson@boral.com.au

2. Introduction

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

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

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

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

A layout of the site is illustrated in Figure 1.

Figure 1 Dunmore Lakes Sand Project Site Layout

2.2. List of Relevant Approvals

A summary of all the approvals relevant to the Dunmore Lakes Sand Project are provided in Table 4.

Table 4 List of Relevant Approvals

Approval Type	Approval Authority	Approval No.	Date Granted
Development Consent	Department of Planning & Environment	195-8-2004	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

2.3. Summary of Operations

The water management plan was updated and approved in September 2018. All other plans were reviewed and determined to be suitable for current operations. If MOD 2 is approved in the next reporting period all management plans will have to be updated to account for the extension of operations.

2.4. Operations last 12 months

DSS fine sand production has been gradually re-adjusted from 30,000t/month to 20,000t/month to fall in line with the amount of remaining resource. Dredging is occurring approximately 6hrs x 5 days. The re-adjustment in production has led to the right sizing of the business with two employees' positions being made redundant.

No modifications of operations were approved in the last 12 months. There are currently two modifications being assessed by DPIE. The water management plans was updated and approved in September 2018. All other plans were reviewed and determined to be suitable for current operations.

DSS is receiving (VENM) for rehabilitation purposes and are looking to start placing in the Stage 3 Pond in the coming months. Revegetation is planned to start along the VENM runway in Stage 2 in spring.

2.5. Operations next 12 months

Production will align with current remaining resource. Determination for MOD 2 is expected in the next reporting period which will govern the nature of future operations in the next 12 months.

DLSP MOD 2 is currently under assessment with the Independent Planning Commission. This modification outlines an expansion to operation to Stage 5A and Stage 5B.

DLSP MOD 3 is currently under assessment by DPIE. This is an administrative modification relating to the receiving protocols and use of Virgin Excavated Natural Materials to include processing and resale rather than just backfilling and rehabilitation.

If MOD 2 is approved in the next reporting period management plans will likely have to be updated to account for the extension of operations. All management will be reviewed as per S5.C4.

2.6. Production and Sales and Transport

Production data is shown below in Table 5-7. Future reporting of production data in subsequent AR will be in FY format for consistency with requirements to report in the DRG format. A summary of the production data as reported to the DRG is shown in Table 7.

Table 5 Calendar Year Production Data

Month	Production (t)	Sales (t)	
		Road	Rail Transfers Out
Jan 2018	39,187	23,461	11,563
Feb 2018	33,411	34,431	14,162
Mar 2018	36,630	36,373	12,881
Apr 2018	45,673	28,108	13,855
May 2018	63,368	36,094	12,732
Jun 2018	39,038	23,127	10,926
Jul 2018	27,766	23,297	12,797
Aug 2018	28,974	23,264	12,583
Sep 2018	32,930	22,874	10,717
Oct 2018	34,640	20,658	9,043
Nov 2018	39,815	26,424	8,984
Dec 2018	26,761	21,274	10,866
Total	448,193	319,387	141,108
		460,495	

Table 6 Financial Year Production Data

Month	Production (t)	Sales (t)	
		Road	Rail Transfers Out
Jul 2018	27,766	23,297	12,797
Aug 2018	28,974	23,264	12,583
Sep 2018	32,930	22,874	10,717
Oct 2018	34,640	20,658	9,043
Nov 2018	39,815	26,424	8,984
Dec 2018	26,761	21,274	10,866
Jan 2019	33,058	16,971	14,499
Feb 2019	31,798	24,409	19,036
Mar 2019	37,872	18,007	21,166
Apr 2019	35,315	20,017	16,133
May 2019	66,908	23,102	15,123
Jun 2019	28,552	18,552	11,835
Total	257,794	137,791	94,612
		232,403	

Table 7 Production Data DRG Format

Product	Quantity Tonnes FY19
Virgin Materials Crushed Coarse Aggregates	
Over 75mm	
Over 30mm to 75mm	
5mm to 30mm	**25,570**
Under 5mm	
Natural Sand	
Manufactured Sand	**53,022**
Prepared Road Base & Sub Base	
Other Unprocessed Materials	**6,787**
Construction Sand Excluding Industrial	**141,327**
Industrial Sand	
Foundry, Moulding	
Glass	
Other (Specify)	
TOTAL SITE PRODUCTION	**258,811**

Note: This data is an approximation of FY19 production data and is subject to change.

2.7. Production Sales and Transport Next 12 months

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

It is expected that production volumes in FY20 will be less than FY19. Production volumes will dependant on the outcome of MOD 2 determination.

3. Actions Required from the Last Annual Review

Actions undertaken as a result of the last annual review are summarised below in Table 8.

Table 8 Summary of Completed Actions from 2017-18 Annual Review

Aspect	Actions Taken
Review/Update Air Quality Management Plan with a consideration of removing obsolete monitoring points	It was assessed that the air quality management plans would not updated and was suitable for current operations. Although related to Stage 1 operations and now obsolete, DD-1 and DD-4 were providing useful background information for proposed MOD 2 operations and may be utilised if approved. The AQMP will be updated if MOD 2 is approved.
Review/Update Waste Management Plan	It was assessed that the Waste Management Plan was suitable for current operations. The Waste Management Plan will be updated in the case of either MOD 2 or MOD 3 being approved due to changes to operations affecting waste management and VENM receiving protocols.
Review/Update Water Management Plan	It was assessed that an update was necessary for the Water Management Plan. This was submitted and approved in September 2018
Review other management plans	All other plans were deemed to be sufficient for current operations. These will also be reviewed 3 months after this AR is submitted as per S5.C4. It is expected in the case of MOD 2 approval most management plans will require an update due to a substantial change in operations.
Continue with backfilling and remediation of the Stage 2 eastern edge	This area has been backfilled and planting of selected sections is scheduled for Spring 2019.
Investigate an early warning network to predict wind strength and direction	The Dunmore weather station will be updated as part of the approved AQMP for Dunmore Quarry. This system has an app interface which can alert personnel of adverse wind conditions. This system is scheduled to be operational in next reporting period.
Investigate trends in the Stage 3 pond and fines pond relating to salinity.	As predicted in the EIS and previously reported in the 2017-18 AR short term salinity elevations are expected as dredging operation move south in Stage 3 due to the natural groundwater conditions in this area. It is expected that once backfilling and of the southern section of Stage 3 is completed that electrical conductivity will decrease.

4. Meteorological Monitoring FY19 Performance Review

An onsite weather station is located at Dunmore which collects a range on meteorological parameters. The location of the weather station is shown in Figure 7 Appendix A.

There is no prescribed impact assessment criteria and meteorological monitoring is used to provide background information for management of the site. A review of weather data is undertaken by the environmental co-ordinator. Important meteorological conditions assessed are rainfall, wind speed direction and atmospheric stability.

A detailed summary of the FY19 and historical rainfall and wind data can be found in Appendix A.

4.2. Meteorological Monitoring Long Term Analysis and Trends

Highest rainfall was experienced in late spring and early summer which is line with historical site and regional averages. Overall FY19 was below site and regional averages which is consistent with other regional areas in southern NSW.

Prevailing winds were from the WSW during the majority of the year with the exception of the summer months. In summer the prevailing wind tended to be from the N or NNE. There was a lower percentage of calm conditions with no/low wind in winter. This is consistent with historical trends for the site and the region generally

4.3. Meteorological Monitoring Summary and Opportunity for Improvement

A new weather system is being constructed as part of the transition to real time air quality monitoring at Dunmore Quarry which DLSP currently uses. An app system will run alongside this system which will allow the integration of wind data to the monitors. This app system will allow more intuitive access to monitoring data to inform operations.

5. Air Quality

Two methods of monitoring air quality is used at DLSP. Deposited dust gauges are used to measure deposited dust every 30 days (+/- 2 days). A High Volume Air Sampler (HVAS) is used to measure the fine particulate matter under 10 microns (PM10) every 6 days. Annual monitoring for FY19 indicated compliance with the relevant air quality impact assessment criteria for TSP, PM10 and deposited dust. The location of the relevant air quality monitoring points is shown in Appendix B.

5.2. Deposited Dust Impact Assessment Criteria

Deposited Dust impact criteria is assessed at a residence on privately owned land. It is important to note that the assessment criteria refers to an annual averaging period (i.e a monthly average over the last 12 months). Impact Assessment Criteria is shown in Table 9 below.

Table 9 Deposited Dust Impact Assessment Criteria

Pollutant	Averaging Period	Criterion	
Deposited Dust[c]	Annual	2g/m2/month[b]	4g/m2/month[a,d]

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

5.3. Deposited Dust Monitoring Performance Review

All sites were below the required assessment criteria or dust measured as insoluble solids over the annual averaging period. All sites also were below 4g/m2/month for ash fraction which excludes the organic (combustible) component of the sample such as vegetation, bird droppings and insects. These organic contaminants within the sample are typically representative of the surrounding wetlands and farmland which the monitors are located within.

A summary of deposited dust results measure at the gauge for the 4 monitoring points is shown in Table 10 below. A monthly breakdown of each site and summary graphs is located in Figures 21-26 in Appendix B.

Table 10 Deposited Dust FY19 Performance

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
18/19 Average	3.63	1.87	3.10	1.90	3.03	1.94	2.78	1.57

It is important to note that a state wide dust storm was experienced regionally from 12-14th of February which caused elevated readings for February at most sites. Despite this, annual averages were still below impact assessment criteria. Images of the dust storm is shown in Figure 26-27 in Appendix B.

5.4. Particulate Matter Monitoring Impact Assessment Criteria

The impact assessment criteria for Particulate Monitoring is detailed in S3.C19 of DA 195-8-2004 and is summarised below in Table 11.

Table 11 Particulate Matter Impact Assessment Criteria

Pollutant	Averaging Period	Criterion
PM10	Annual	[a,d] 25 µg/m³
PM10	24 hour	[b]50 µg/m³
TSP	Annual	[a,d] 90 µg/m³

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

5.5. Particulate Matter Monitoring Performance Review

TSP concentrations are not measured in the vicinity of the Dunmore operations, however annual average TSP concentrations can be derived based on typical ratios of PM10/TSP. Rural areas (such as DLSP), typically experience a PM10/TSP ratio of 0.4. This ratio has been applied to the annual average PM10 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 Dunmore Quarry.

The annual average PM10 measurement for the reporting period from monitoring point 5 was below impact assessment criteria for 25 µg/m³ for PM10 and 90 µg/m³. PM10 measurements were also similar to Albion Park annual averages as seen in Table 12 below.

Table 12 Particulate Matter FY19 Performace

Pollutant	DLSP FY19 Average (µg/m³)	Albion Park FY19 Average	DLSP Long Term Average (µg/m³)
PM10	18.57	17.8	12.95
Derived TSP	46.43	44.5	32.38

There was one (1) reading above short term PM10 criteria. On 1/02/19 a reading recorded at the HVAS located at monitoring point 5 had a reading of 81.47ug/m3. An investigation was undertaken of the operations and ambient conditions experienced on 1 February. Findings were sent to DPIE and EPA within 7 days of receiving these results. To summarise:

- Alerts were received on February 1 indicating that regional air quality exceeded PM10 national standards the day previously.
- The production plant at Dunmore Quarry was shut down for scheduled maintenance all day on February 1 2019. No production occurred during this time. Haul road and water cart

operation continued as per normal operations. Production ran as normal at DLSP. Which is a wet process via dredge excavation.

- Weather data recorded on the Dunmore Weather Station indicate that the prevailing wind was from the S/SSW which were not from the direction of the DLSP.

As a result of these investigations it has been determined that the elevated measurements of PM10 at Monitoring point 5 are not due DLSP operations but are reflective of the regionally high ambient PM10 levels above the 50µg/m3 which led to the elevated reading on the HVAS. This was investigation was reported to DPIE and EPA as per S5.C7.

Figure 30 and 31 in Appendix B shows the regional alerts sent out from the OEH notifying the high PM10 values experienced throughout the region on 31/1/19 and 1/2/19.

5.6. Air Quality Monitoring Long Term Analysis and Assessment

The site has been collecting deposited dust data since 2002. A graph of long term trends can be found in Figure 25 in Appendix B. Generally measured deposited dust at the gauge has decreased over time.

Months with high production such as May 2019 generally had lower deposited dust results indicating production volume do not substantially affect deposited dust measurements. This is to be expected as production is a wet process via dredge excavation.

A general trend which has been observed is that generally measured deposited dust is higher in dry summer months than winter months. This trend is also confirmed in trends in PM10 measurements and is generally reflective of regional conditions as a whole. Figure 29 in Appendix B clearly demonstrates the seasonal fluctuation in PM10 measurements and shows a clear trend that PM10 values are typically higher in the dry periods in summer and are lower in winter. This fluctuation is mirrored by Albion Park PM10 measurements available on the OEH website. https://www.environment.nsw.gov.au/AQMS/search.htm

These trends indicate that deposited dust and PM10 levels are typically influenced more from ambient local conditions than DLSP operations.

5.7. Air Quality Summary and Opportunities for Improvement

TSP, PM10 and deposited dust measurements were within impact assessment criteria for all compliance monitoring points. Analysis of long term monitoring trends suggests that typically local ambient regional conditions have a greater impact on measurements than DLSP operations.

Resource extraction at DLSP are wet operations with a 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.

The weather station functionality is being updated during the next reporting period to allow for near real time access to weather data such as rainfall and wind speed/direction. This will allow more intuitive response to adverse conditions from site management.

6. Noise

Annual Noise Monitoring is undertaken annually in winter to determine DLSP contribution to noise to private residence. Annual noise monitoring indicated compliance with relevant noise limits.

6.2. Noise Impact Assessment Criteria

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

Table 13 Noise Impact Assessment Criteria

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

6.3. Noise Performance Review

Annual Noise Monitoring indicated compliance with the noise limits described in Section 6.2 during all times. The annual noise compliance report is included in Appendix C.

6.4. Noise Long Term Trend Analysis and Assessment

Attended noise readings have typically remained stable or slightly decreasing in the last 10 years as seen in Figure 2 below. Noise monitoring results were generally lower in FY19 which is to be expected due to the lower production volumes compared to FY18

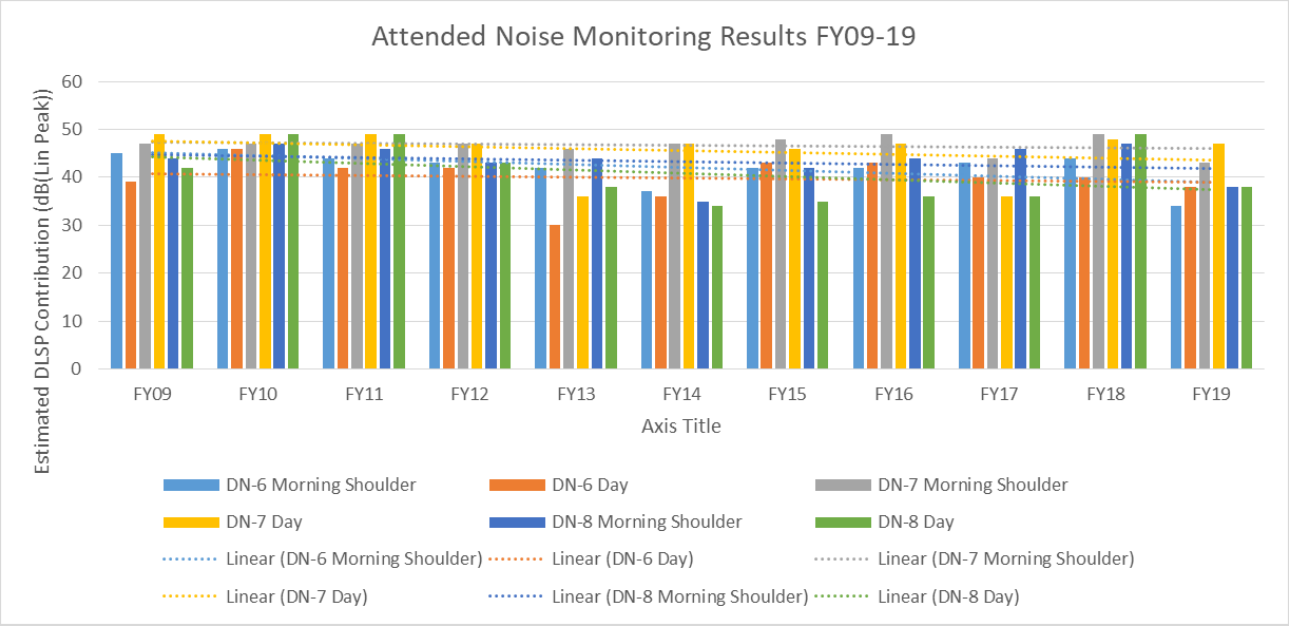


Figure 2 Summary of Historical Noise Monitoring Results

6.5. Noise Summary and Opportunities for Improvement

The weather station is being upgraded which will allow site management to immediately access weather information via an app. This will allow more intuitive reaction to adverse meteorological conditions which may affect noise such as temperature inversions.

7. Surface Water

Discharge water quality monitoring indicated compliance during all periods at the licenced discharge point of the site at DW20b(EPL9). Monthly monitoring results for the dredge ponds align with predicted EIS results. WQO for most parameters within the dredge ponds were met within the reporting period. Typically, water quality within operational ponds and discharge points was of higher quality than upstream conditions with the exception of salinity and associated parameters.

Monitoring Point Locations are shown in Figure 32 in Appendix D. Monitoring is generally taken monthly. Two special frequency water monitoring are also required as part of EPL77

- Within 24 hours from receiving more than 20 mm in any 24 hour period for background and discharge water quality monitoring points (to confirm rainfall does not impact discharge water quality).
- Monitoring is also undertaken in the Stage 2 dredge pond during the placement of Potential Acid Sulphide Soils (PASS) for rehabilitation. The required frequency in condition E1-E11 in EPL11147 is daily for a period of 30 days for surface waters. Monitoring then reverts back to weekly frequency until PASS is received again. PASS has only been placed in the Stage 2 pond so only this monitoring location has been activated for this frequency.

