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6 July, 2019

EPA South Australia
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Outer Harbor Channel Widening Project - Monthly Report for June 2019

Flinders Ports are currently undertaking dredging of the Outer Harbor Channel and Swing Basin. This work is being undertaken in accordance with the conditions of EPA licence 50556.

Flinders Ports has engaged dredge contractor Boskalis to undertake this work.

Dredging commenced on 7/6/19 utilising the trailing suction hopper dredge 'Gateway'. Backhoe dredge 'Magnor' arrived in Adelaide on 29/6/19 and commenced dredging on 3/7/19.

This monthly report is consists of 3 components:

- Boskalis Monthly Environmental Report – June 2019
- BMT Monthly Water Quality Monitoring & Validation Report – June 2019
- Flinders Ports Monthly Stakeholder Engagement Update – June 2019

In addition, also attached for information is the Stakeholder Engagement Summary for pre-dredging activities undertaken between March and May 2019.

Next report for July will be issued at the start of August.

Monthly Environmental Report – June 2019

DOCUMENT NUMBER: 036-10315-01-002

PROJECT NAME: Port Adelaide Outer Harbor Channel Widening
PROJECT NUMBER: 036-101315

CLIENT NAME: Flinders Ports Pty Ltd
CLIENT REFERENCE: FP-10/18

Boskalis
Dredging & Marine Experts

DOCUMENT CONTROL

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Project Number:	036-10315
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Client Reference:	FP-10/18
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Prepared By:	Irena Doets	Role: Environmental Manager
Reviewed By:	Michel Oosterwegel	Role: Environmental Engineer
Interdisciplinary Check:	Gary Beer	Role: SHE-Q Manager
Approved By:	Pieter Jan Stuiver	Role: Project Manager

Change log		
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Rev A1	All	Issued for internal review
Rev B1	All	Issued for Client review
Rev 01	All	Issued for Use
Rev 02	4.1	Issued for Use

Boskalis
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1. INTRODUCTION

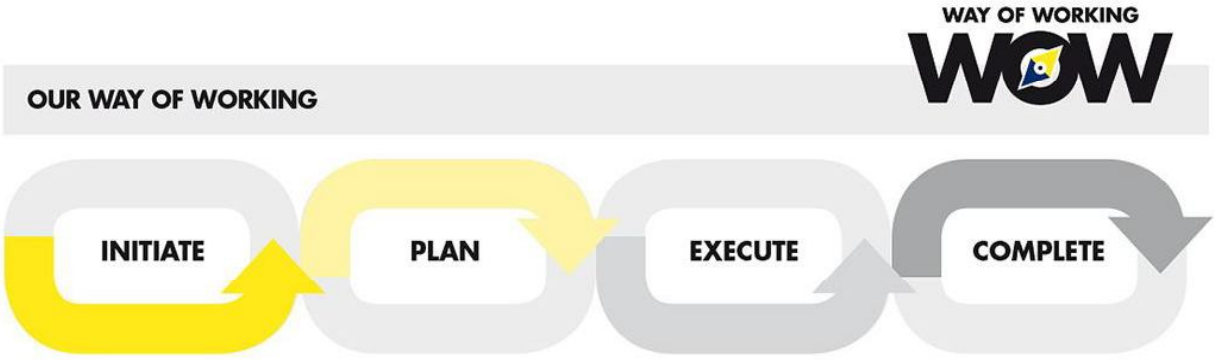
This Monthly Environmental Report presents the results of the first month of dredging, which commenced on the 7th of June. Hence the reporting period includes the 7th until the 30th of June. The report presents action taken by the Contractor in line with the Licence conditions [1] and the Dredge Management Plan (DMP) [12]. It covers the following items:

- Any updates to the DMP (Chapter 3);
- Overview of dredge activities in this period including dredge and disposal volumes (Chapter 3).
- Actions taken to correct turbidity exceedances (Chapter 4);
- Summary of additional monitoring undertaken by the Contractor (Chapter 4);
- Marine mammal observations (Chapter 5);
- Summary of Weekly Site Inspections (Chapter 6);
- Register of non-conformances and actions taken (Chapter 7); and
- Removal of *Caulerpa Taxifolia* (Chapter 8).

For results on Water Quality monitoring data and Zone Validation monitoring in this period, reference is made to Water Quality and Validation Report from June 2019 [11].

1.1. Boskalis Way of Working

This document forms part of the Boskalis Way of Working, the integrated quality management system applicable to all operations in Boskalis. The Boskalis Way of Working is structured around four Phases as pictured below. This Monthly Environmental Report is prepared in the EXECUTE Phase.