7.2. Surface Water Quality Impact Criteria

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

- DW 11 (EPL12) – Upstream of Western Tributary in Stage 2
- DW 12 (EPL11) – Upstream of Western Tributary in Stage 2
- DW 18 (EPL13) – Upstream of Rocklow Creek in Stage 3
- DW 20b (EPL9) – Licenced discharge point of DLSP via the re-aligned Western Tributary
- DW 21b (EPL13) – Secondary licenced discharge point to be activated after re-aligning Rocklow Creek. This site has not been activated as Rocklow Creek has not been re-aligned. Extraction is not expected to occur in the southern section of Stage 3 due to the landowners requests.

Discharge water quality criteria for DW20b is detailed in S3.C23 of DA-195-8-2004 is shown below in Table 14.

Table 14 Surface Water Discharge Limits

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

There are two compliance operational monitoring points. These are the dredge ponds in Stage 2 (DW-14) and Stage 3 (DW-19). Water Quality Objectives within dredge ponds is detailed below in Table 15.

Table 15 Dredge Pond Water Quality Objectives

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

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

Additional monitoring points are collected as part of the approved Water Management Plan to provide additional background water quality data for water entering the 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

7.3. FY19 Surface Water Performance Review

A summary of the water quality monitoring points is shown below in Table 16 below.

Table 16 Water Quality Monitoring Results

FY19 Average	pH	Conductivity (µS/cm)	TSS (mg/L)	Turbidity (NTU)	Bicarbonate (mg/L)	Sulphate (mg/L)	Chloride (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Fe (mg/L)	Ammonium Ion (mg/L)	Total Nitrogen (mg/L)	Total P (mg/L)	Chlorphyll-a (µg/L)	Dissolved Oxygen (mg/L)	Faecal Coliforms (n/100mL)	Enteroccoci (n/100mL)	Algae/Blue green algae (n/mL)
DW-9	7	487	15	13.3	107	11	74	13	59	2	1.98	0.14	0.77	0.26	3	5.5	473	713	581
DW-10	6.4	686	89	38.2	85	18	108	19	82	7	8.71	0.26	1.3	3.37	7090	3.4	7090	1801	17880
DW-11/EPL12	7.3	1055	69	11.3															
DW-12/EPL11	5.9	356	7	33.2															
DW-13	7.1	806	26	38.7	225	21	88	16	92	3	1.09	0.14	0.99	0.45	1	5.2	96	187	1142
DW-14	8.2	1948	11	8.4	150	154	465	34	292	9	0.16	0.1	0.63	0.06	6	9	10	7	58163
DW-15a	8.1	6487	46	22.5	168	493	1703	112	929	30	0.09	0.13	0.81	0.09	23	8.6	77	36	96195
DW-16	8.1	2369	16	9.5															
DW-18/EPL13	7.3	3242	18	16.2															
DW-19	7.9	6273	17	7.4	194	391	1603	114	928	28	0.09	0.16	0.75	0.04	7	8.8	8	8	186163
DW-20b/EPL9	8	2778	13	7.2															
DW-21a	7.6	9855	14	9.6															

Upstream drainage channels are ephemeral and are generally impacted by upstream agriculture with cattle grazing often observed in the immediate vicinity of monitoring locations. These streams flow directly into the Stage 2 dredge pond. 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 upstream conditions.

Discharge monitoring was within limits prescribed in S3.C23 during all instances of sampling. A breakdown of discharge water quality monitoring results at DW20b is summarised below in Table 17.

Table 17 FY19 Discharge Water Quality Results

Sample Type	Date	pH	TSS (mg/L)
monthly	6/08/2018	8.3	10
monthly	5/09/2018	8.2	5
monthly	4/10/2018	7.8	5
20mm	5/10/2018	8.1	12
monthly	2/11/2018	7.6	11
20mm	8/11/2018	7.8	5
20mm+monthly	29/11/2018	7.8	14
monthly	19/12/2018	8.0	5
20mm+	6/01/2019	8.0	12
monthly	18/01/2019	8.0	5
monthly	6/03/2019	7.5	5
20mm+	15/03/2019	8.1	23
20mm+	16/03/2019	7.9	30
20mm+	18/03/2019	8.2	20
20mm+	19/03/2019	8.1	17
monthly	29/03/2019	8.0	30
20mm+	5/04/2019	7.9	20
20mm+	24/04/2019	7.8	5
monthly	2/05/2019	8.1	18
20mm+monthly	4/06/2019	8.2	22
monthly	2/07/2019	8	6
2018-19 Average		**8.0**	**13.3**

A summary of the water quality monitoring after placement of PASS in the Stage 2 dredge pond is shown below in Figure 3and 4 below.

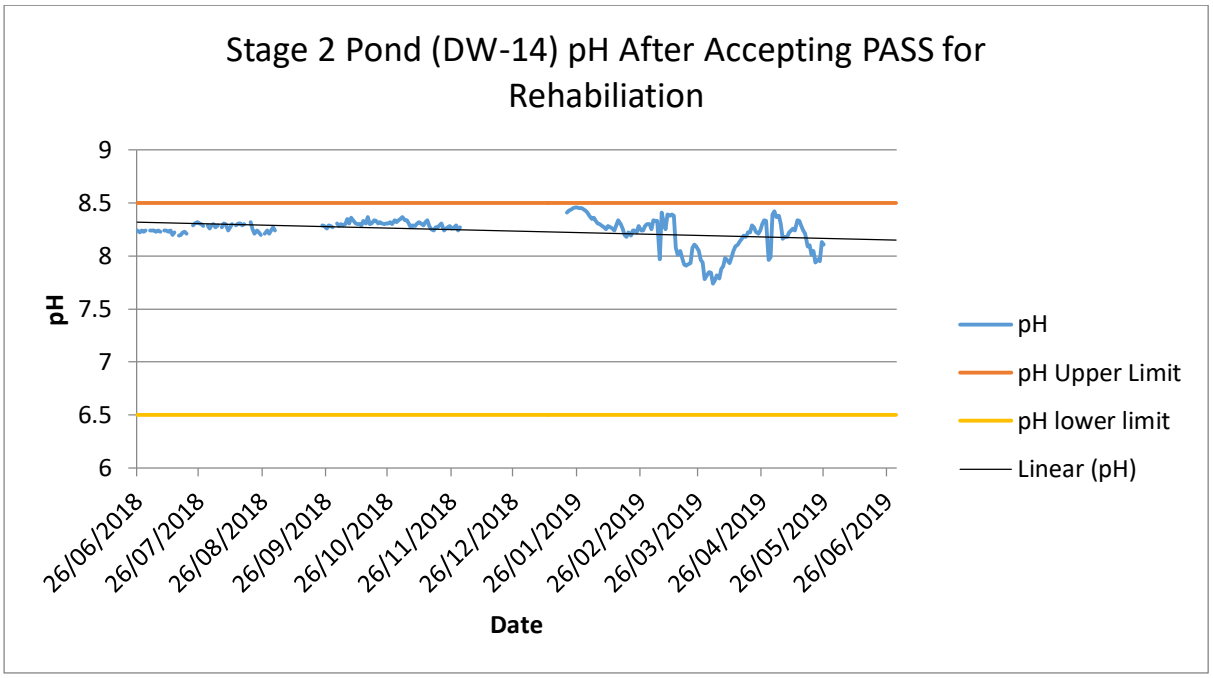


Figure 3 Stage 2 pH After Accepting PASS for Rehabilitation

External backfilling material received typically comes in campaigns based on job availability. As a result, monitoring reverted back to weekly from 1/12/18-21/1/19 and 27/5/19-30/6/19 due to 30 days elapsing since PASS placement.

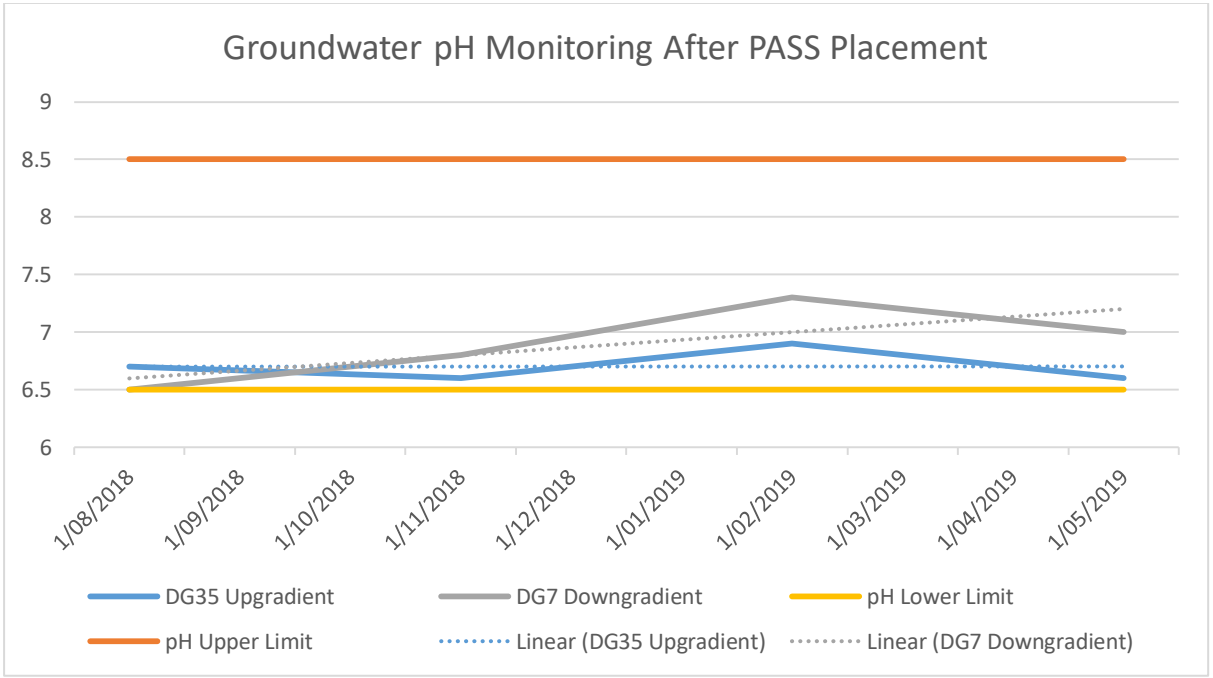


Figure 4 Groundwater pH After Accepting PASS for Rehabilitation

7.4. Surface Water Monitoring Long Term Trend Assessment and Analysis

The following general trends can be observed:

- Typically upstream pH, DO and conductivity is lower which aligns with observations that upstream drainage channels are ephemeral and generally only flow during periods of rainfall. These sites are impacted by upstream agriculture with cattle grazing.
- Upstream turbidity, TSS faecal coliforms and enterococci are higher upstream of the site due to the impacts of cattle grazing and defecation. The operational dredge ponds typically have lower turbidity than upstream conditions. The dredge ponds act as large settling basins which allow reducing turbidity and sediment load downstream of the ponds during high rainfall.
- Typically the fines pond has 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 from a 1 in 100 year flood event.
- Salinity is generally higher in the southern sections of Stage 3 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 within the WQO detailed in S3.C24. 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 completely expected based on the natural conditions present in Stage 3.

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

7.5. Surface Water Monitoring Summary and Opportunity for Improvements

Monitoring will continue for all parameters in the next reporting period. Backfilling will commence within the southern and eastern section of Stage 3. It is expected once backfilling and landform construction commences in the southern section of Stage 3, salinity caused by tidal saline flow will decrease in the stage 3 pond.

7.6. Water Balance

Water extracted from the 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.

7.6.1. Surface Water Flows

- Surface water enters the site ponds from the Western Eastern and Northern Tributaries and flows out of the ponds back into the re-aligned Western Tributary.
- No flooding occurred during FY19
- No instances of overflow of the Stage 3 dredge pond.

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

7.6.2. Water Use for Dust Suppression

- Typically 5 tanker loads of water is used during dry days in summer
- The water cart on site holds 30,000L
- The site is operational for 5.5 days a week
- There were 106 rain days last financial year

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

7.6.3. 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 18.
- This water returns via overland flow to the fines return pond (i.e flows back into the system) so are excluded from the water balance and reported for information only.

Table 18 Summary of Pump Rates during Production

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

- 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).
- FY19 production was 257,794 tonnes.
- Water loss from sand production is calculated as 20.62 ML.

Total water use is therefore calculated as 47.62ML which is within the volumes of groundwater take of WAL24477 of 77ML/year.

7.7. Flood Storage Capacity

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

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

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

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

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

8. Groundwater Management

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

8.2. Ground Water Quality Impact Assessment Criteria

EES have devised site specific trigger values devised from monitoring the aquifer in Stage 2 and Stage 3 since 2003 before operation commenced 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 19.

Table 19 Groundwater Trigger Values

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)

8.3. Ground Water Long Term Analysis and Assessment

In general, groundwater did not exceed the site-specific trigger levels outlined in the GMMP (Environmental Earth Sciences, 2018b) across the monitoring period.

Due to tidal/ estuarine influences, bores east of the Princes Highway consistently reported greater EC and cation/ anion concentrations than those west of the Princes Highway. The bores screened in the deeper portion of the aquifer (DG5-D and DG6-D) exhibited greater EC and cation/ anion concentrations than those screened in the shallow aquifer (DG5-S and DG5-D and DG-7).

It was noted that bore DG59 reported elevated EC as well and bicarbonate (HCO3) concentrations. This is considered a result of the proximity of the bore to the dredge pond causing interference.

Ammonia (NH4N) concentrations in both the west and the east of the site were reported as elevated to the trigger levels at various times. As the natural environment surrounding the site contains numerous wetlands and swamps, the presence of elevated concentrations of ammonia and other nitrogenous compounds is not unexpected and considered to be due to the natural breakdown of organic material.

Electrical conductivity (EC) above trigger values in the bores west of the Princes Highway will continue to be monitored. Analytes reported above the trigger values will continue to be monitored as per the contingency plan in the GMMP (Environmental Earth Sciences, 2018b), with consideration to current site operations and climate.

Groundwater flow and direction is can be seen in Figure 5 below.

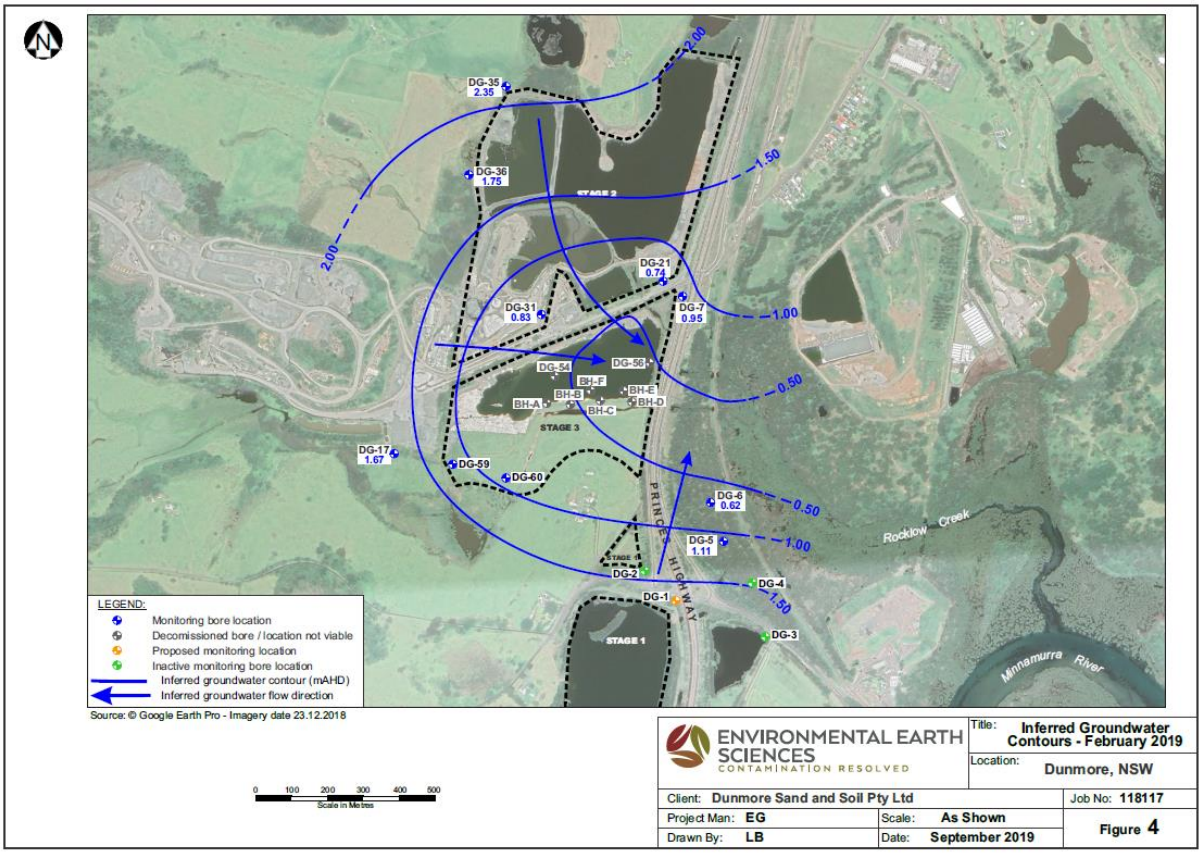


Figure 5 Groundwater Contours and Flow Direction

8.4. Ground Water Summary and Opportunities for Improvement

The data obtained from the data loggers installed in bores DG5, DG6, DG7, DG17, DG21, DG31, DG35, DG36, and DG59 indicates that over the past monitoring year natural fluctuations in water levels were occurring in response to rainfall and tide as illustrated in Appendix E, Charts 1 and 2.

This is consistent with previous findings dating back to 2003.

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

- That influences on groundwater levels are related to recharge from rainfall and more minor tidal influx (this finding is supported by chemical monitoring of tidal seawater intrusion from Rocklow Creek);

- Any reductions in groundwater levels are related to periods of low rainfall (i.e. not to minor recharge) 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.
- Quarterly groundwater level and quality monitoring should continue in line with the Development Consents for Stage 2 – 4 as well as the EMP (DSS, 2006), WMP and GMMP (Environmental Earth Sciences, 2018b).

Based on a review of the 2018/ 2019 monitoring data the following adjustments are recommended to the program:

- Monitoring of representative onsite diver locations should continue at quarterly intervals as indicated on Figure 2 by the active monitoring network;
- Monitoring of onsite bore DG59 (southern edge of Stage 3) can cease, as the dredge area has advanced to the south west;
- Bore DG1 will be included within the active monitoring network, be monitored at quarterly intervals and be installed with a diver; and
- Inclusion of monitoring of bores within Stage 5 at quarterly intervals to provide background date for potential Stage 5 operations.

9. 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.

9.2. Rehabilitation Assessment Criteria

S4.C42 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 to the DA consent.

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

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

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

9.3. 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 listed above.

Landform construction using VENM is ongoing along the southern section of Stage 2. This landform will form the foundations for a further section of Swamp Oak Forest to be planted in Spring 2019.

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

Maintenance of these sections has been ongoing throughout FY19 by the bushland regeneration contractor Jamberoo Native Nursery which work on site weekly.

9.4. 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 1.6 hectares of Swamp Oak Forest and Freshwater Wetland communities have been planted. Further planting campaigns have been scheduled for spring 2019.Comparison photos over the last three reporting periods are shown in Appendix F.

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

Rehabilitation is progressing well with further planting campaigns scheduled for the next reporting period. Backfilling works will begin in south east Stage 3 during the next reporting period to prepare the Stage 3 are for future planting.

10. 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 extracted areas to create wetlands and flood-free land for the final landform.

10.2. VENM Verification Acceptance and Disposal

In January 2018, the site began accepting Virgin Excavated Natural Material from external sources of backfill for 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 are detailed in Section 7.3.

Volumes of external VENM received for the FY19 period are detailed below in Table 20.

Table 20 Summary of VENM Imported

Month	VENM (a) received (t)	VENM (b) PASS received (t)
Jul 18	40,562.59	1,225.52
Aug 18	16,876.19	334.1
Sept 18	10,677.31	11.16
Oct 18	2,587.24	7,418.81
Nov 18	506.72	0
Dec 18	3,463.81	0
Jan 19	5,718.72	5,982.34
Feb 19	8,220.13	2,914.18
Mar 19	8,992.64	0
Apr 19	2,356.8	286.712
May 19	3,000.57	0
Jun 19	1,618.54	0
Total	104,581.26	18,172

10.3. Waste Minimisation

Boral is committed to ensuring its extraction and processing activities produces 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 continuing non-production waste management 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 21 outlines the total waste and waste types generated by DLSP over the reporting period. These waste management practices will continue over the next 12 months, with a particular focus on managing site recyclable products.

Table 21 FY19 Waste Tracking

	General Waste (t)	Cardboard (t)	Commingle Recycling (t)	Oil/Oily Waters (L)	Effluent (L)	Other Litres	Chemical Waste
Jul-18	0.403	0	0.03				
Aug-18	0.177	0.04	0.03				
Sep-18	0.222		0.03	2080			
Oct-18	0.135	0.04	0.015				
Nov-18	0.235		0.045				
Dec-18	0.143		0.015				
Jan-19	0.18	0.05	0.03		250		
Feb-19	0.18	0.05					
Mar-19	0.16	0.029	0.03	3000			
Apr-19	0.053		0.03				
May-19	0.344	0.065	0.045				
Jun-19	0.373		0.03				
Total	2.605	0.274	0.33	5080	250	0	0

10.4. Waste Tracking Trend Assessment and Analysis

Trends for the last 3 reporting periods are shown below in Table 22.

Table 22 Historical Waste Tracking Data

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

General Waste and cardboard waste decreased in FY19 compared to FY18. This is expected as the number of permanent staff at DSS has decreased from 11 to 8 people. A larger percentage of waste was recycled in FY19 due to the improvements in recycled bin placement and education undertaken in FY18.

Effluent also decreased due to lower production/dredge run times in FY19. Effluent is pumped out from the portable facilities on the dredge. The office is serviced by an underground aerated waste water treatment system (AWTS) which does not require effluent pump out.

10.5. Waste Management Summary Opportunities for Improvement

Education on efficient waste re-use will continue in the next reporting period. VENM will continue to be utilised from Dunmore Quarry and external sources. Further work will continue with subcontractors to optimise the record keeping for waste collection. A waste collection form will be devised for completion prior to contactors leaving site.

11. Incident and Emergency Response Management

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

- The Pollution Incident Response Management Plan was updated in July 2018. The current version is available online on the Boral Dunmore Operations website.
- A Site Emergency Response Plan is available onsite in order to outline procedures in the case of emergency authorities being required on the site.
- A vehicle pedestrian safety audit was undertaken during the reporting period. Car park and traffic areas were refurbished to minimise pedestrian and vehicle interactions wherever possible.

11.2. 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 S3.C70.

12. Community

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

Members include:

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

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

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

The CCC met twice during the FY19 reporting period (August 2018 and February 2019).

12.2. Environmental Complaints Management

Dunmore Sand and Soil Quarry maintain a complaint 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 have been no community complaints during the reporting period. Figure 6 provides an overview of the noise, vibration and dust complaints received since 2007. There have been minimal complaints received over the history of the project.

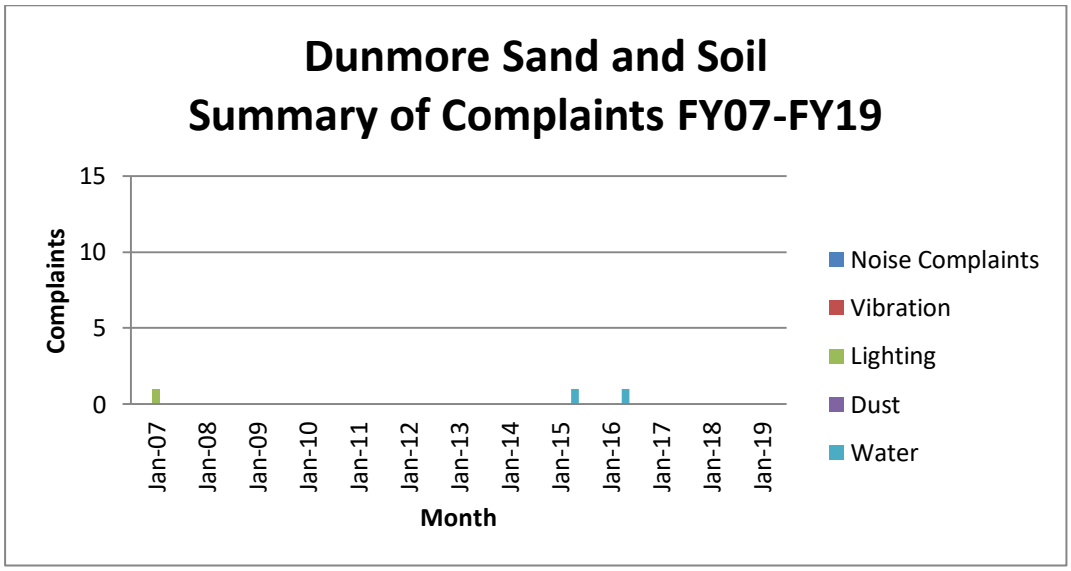


Figure 6 Historical Summary of Complaints

13. Summary of Regulatory Notifications

An official caution was received from the EPA in August 2019 (outside of the reporting period) for a failure to monitor special frequency sampling via condition E1.8 (PASS monitoring) and condition M2.3 (within 24 hours of a 20mm rain event) Both of these non-compliances were reported by Boral to the EPA in the annual returns submitted in November 2018. No adverse environmental impacts had occurred from non-conformance.

Condition E1.8 requires monitoring to be undertaken daily for a period of 30 days after PASS placement. This monitoring was not undertaken on 15 occasions from July 2018- November 2018 on Sundays and public holidays due to a lack of access to monitoring points during site closure. As a corrective action, the site has trained extra staff to undertake monitoring and access to site has been made available for public holidays and Sundays.

M2.3(Note) states that the frequency of (water) samples to be collected is within a 24 hour period after receiving 20 mm or more of rainfall at the premises within any 24 hour period. A grab sample was not collected on 22/12/2017 in response to 22.5mm of rain received in the 24 hours previous.

SMS text notification from the weather station was sent to a phone/staff that was away from work on Christmas leave. Message was not received by staff on site. As a corrective action, SMS text notification has been extended to a greater number of staff both onsite and offsite. Additional staff have been trained in the water sampling procedure and external contractors engaged to undertake sampling at times when staff are unavailable or on extended leave.

For failing to monitor these frequencies the EPA considered the environmental harm, Boral's good compliance history and deemed an appropriate regulatory actions was to issue an official caution.

14. Conclusion

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

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

This reporting period saw the continuation of rehabilitation within Stage 2 area, which will remain a strong focus during the FY20 reporting period. Rehabilitation will commence in Stage 3 for the next reporting period.

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

14.2. Activities to be completed by next reporting period

The following actions have been scheduled for completion in the next reporting period.

- Progress with updates to the weather station
- Continue rehabilitation monitoring of planted sections of Swamp Oak Forest and Freshwater Wetland EEC in Stage 2 and Re-aligned Western Tributary.
- Plant out sections of the Eastern Edge of Stage 2 with Swamp Oak Forest and Freshwater Wetland EEC.
- Commence Backfilling and landform construction in Stage 3 starting with the Eastern edge and the south eastern tidal zone.
- Continue assessing salinity in the southern section of Stage 3.
- Update metering arrangements to align with new NRAR regulations
- Include DG-1 and monitoring bores in Stage 5 into monitoring program

15. Appendix A Meteorological Monitoring

Figure 7 Location of Dunmore Weather Station

Table 23 Summary of FY19 Rainfall Data

	Rainfall (mm)		
Month	FY19	Site Average	Regional Average
July	6	54.0	49
August	31	66.0	53.5
September	41.5	49.2	42.7
October	128	72.0	64.5
November	92	93.6	83.1
December	90.5	89.1	67
January	143.5	80.5	72.9
February	35.5	140.5	140.5
March	156.5	137.2	122.3
April	48.5	88.9	73.8
May	13.5	65.5	55.8
June	103	123.6	93.7
Total	889.5	1060.1	925.6

Table 24 Historical Summary of Rainfall Data

	Rainfall (mm)																		
Month	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	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	54.0	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	66.0	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	49.2	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	72.0	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	93.6	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	89.1	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	80.5	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	140.5	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	137.2	122.3
April	91.5	200	24.4	8	145	90.5	106	63	37.4	87.5	136	64.5	305	37.5	40.5	26.1	48.5	88.9	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	65.5	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	123.6	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	1060.1	925.6

The measured wind conditions experience on site for FY19 is shown below in Table 25. Monthly wind roses and seasonal wind roses are shown in Figure 8 to 20.

Table 25 Summary of FY19 Wind Data

Period	Mean Speed (m/s)	Peak Frequency (%)	Peak Direction	Percent Calm (%)
July	2.53	34.14	WSW	2.86
August	3.29	29.03	WSW	2.52
September	2.77	25.10	WSW	4.58
October	2.99	12.37	WSW	5.48
November	3.01	15.38	WSW	5.24

December	2.48	17.78	WSW	7.53
January	2.28	13.10	NNE	14.42
February	2.74	13.80	N	11.64
March	2.63	14.52	WSW	12.33
April	1.97	26.67	WSW	13.92
May	2.47	33.13	WSW	8.90
June	2.42	27.53	SW	12.85

Note: Wind measurements are taken over a 15 minute interval. Calm is defined as less than 0.3m/s.

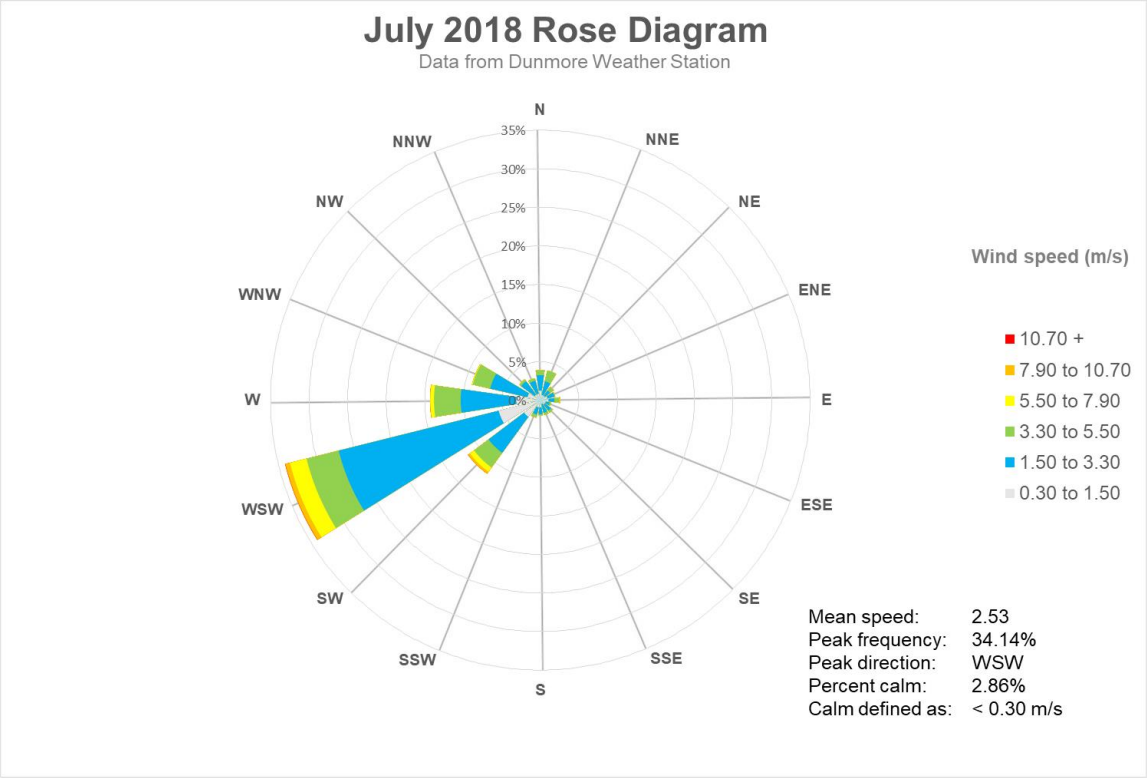


Figure 8 July Wind Rose Data

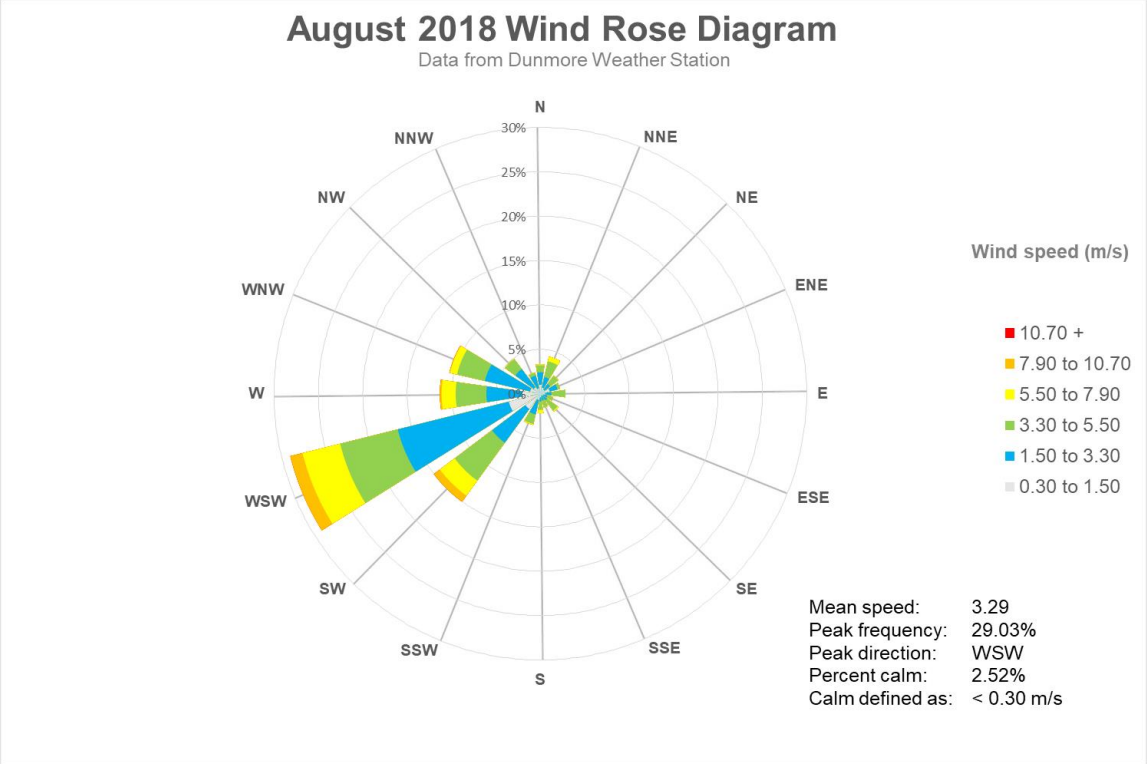


Figure 9 August Wind Rose Data

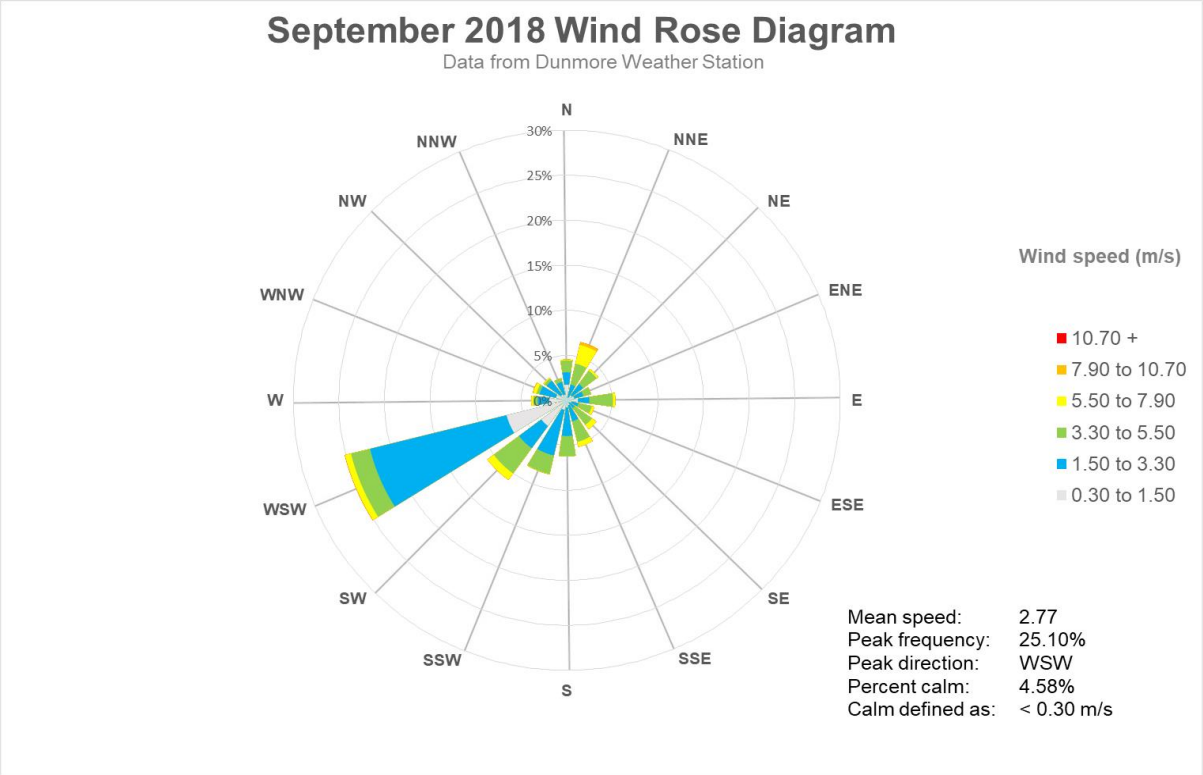


Figure 10 September Wind Rose Data

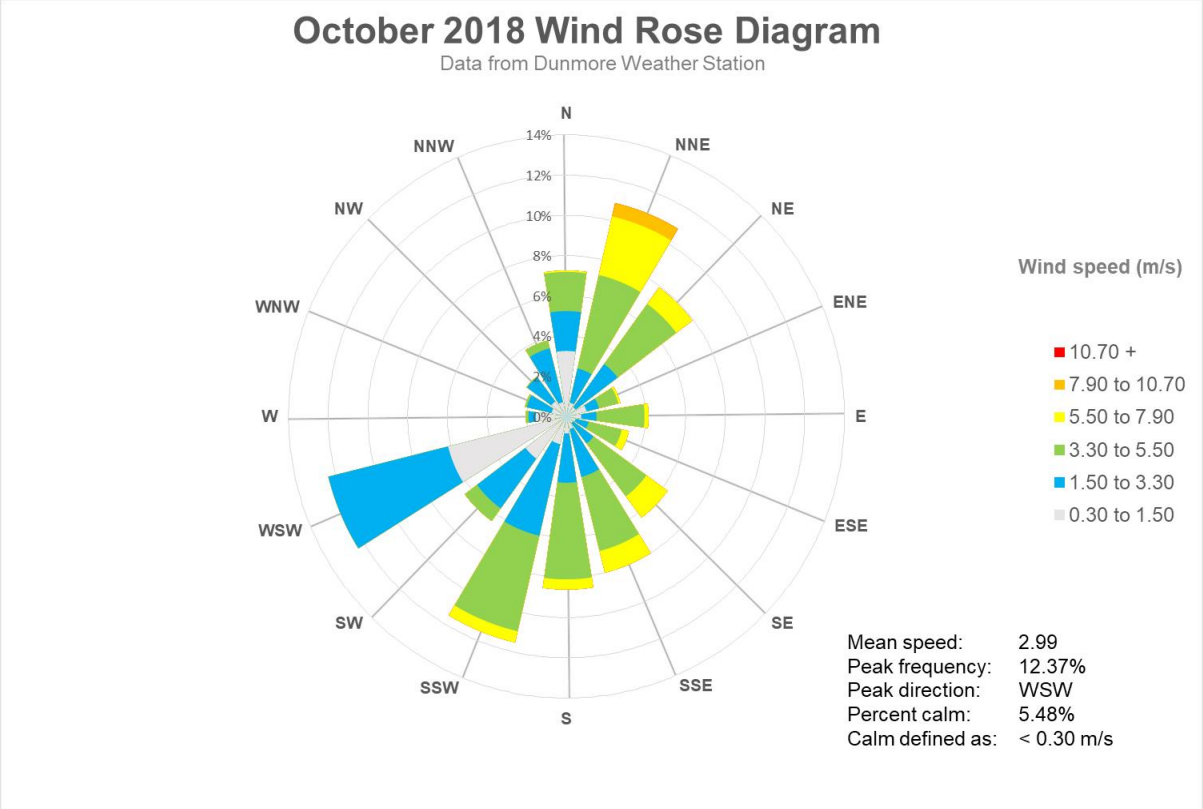


Figure 11 October Wind Rose Data

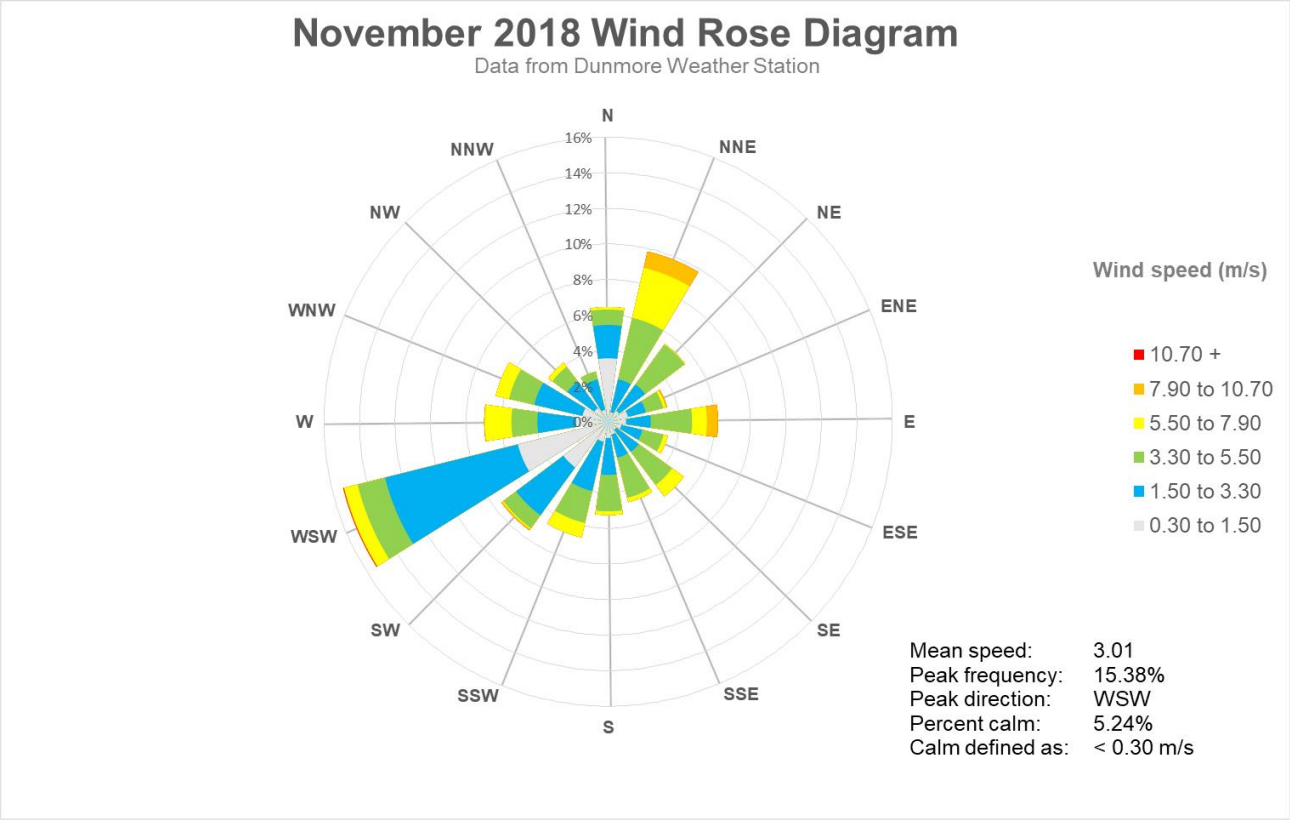


Figure 12 November Wind Rose Data

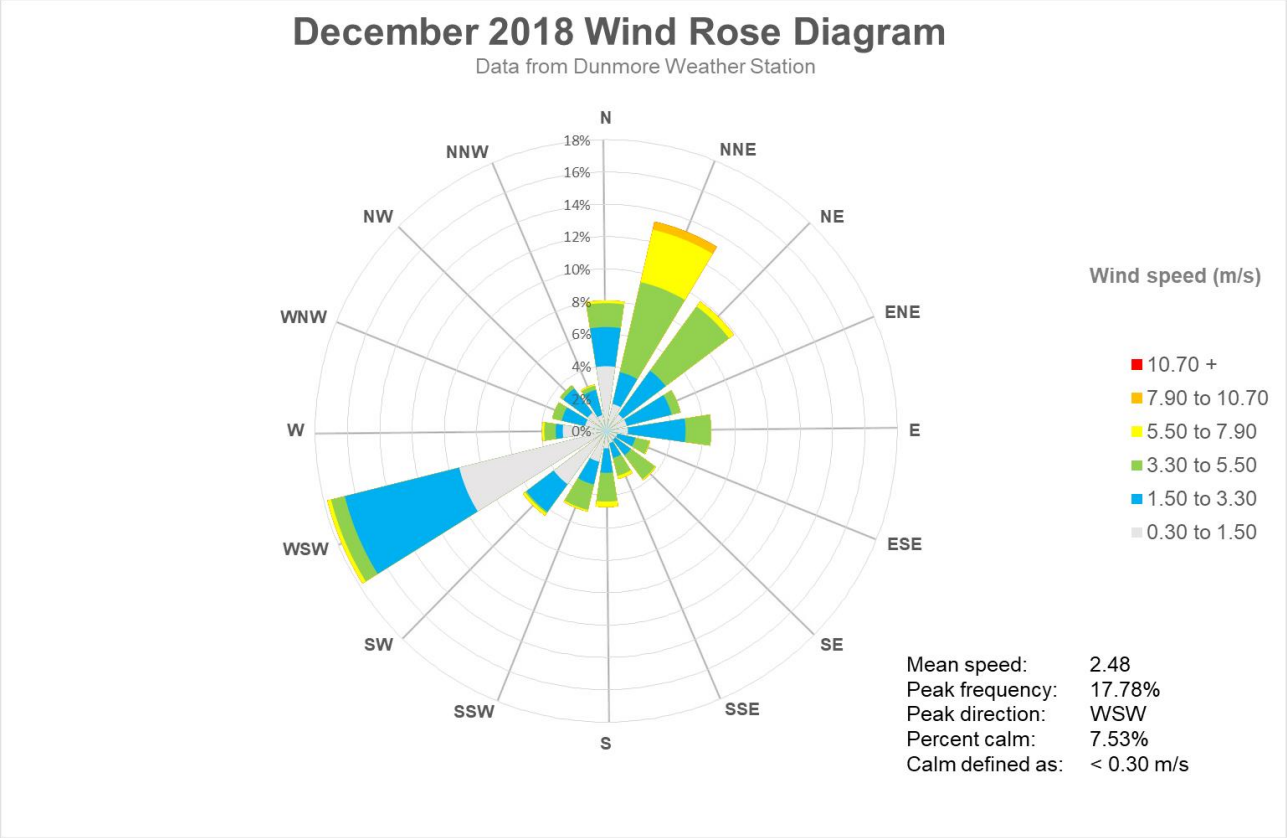


Figure 13 December Wind Rose Data

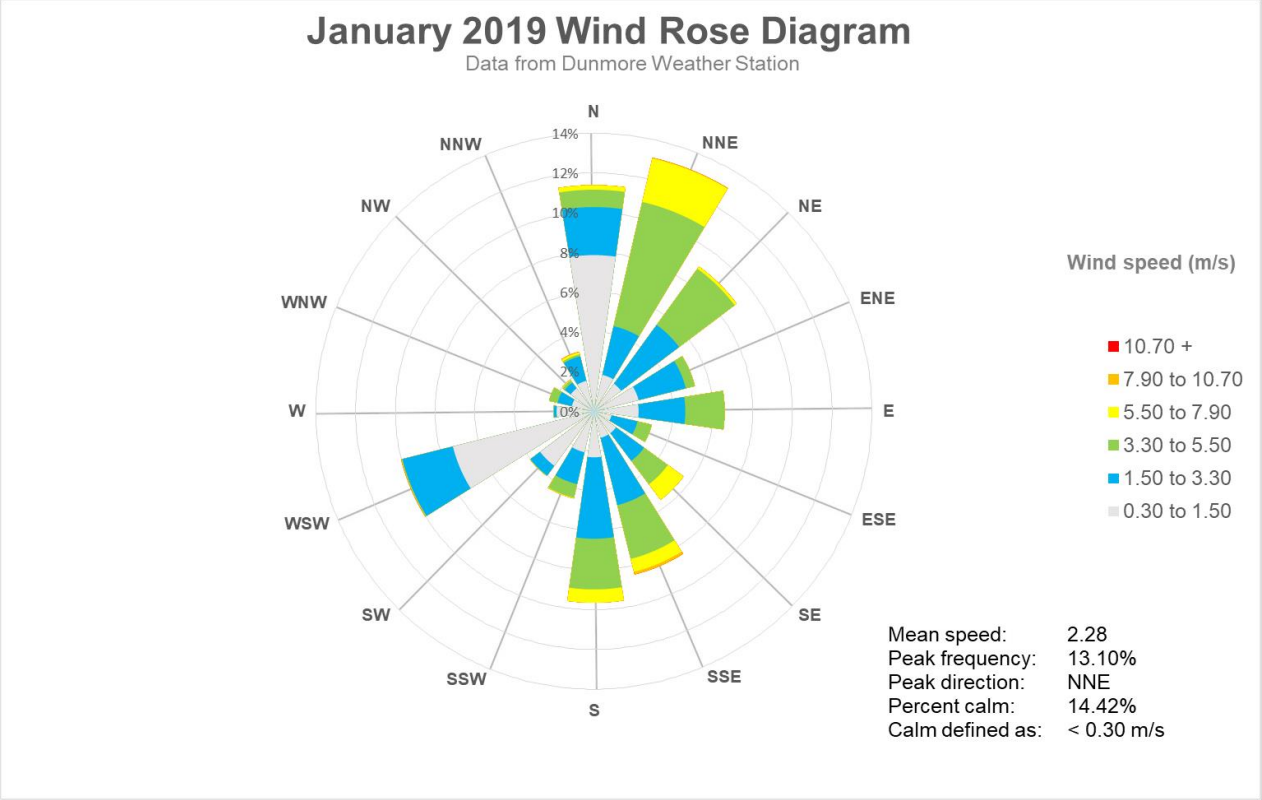


Figure 14 January Wind Rose Data

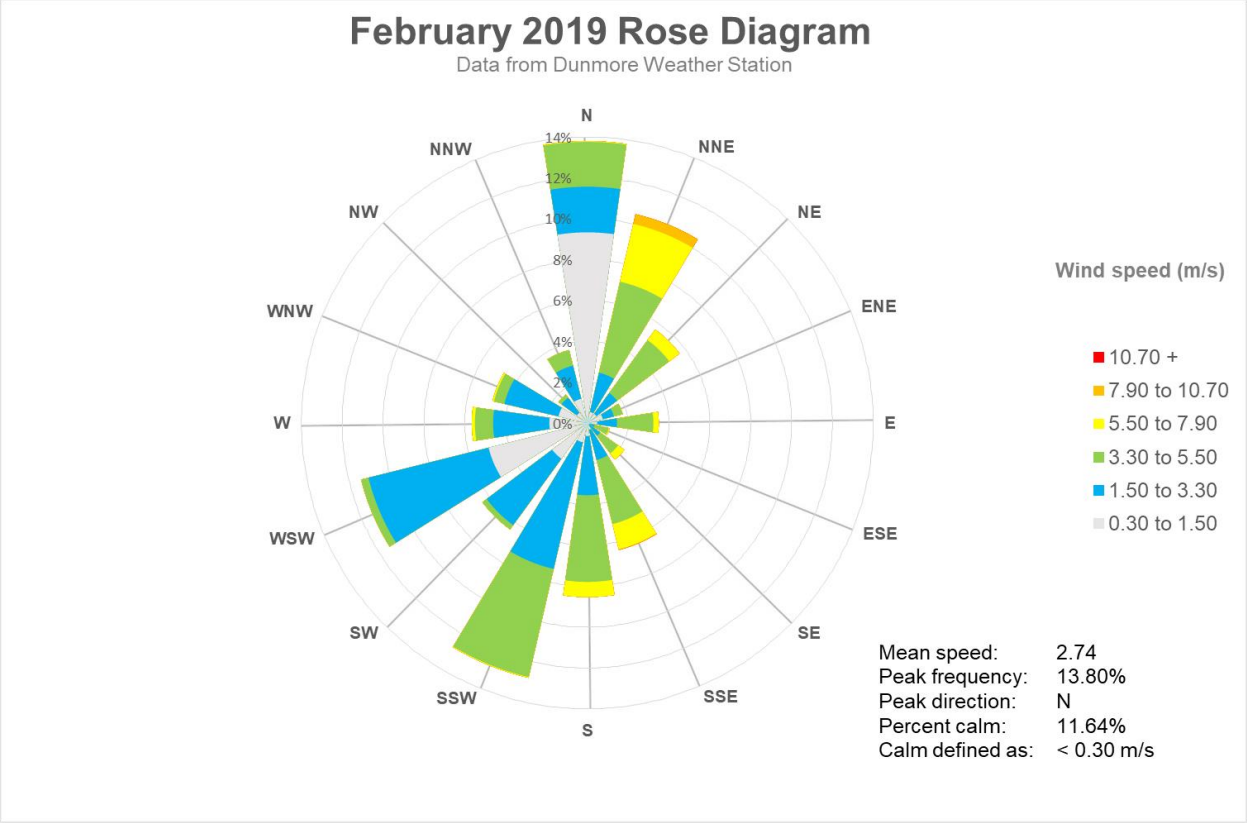


Figure 15 February Wind Rose Data

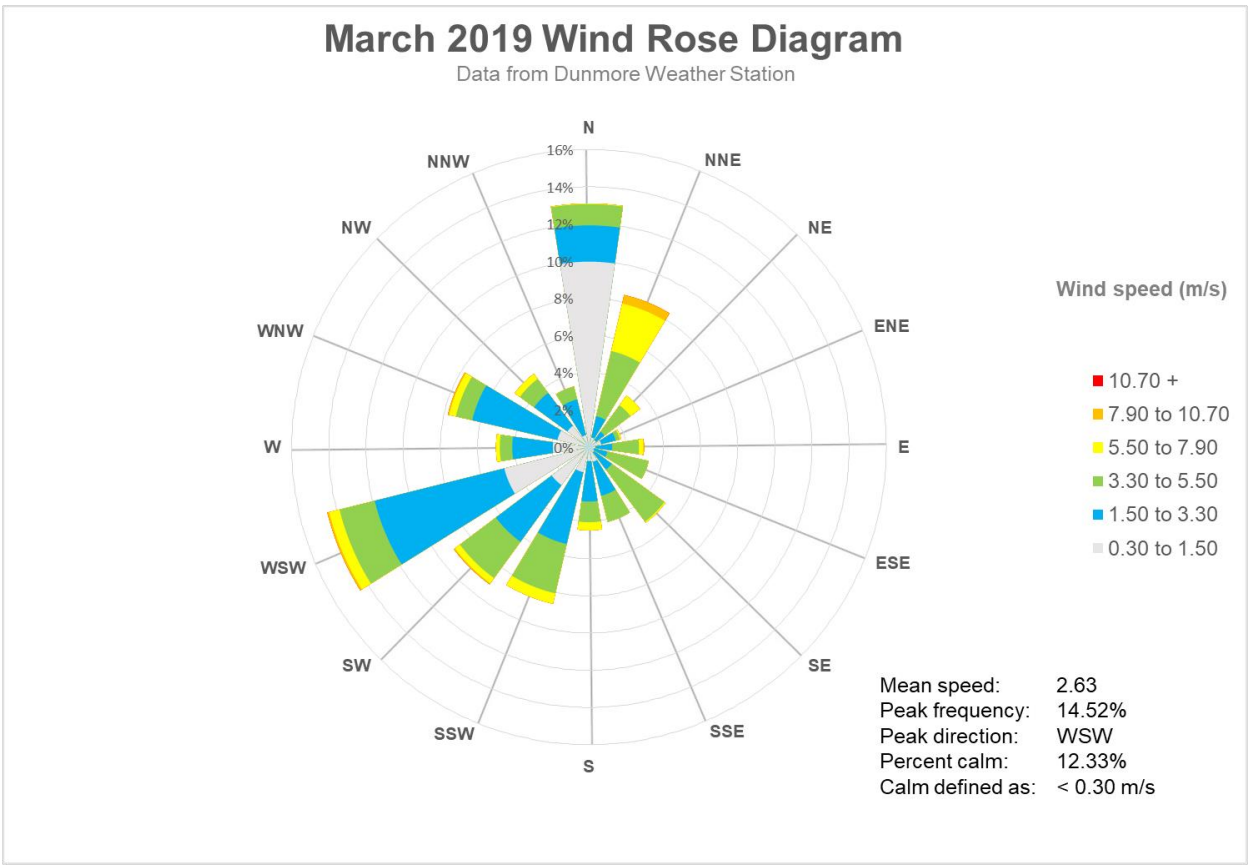


Figure 16 March Wind Rose Data

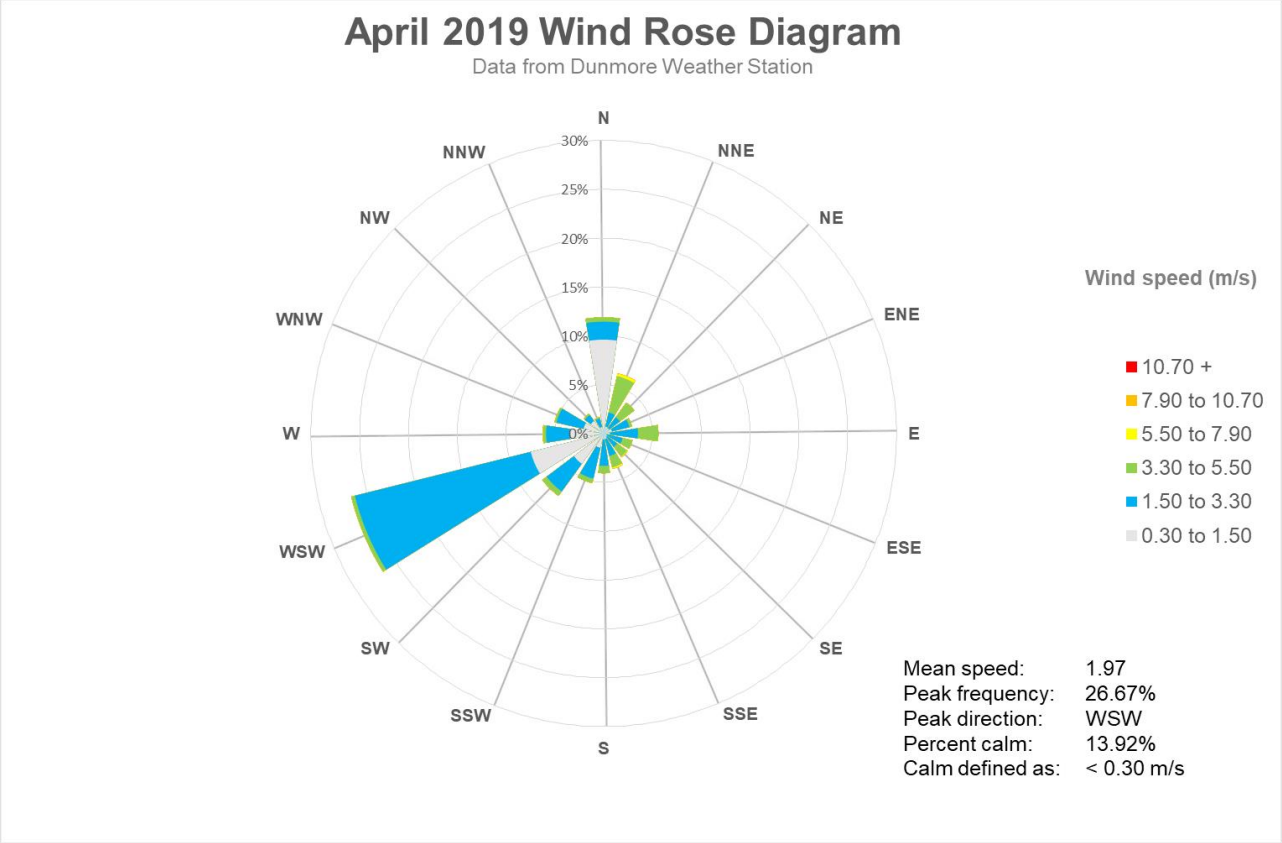


Figure 17 April Wind Rose Data

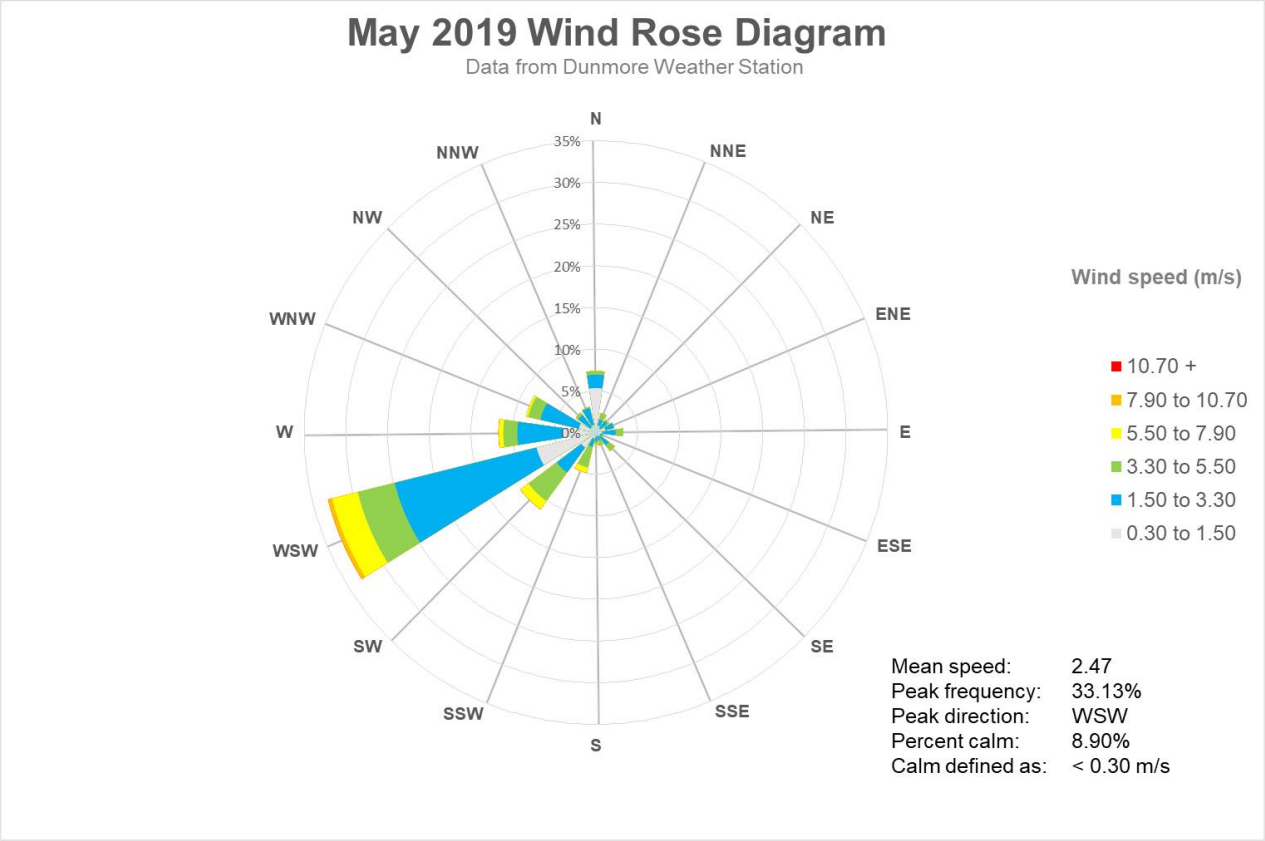


Figure 18 May Wind Rose Data

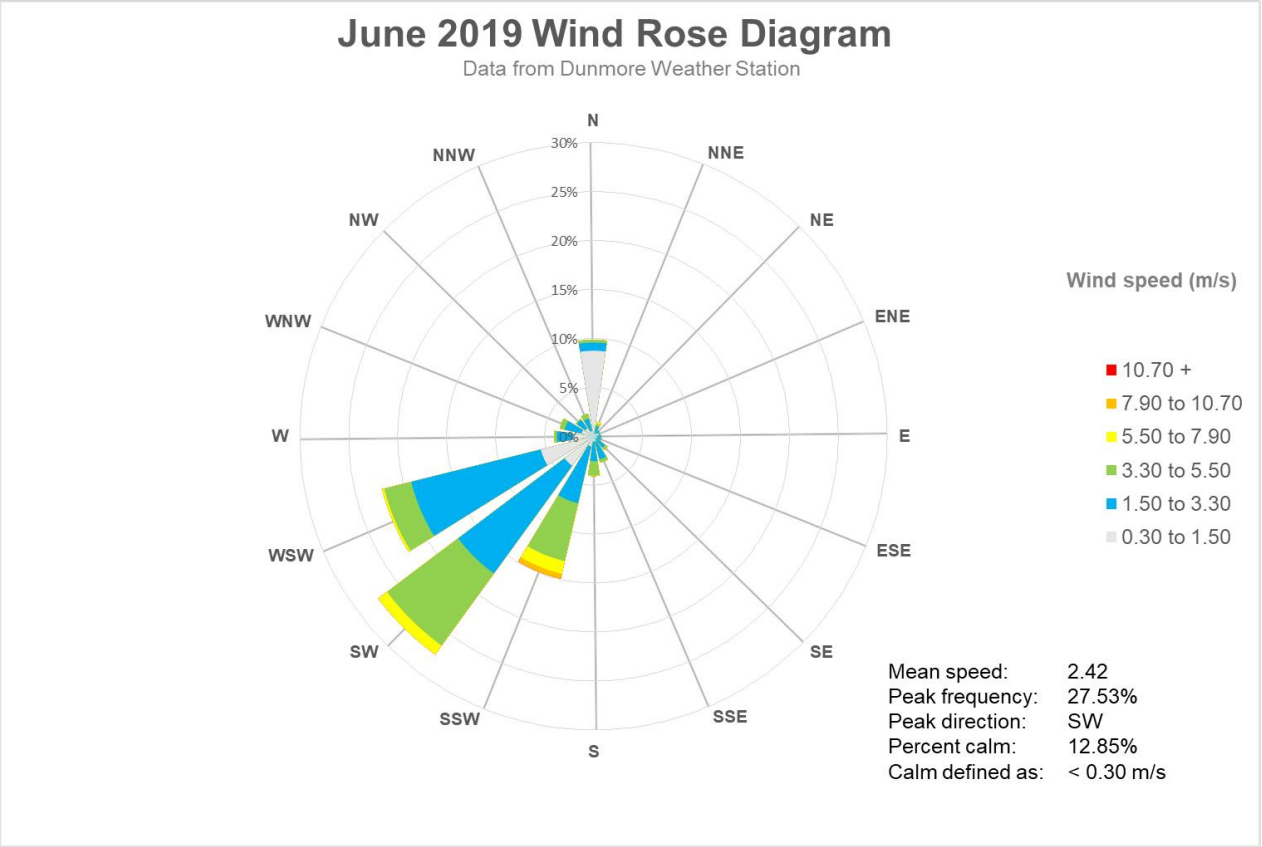
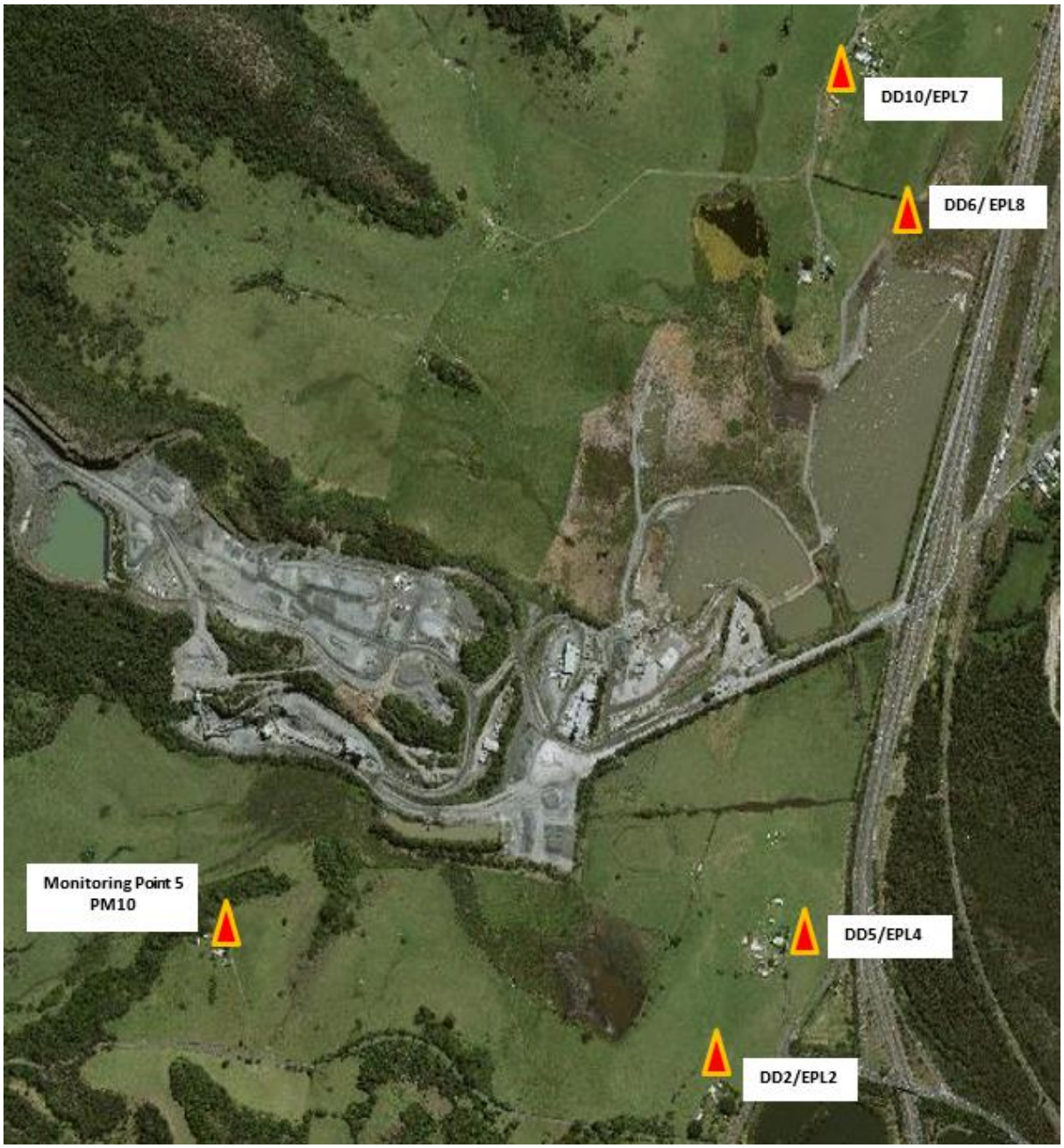


Figure 19 June Wind Rose Data

Figure 20 Annual and Seasonal Wind Data Averages

16. Appendix B Air Quality Monitoring



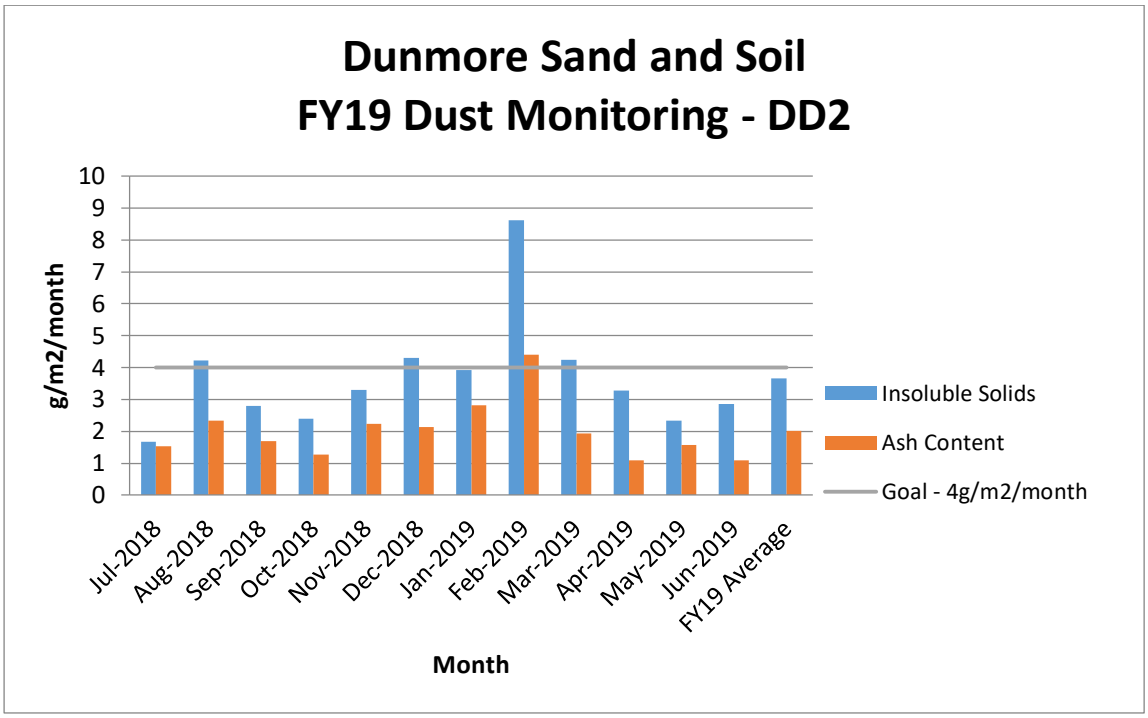


Figure 21 DD2 FY19 Deposited Dust Monitoring

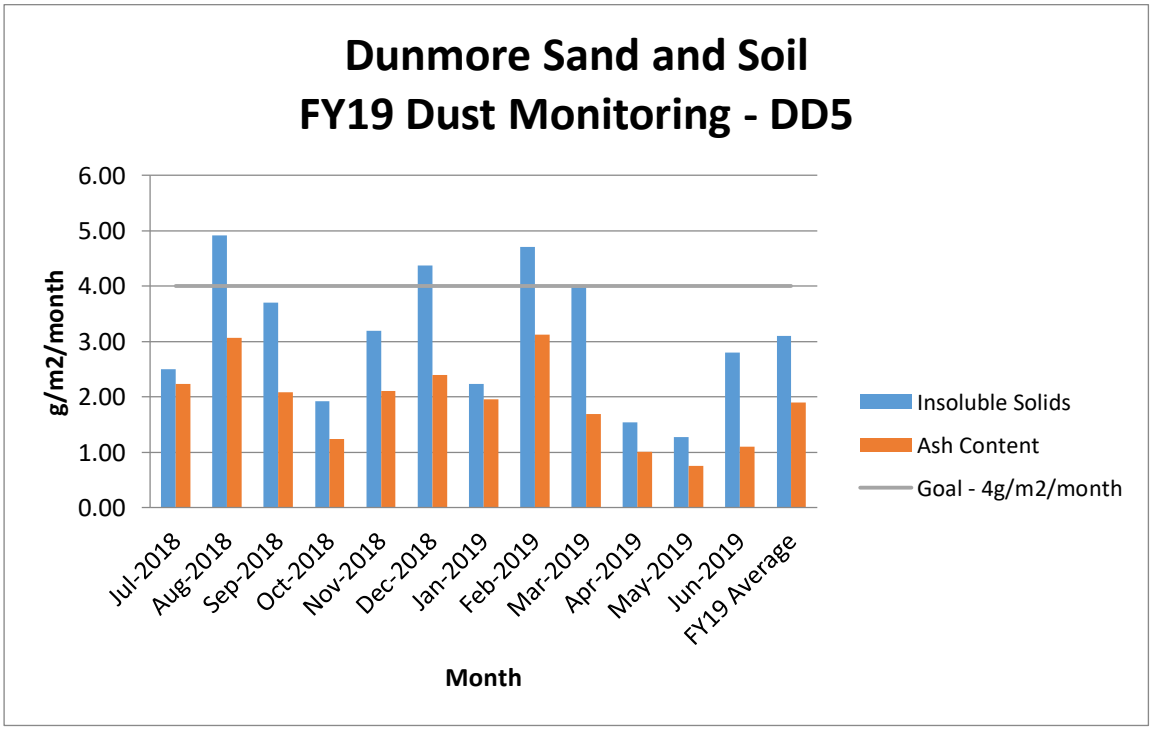


Figure 22 DD5 FY19 Deposited Dust Monitoring

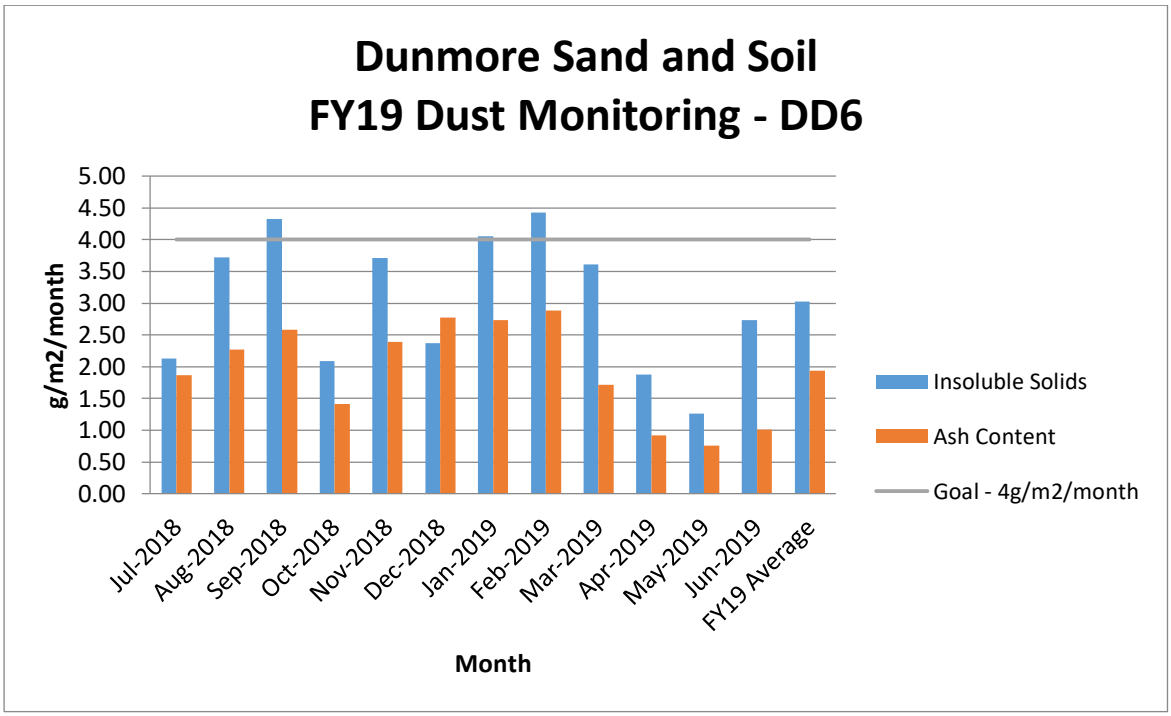


Figure 23 DD6 FY19 Deposited Dust Monitoring

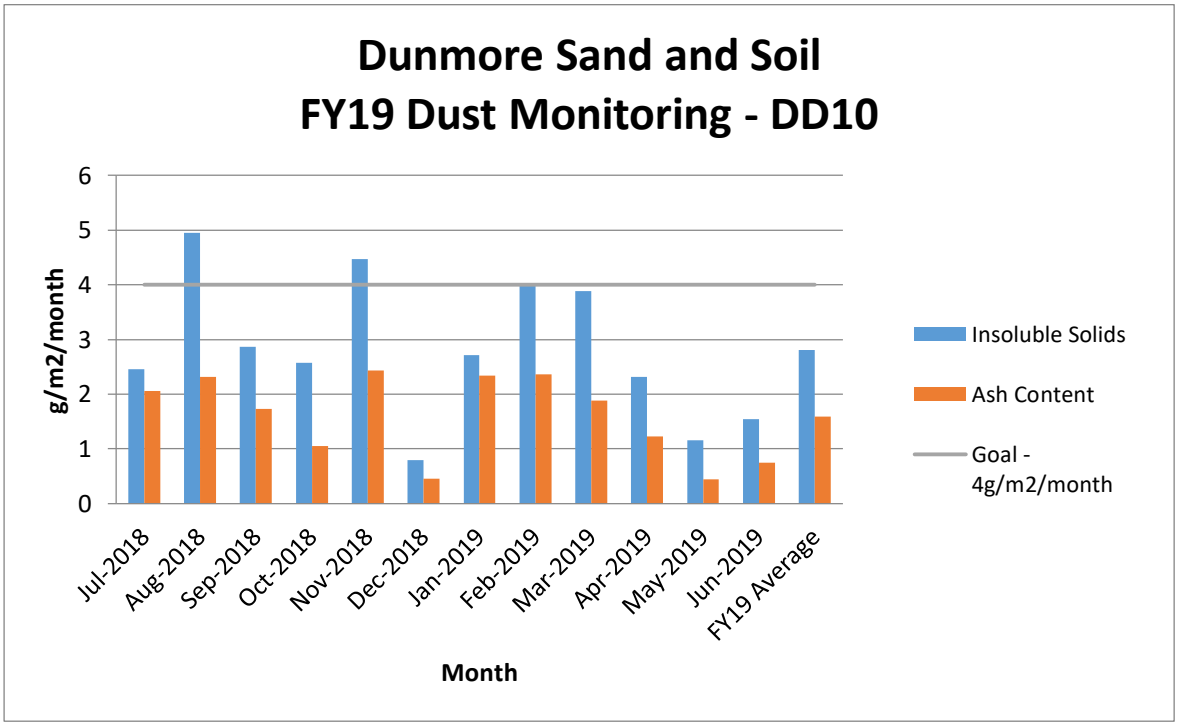


Figure 24 DD10 FY19 Deposited Dust Monitoring

Table 26 Summary of Deposited Dust Results

Month	DD2 grams/m²/month		DD5 grams/m²/month		DD6 grams/m²/month		DD7b/10 grams/m²/month		Dominant Wind Direction	Direction of Strongest Winds	Production Tonnes
	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash	Insoluble Solids	Ash			
FY07 Average	3.68	1.9	3.3	2.1	5.75	3.36	3.9	1.92			
FY08 Average	2.97	1.84	2.88	1.66	4.23	2.43	4.31	2.44			
FY09 Average	3.07	1.98	3.79	1.94	3.83	2.87	5.55	3.17			
FY10 Average	5.29	3.3	3.42	2.5	4.88	2.96	2.71	1.66			
FY11 Average	6.16	3.68	3.42	1.99	3.92	2.47	3.15	2.33			
FY12 Average	5.51	2.82	3.09	1.82	3.17	2.32	2.53	1.6			
FY13 Average	4.19	2.19	3.26	1.84	3.7	2.48	2.75	1.81			
FY14 Average	2.21	1.42	3.63	1.76	2.67	1.58	3.36	2.36			
FY15 Average	3.57	1.77	2.55	1.46	3.94	2	3.2	2			
FY16 Average	1.85	1.19	2.59	1.44	2.55	1.55	2.66	1.66			
FY17 Average	2.28	1.56	2.67	1.77	3.31	1.68	2.01	1.30			
FY18 Average	2.36	1.65	2.32	1.78	2.71	1.88	2.84	1.79			
FY19 Average	3.63	1.87	3.1	1.9	3.03	1.94	2.81	1.59			
Jul-2018	1.67	1.53	2.50	2.23	2.13	1.87	2.46	2.06	WSW(34%)	WSW	27,766
Aug-2018	4.23	2.33	4.92	3.07	3.72	2.27	4.95	2.32	WSW(29%)	WSW,SW	28,974
Sep-2018	2.8	1.69	3.70	2.09	4.33	2.58	2.87	1.73	WSW(25%)	WSW,SW	32,930
Oct-2018	2.39	1.27	1.92	1.24	2.09	1.41	2.57	1.05	WSW(12%)	NNE	34,640
Nov-2018	3.29	2.24	3.20	2.11	3.71	2.39	4.47	2.43	WSW(15%)	NNE	39,815
Dec-2018	4.3	2.14	4.38	2.40	2.37	2.77	0.79	0.45	WSW(18%)	NNE,E	26,761
Jan-2019	3.93	2.82	2.24	1.96	4.05	2.73	2.71	2.34	NNE(13%)	SSE,NNE	33,058
Feb-2019	8.62	4.4	4.71	3.13	4.43	2.88	4.02	2.36	N(14%)	NNE	31,798
Mar-2019	4.25	1.94	3.98	1.69	3.61	1.72	3.89	1.88	WSW(15%)	NNE	37,872
Apr-2019	3.28	1.09	1.54	1.01	1.88	0.92	2.31	1.23	WSW(27%)	-	35,315
May-2019	2.33	1.58	1.27	0.75	1.26	0.76	1.15	0.44	WSW(33%)	WSW	66,908
Jun-2019	2.86	1.09	2.80	1.10	2.73	1.01	1.54	0.75	WSW(28%)	SSW	28,552
FY19 Average	3.66	2.01	3.10	1.90	3.03	1.94	2.81	1.59			257,794

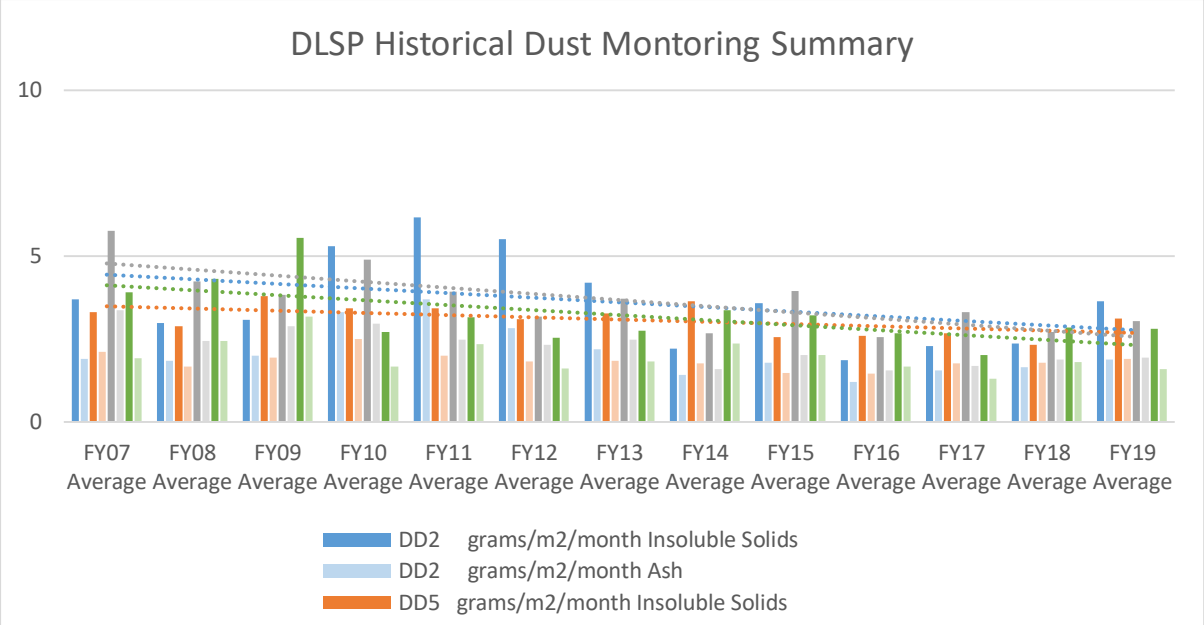


Figure 25 DLSP Historical Dust Monitoring Summary

Figure 26 Dust Storms 12-14th of February

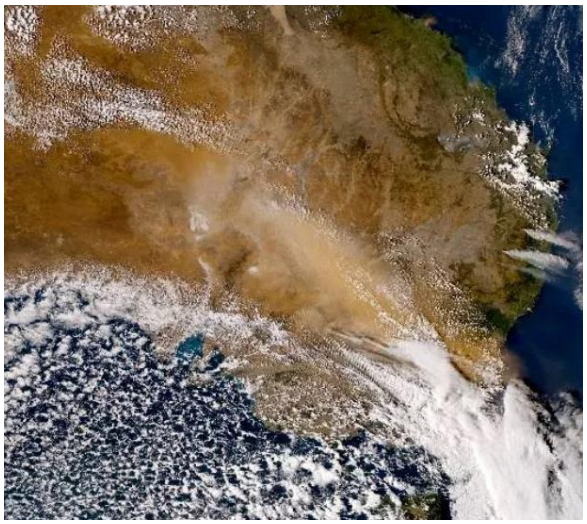


Figure 27 Extent of Dust Storms 12-14th of February

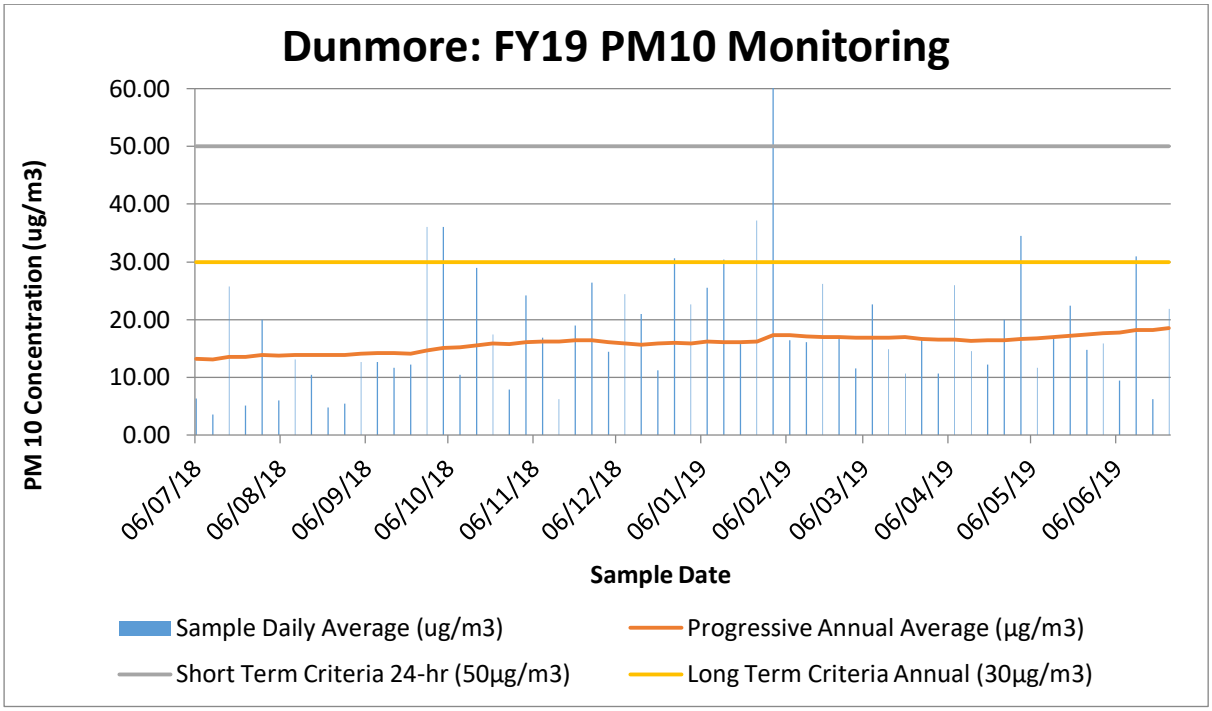


Figure 28 FY19 Dunmore PM10 Monitoring

Table 27 FY19 PM10 Monitoring Results

Sample				Criteria		
	Date	Sample Daily Average (µg/m$^{3)}$	Sample Average To Date (µg/m^{3})	Short Term Criteria 24-hr (50µg/m$^{3)}$	Long Term Criteria Annual (30µg/m$^{3)}$	Progressive Annual Average (µg/m3)
Jul-18	6/07/2018	6.36	12.43	50	30	13.16
Jul-18	12/07/2018	3.57	12.41	50	30	13.15
Jul-18	18/07/2018	25.79	12.43	50	30	13.52
Jul-18	24/07/2018	5.11	12.42	50	30	13.53
Jul-18	30/07/2018	20.02	12.43	50	30	13.83
Aug-18	5/08/2018	6	12.42	50	30	13.73
Aug-18	11/08/2018	13.07	12.42	50	30	13.88
Aug-18	17/08/2018	10.46	12.42	50	30	13.93
Aug-18	23/08/2018	4.81	12.41	50	30	13.93
Aug-18	29/08/2018	5.46	12.40	50	30	13.91
Sep-18	4/09/2018	12.67	12.40	50	30	14.11
Sep-18	10/09/2018	12.67	12.40	50	30	14.25
Sep-18	16/09/2018	11.71	12.40	50	30	14.23
Sep-18	22/09/2018	12.24	12.40	50	30	14.13
Sep-18	28/09/2018	36.06	12.43	50	30	14.69
Oct-18	4/10/2018	36.06	12.47	50	30	15.12
Oct-18	10/10/2018	10.43	12.46	50	30	15.26
Oct-18	16/10/2018	29	12.49	50	30	15.59
Oct-18	22/10/2018	17.47	12.49	50	30	15.82
Oct-18	28/10/2018	7.9	12.49	50	30	15.79

Nov-18	3/11/2018	24.24	12.51	50	30	16.09
Nov-18	9/11/2018	16.82	12.51	50	30	16.17
Nov-18	15/11/2018	6.18	12.50	50	30	16.24
Nov-18	21/11/2018	19.01	12.51	50	30	16.44
Nov-18	27/11/2018	26.44	12.53	50	30	16.37
Dec-18	3/12/2018	14.38	12.53	50	30	16.11
Dec-18	9/12/2018	24.36	12.55	50	30	15.85
Dec-18	15/12/2018	20.95	12.56	50	30	15.71
Dec-18	21/12/2018	11.23	12.56	50	30	15.82
Dec-18	27/12/2018	30.6	12.59	50	30	16.03
Jan-19	2/01/2019	22.64	12.60	50	30	15.87
Jan-19	8/01/2019	25.55	12.62	50	30	16.18
Jan-19	14/01/2019	30.42	12.64	50	30	16.15
Jan-19	20/01/2019	15.81	12.65	50	30	16.14
Jan-19	26/01/2019	37.2	12.68	50	30	16.24
Feb-19	1/02/2019	81.47	12.78	50	30	17.35
Feb-19	7/02/2019	16.46	12.78	50	30	17.31
Feb-19	13/02/2019	16.04	12.79	50	30	17.09
Feb-19	19/02/2019	26.15	12.80	50	30	16.97
Feb-19	25/02/2019	16.93	12.81	50	30	16.96
Mar-19	3/03/2019	11.53	12.81	50	30	16.86
Mar-19	9/03/2019	22.58	12.82	50	30	16.91
Mar-19	15/03/2019	14.91	12.83	50	30	16.83
Mar-19	21/03/2019	10.64	12.82	50	30	16.95
Mar-19	27/03/2019	16.82	12.83	50	30	16.70
Apr-19	2/04/2019	10.7	12.82	50	30	16.58
Apr-19	8/04/2019	25.91	12.84	50	30	16.54
Apr-19	14/04/2019	14.56	12.84	50	30	16.28
Apr-19	20/04/2019	12.18	12.84	50	30	16.39
Apr-19	26/04/2019	19.96	12.85	50	30	16.45
May-19	2/05/2019	34.46	12.88	50	30	16.68
May-19	8/05/2019	11.65	12.88	50	30	16.77
May-19	14/05/2019	16.76	12.89	50	30	16.95
May-19	20/05/2019	22.4	12.90	50	30	17.19
May-19	26/05/2019	14.8	12.90	50	30	17.43
Jun-19	1/06/2019	15.92	12.91	50	30	17.63
Jun-19	7/06/2019	9.45	12.90	50	30	17.71
Jun-19	13/06/2019	30.97	12.93	50	30	18.18
Jun-19	19/06/2019	6.18	12.92	50	30	18.25
Jun-19	25/06/2019	21.87	12.93	50	30	18.57

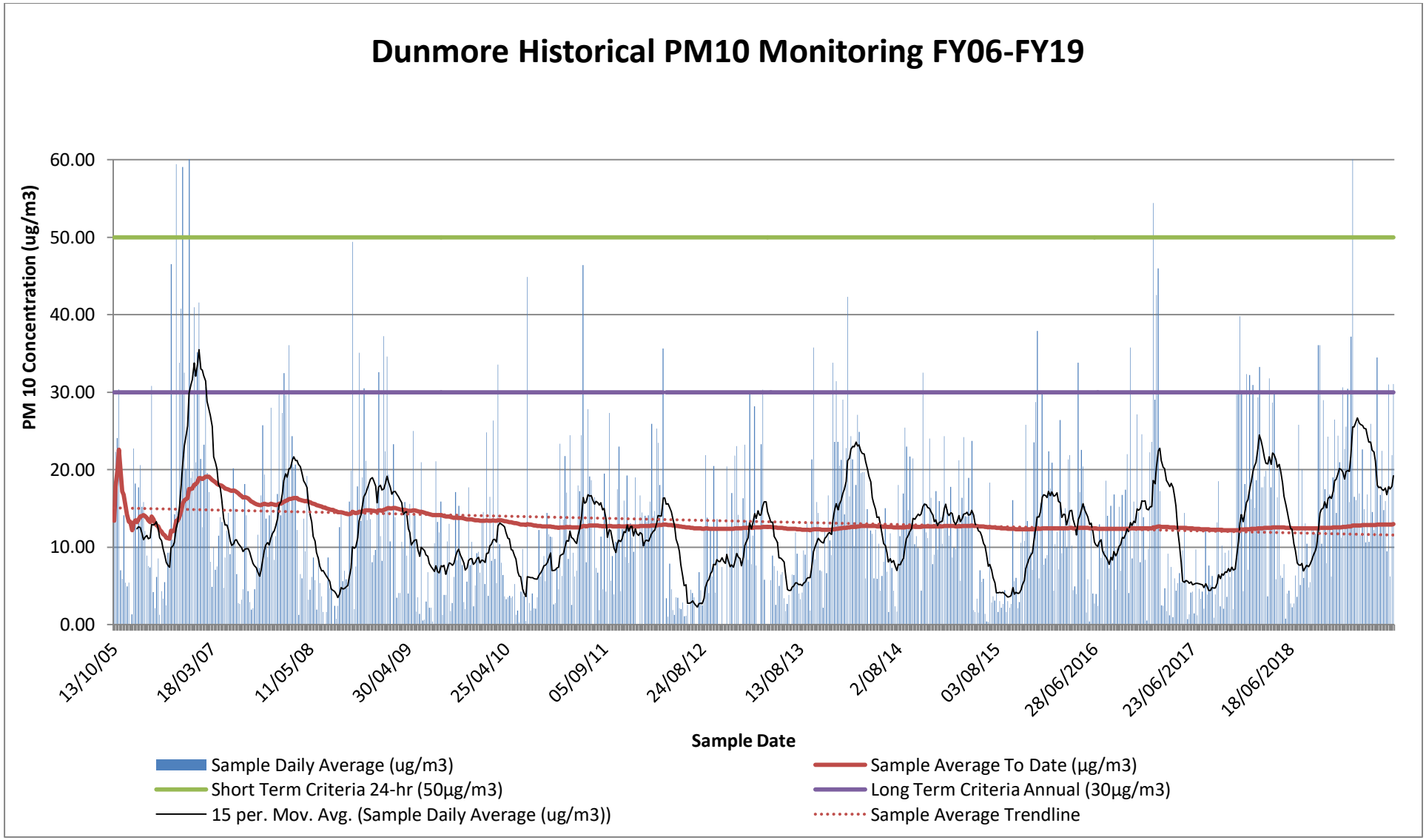


Figure 29 Dunmore Historical PM10 Monitoring

Thursday 31 January 2019 13 - 14 pm

Pollutants		Ozone (O3)	Ozone (O3)	Nitrogen Dioxide (NO2)	Visibility (NEPHM)	Carbon Monoxide (CO)	Sulfur Dioxide (SO2)	Particles (PM10)	Particles (PM2.5)	Site AQI	Regional AQI
Averaging Periods		1-hour average	rolling 4-hour average	1-hour average	1-hour average	rolling 8-hour average	1-hour average	rolling 24-hour average	rolling 24-hour average	highest level at the site	highest level for the region
Sydney East	Randwick	55	55	4	6		0	62	46	62	
	Rozelle	49	51	2	7	3	0	70	46	70	
	Lindfield	46	48	2	6		0	45		48	70
	Chullora	49	52	3	7	2	1	55	48	55	
	Earlwood	50	54	3	8			53	41	54	
	Macquarie Park	45	48	1	7	3	0	38	35	48	
Sydney North-west	Parramatta North	41	46	8	8	2	0	57	43	57	
	Richmond	40		0	6			53	47	53	
	St Marys	41	48	0	6			58	51	58	64
	Vineyard										
	Prospect	46	49	0	7	1	0	64	49	64	
Sydney South-west	Bargo	35	42	0	10		0	70	62	70	
	Bringelly	38	46	0	7		0	67	49	67	
	Camden	36	47	1	9	2		55	46	55	80
	Campbelltown West	36	50	3	10	4		58	64	64	
	Liverpool	49	57	2	9	2	0	70		70	
	Oakdale	57	80	0	8			47	60	80	
Illawarra	Wollongong	67	66	3	14	2	1	102	58	102	
	Kembla Grange	36	47	1	13			107	66	107	107
	Albion Park Sth	39	46	0	12		0	100	65	100	
Lower Hunter	Wallsend	41	47	2	8		0	57	40	57	
	Newcastle	40	45	3	7	4	0	83	45	83	83
	Beresfield	34	42	2	8		0	51	39	51	
Central Coast	Wyong	27	33	1	7	2	0	49	36	49	49
Central Tablelands	Bathurst							42	21	42	42
Northern Tablelands	Armidale				6			17	28	28	28
North-west Slopes	Gunnedah	29	34	2				37	24	37	
	Narrabri							26	21	26	50
	Tamworth							50	33	50	
South-west Slopes	Albury							58	36	58	226
	Wagga Wagga Nth							226	72	226	
Upper Hunter - Muswellbrook	Muswellbrook			1			0	85	38	85	85
Upper Hunter - Singleton	Singleton			1			0	61	42	61	61

Figure 30 Regional PM10 Conditions 31/1/19

Friday 1 February 2019 13 - 14 pm

Pollutants		Ozone (O3)	Ozone (O3)	Nitrogen Dioxide (NO2)	Visibility (NEPHM)	Carbon Monoxide (CO)	Sulfur Dioxide (SO2)	Particles (PM10)	Particles (PM2.5)	Site AQI	Regional AQI
Averaging Periods		1-hour average	rolling 4-hour average	1-hour average	1-hour average	rolling 8-hour average	1-hour average	rolling 24-hour average	rolling 24-hour average	highest level at the site	highest level for the region
Sydney East	Randwick	20	25	2	9		0	62	33	62	
	Rozelle	16	20	7	11	2	0	67	33	67	
	Lindfield	19	23	4	10		0	57		57	67
	Chullora	17	22	5	10	0	0	55	29	55	
	Earlwood	19	23	2	10			53	33	53	
	Macquarie Park	17	22	4	11	3	0	52	33	52	
Sydney North-west	Parramatta North	16		4	10	0		65	34	65	
	Richmond	18	23	3	11		0	41	27	41	
	St Marys	19	24	1	10			47	18	47	65
	Vineyard										
	Prospect				8			57	29	57	
Sydney South-west	Bargo	17	22	2	8		0	34	20	34	
	Bringelly	19	23	2	10		0	44	25	44	
	Camden	19	22	1	9	12		34	23	34	56
	Campbelltown West	19	23	3	10	2		50	43	50	
	Liverpool	16	20	4	11	2	0	56	43	56	
	Oakdale	20	23	1	9			28	27	28	
Illawarra	Wollongong	21	24	3	12	1	0	57	38	57	
	Kembla Grange	21	24	0	10			60	31	60	60
	Albion Park Sth	20	24	0	10		0	52	43	52	
Lower Hunter	Wallsend	23	26	1	13		0	51	22	51	
	Newcastle	22	27	1	18	3	0	73	35	73	73
	Beresfield	23	25	0	13		0	55	31	55	
Central Coast	Wyong	20	24	3	10	1	0	42		42	42
Central Tablelands	Bathurst							43	21	43	43
Northern Tablelands	Armidale				10			25	43	43	43
North-west Slopes	Gunnedah	34	41	1				37	24	41	
	Narrabri							37	30	37	50
	Tamworth							50	26	50	
South-west Slopes	Albury							47	31	47	70
	Wagga Wagga Nth							70	18	70	
Upper Hunter - Muswellbrook	Muswellbrook			4			4	55	21	55	55
Upper Hunter - Singleton	Singleton			1			1	39	24	39	39

Figure 31 Regional PM10 conditions 1/2/19

17. Appendix C Annual Noise Compliance Monitoring

18. Appendix D Surface Water Monitoring

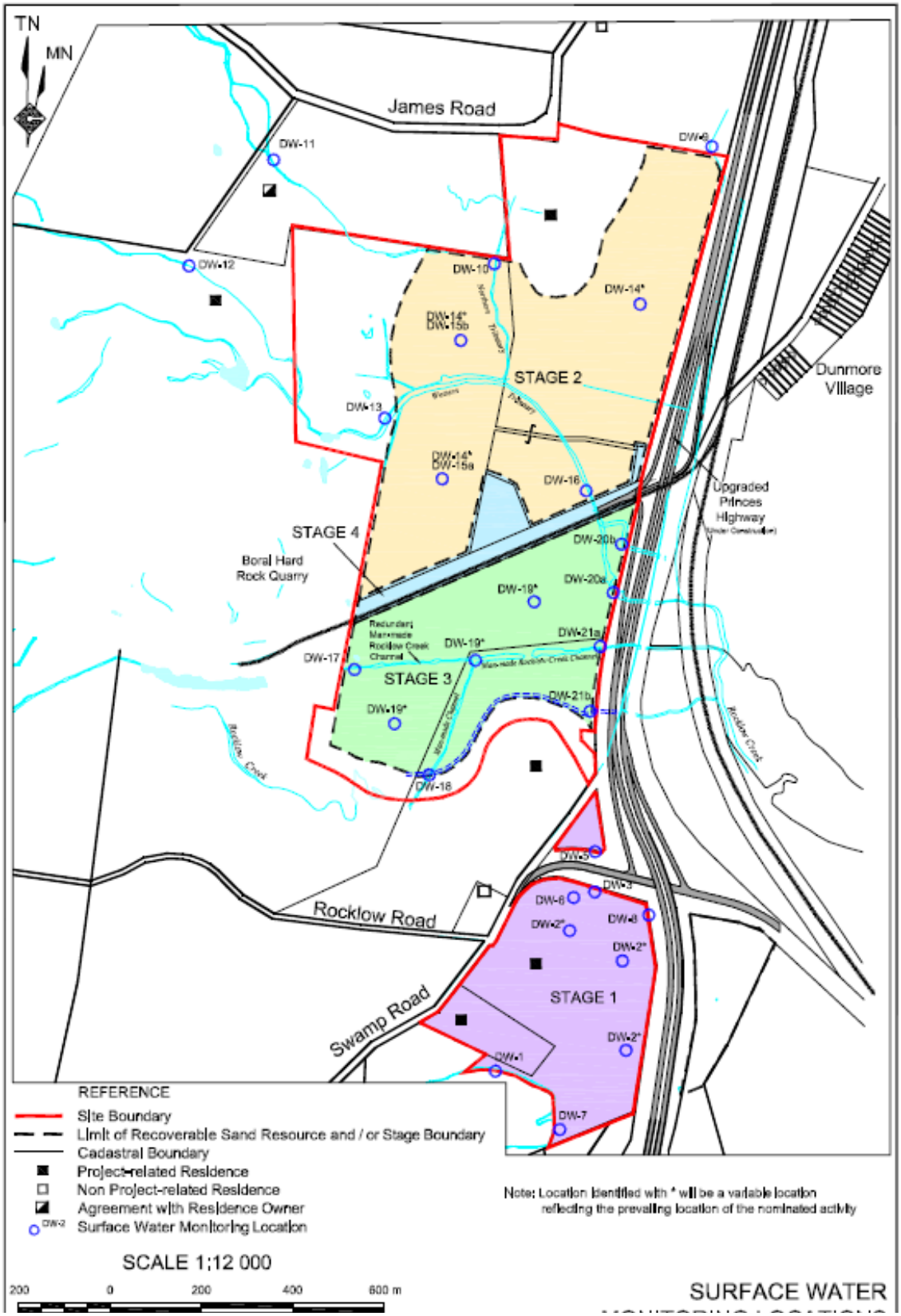


Figure 32 Surface Water Monitoring Locations

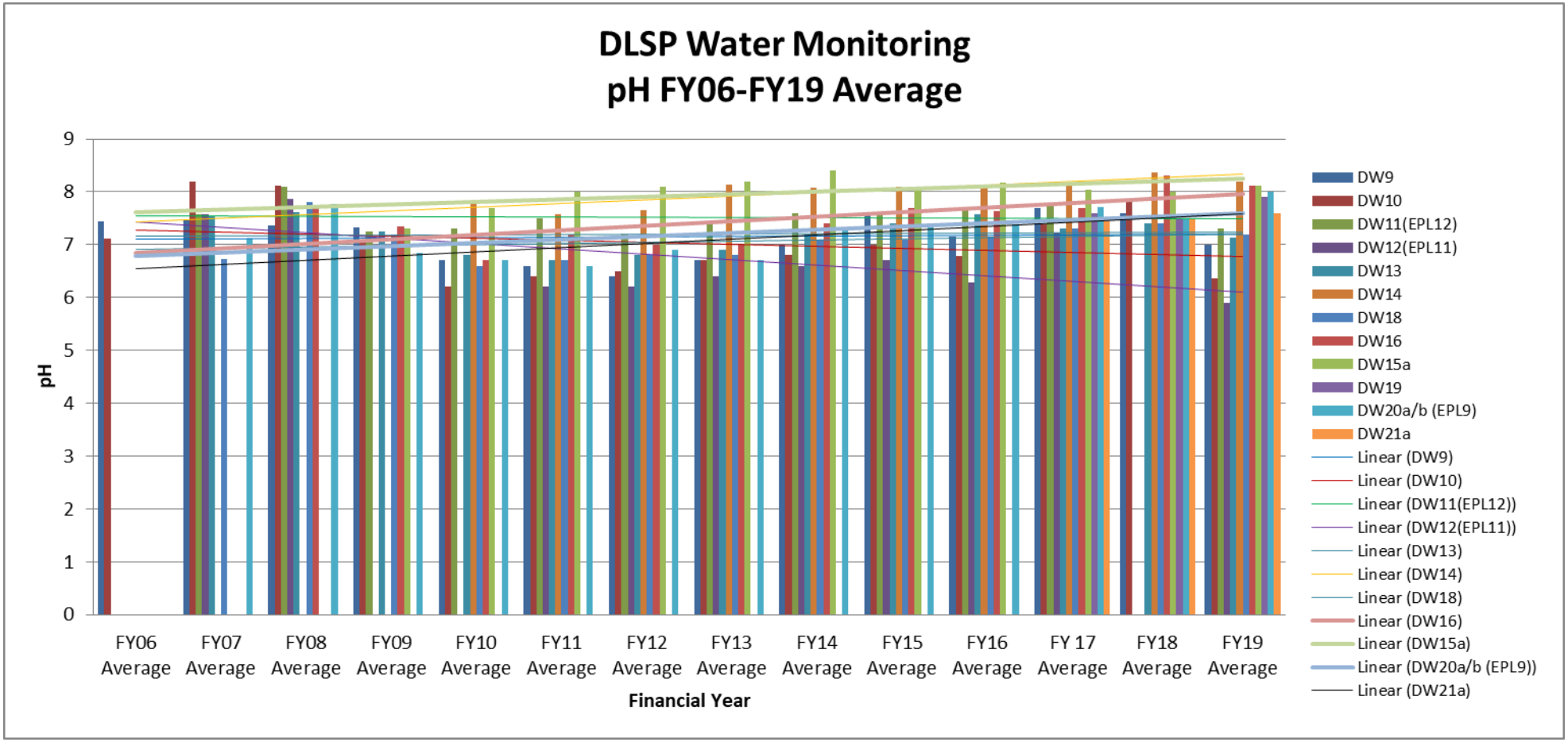


Figure 33 DLSP pH Historical Trends

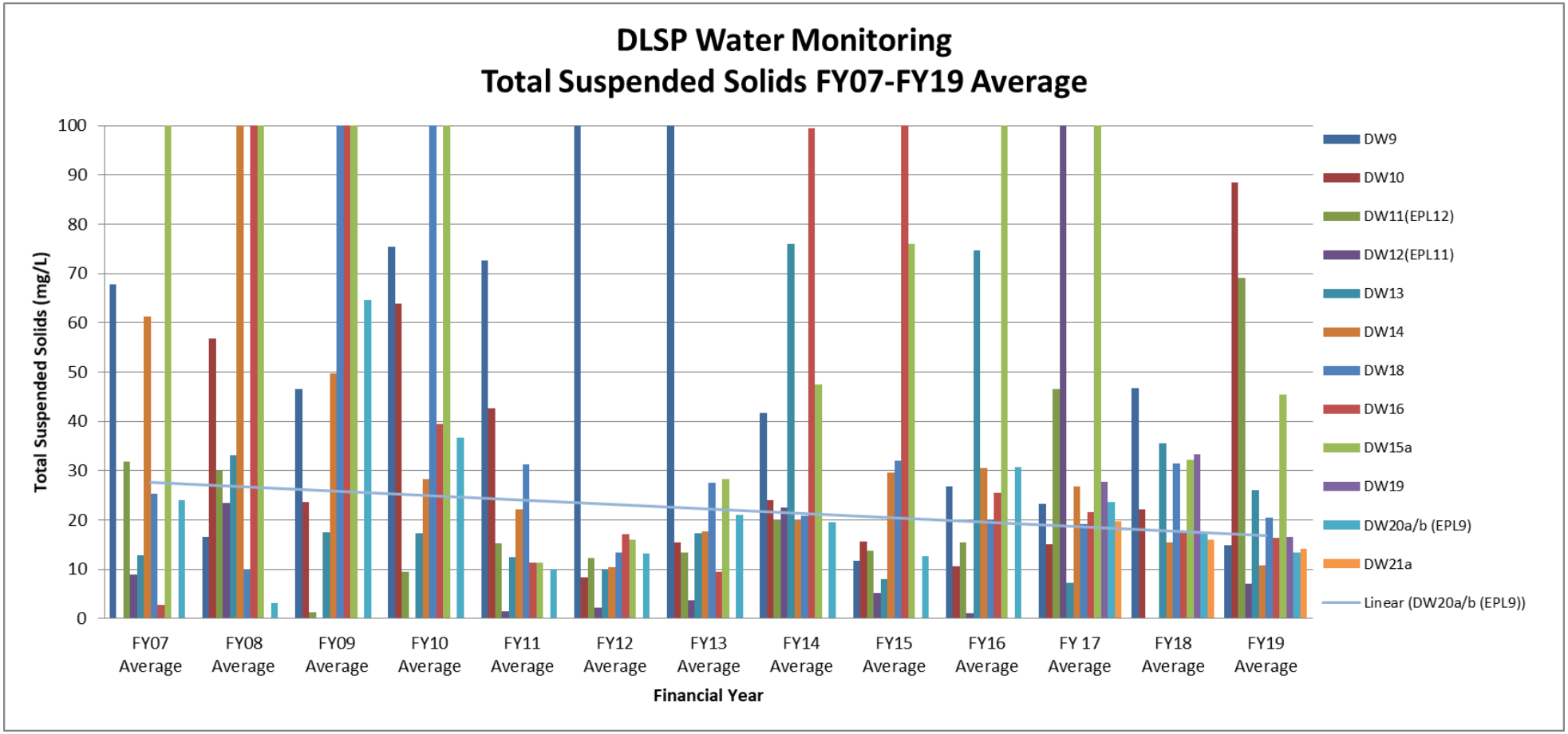


Figure 34 DLSP TSS Historical Trends

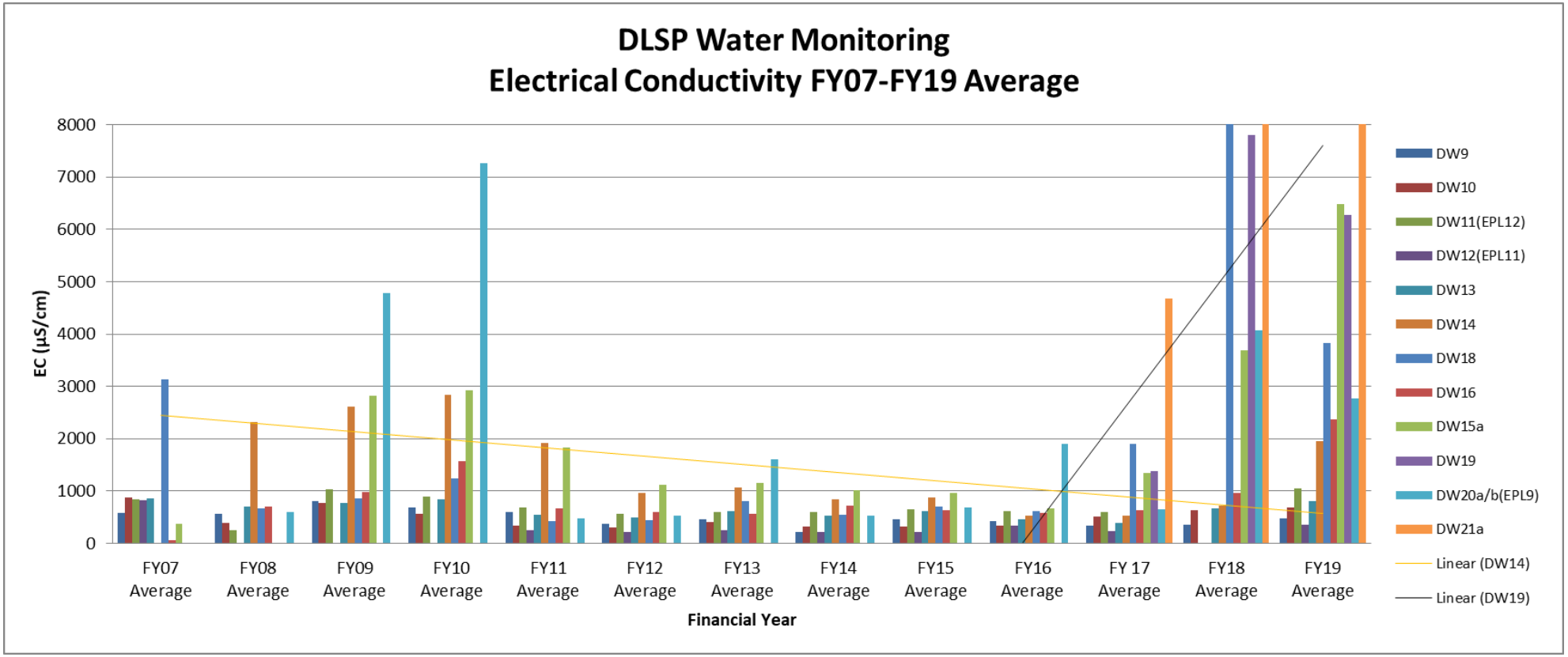


Figure 35 DLSP Conductivity Historical Trends

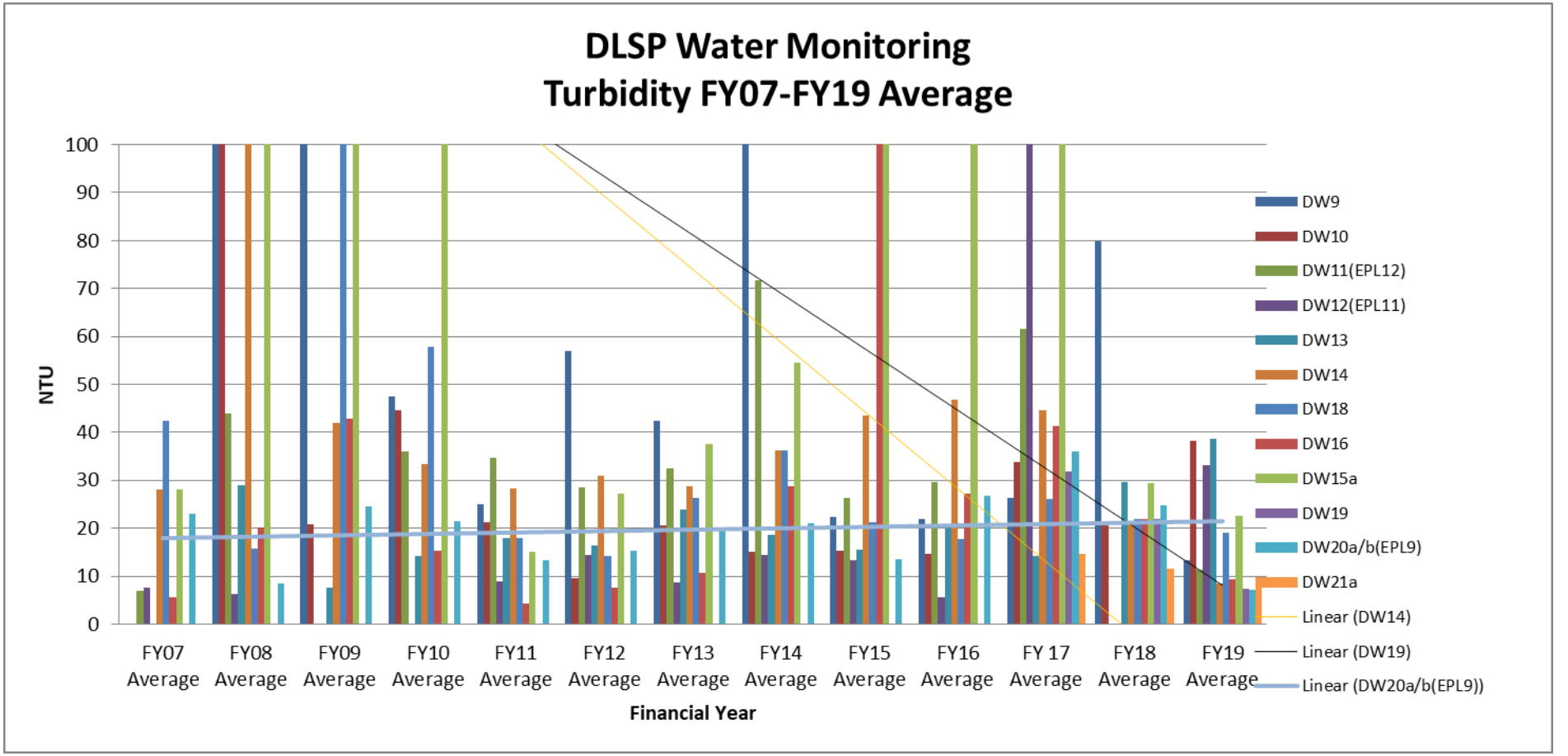


Figure 36 DLSP Turbidity Historical Trends

19. Appendix E Annual Groundwater Monitoring Report

20. Appendix F Rehabilitation Progress Photos

Figure 37 FY17 Re-aligned Western Tributary Rehabilitation Progress

Figure 38 FY18 Re-aligned Western Tributary Rehabilitation Progress

Figure 39 FY19 Re-aligned Western Tributary Rehabilitation Progress

Figure 40 FY17 NW Stage 2 Rehabilitation Progress

Figure 41 FY18 NW Stage 2 Rehabilitation Progress

Figure 42 FY19 NW Stage 2 Rehabilitation Progress