More detailed information about the Boskalis Way of Working can be found in the Group Manual and the User Guide. A dedicated website with all supporting materials is available at wow.boskalis.com

Where the Corporate Way of Working system does not meet the requirements of Australia Work Health and Safety legislation or Environmental legislation, additional or alternative procedures (BKA – Country Tools) have been prepared by Boskalis Australia as described in the Way of Working Booklet – Australia.

Management commitment is shown to SHE-Q through the various policy statements.
Reference is made to:

- GT-001 Way of Working Policy Statement
- BKA-016 Way of Working Booklet - Australia.
- BKA-001 Boskalis Fitness for Duty Policy
- BKA-002 Boskalis Rehabilitation Policy
- BKA-003 Boskalis Business Conduct and Workplace Behaviour Policy
- BKA-004 Boskalis Privacy Policy

1.2. Plan ownership, change management, approval and distribution

The Project Manager is the document owner and is responsible for the contents of the Monthly Environmental Report. He will ensure that the content is up to date and that only authorized and updated versions are in circulation.

Revision to the Report can be initiated by the following processes:

- Changes in legislation
- Changes in work methods
- Major scope and schedule changes
- Results from risk assessments
- Results from audits (external & internal)
- Results from management reviews
- Results from Client inspections/reviews
- Changes in the Boskalis Way of Working

Any resultant changes will be issued, and agreed upon, by all parties concerned.

2. PROJECT OUTLINE

The Port of Adelaide is the primary port in South Australia, located at Outer Harbor (approximately 14km north-west of the Adelaide CBD) in South Australia (Figure 2.1). The port is operated by Flinders Ports and handles a diverse array of inbound and outbound cargoes, contributing significantly to the State's economic activity. A significant amount of this trade is containerized, and Outer Harbor is the location of the Flinders Adelaide Container Terminal and the Port Adelaide Passenger Terminal which contribute significantly to South Australia's import and export of goods and visitors.

Flinders Ports Pty Ltd (FP) has identified the need to widen the existing shipping channel and swing basin at Outer Harbor in Port Adelaide. This is being driven by the emergence of Post Panamax class vessels which are wider than the 36m design vessel width of the existing channel and swing basin. Outer Harbor can only currently accommodate vessels up to a maximum width of 42.2m width with operational restrictions. The Port Adelaide Outer Harbor Channel Widening Project will enable the port to accommodate vessels with a maximum width of 49m without operational restrictions.

To meet this growth, the existing channel will be widened by 40m to a total width of 170m. The swing basin will be widened from 505m to 560m. The widening footprint of the channel and turning basin are illustrated by the red line in Figure 2.1.

The dredged material will be transported to a designated Dredge Material Placement Area (DMPA), located approximately 30km offshore in the Gulf of St Vincent (yellow box in Figure 2.1). This area is approximately 7km by 5km in size and located in deep water (>30m), thereby avoiding major shipping routes.

Figure 2.1: Overview Project area with outer shipping channel and turning basin

2.1. Project Identification

Project	
Details	**Description**
Project Name	Port Adelaide Outer Harbor Channel Widening Project
Project Scope	Widen and deepen the turning basin and approach channel to the port
Project Location	Outer Harbor, South Australia
Project Number	036-10315
Client Project Number	FP 10/18

Client	
Details	**Description**
Name Client	Flinders Ports Pty Ltd
Address Client	Level 1, 296 St Vincent Street, Port Adelaide South Australia, 5015
Other Client details	Carl Kavina Principal's Representative Lee Kolokas Principal's Representative's Delegate

Engineer / Consultant	
Details	**Description**
Name	ARUP via Flinders Ports
Address	N/A
Other details	Jasvinder Opkar (Principal's Site Representative)

Operating Company	
Details	**Description**
Name	Boskalis Australia Pty Ltd
Address	Level 1 - Suite 3 9 Havelock Street, West Perth, WA 6005 Australia
Other details	General Manager – Peter Boere

3. GENERAL

3.1. Updates to the DMP

After approval of the DMP [12] two Addenda have been made, covering the following elements:

- Addendum 1 to both the EMP and DMP [8] describing a methodology and framework for providing public access to the approved DMP and EMP and reports generated under the licence according to condition 2.7.3.
- Addendum 2 to the DMP [13] detailing revised contact details for:
  - HOLD trigger exceedance notifications;
  - Request for re-commencement after HOLD trigger exceedance;
  - Dolphin incidents;
  - Environmental incident reporting; and
  - Fuel spills.

3.2. Dredging Activities

Dredging in this period took place from the 7th of June until 30th of June. Dredging was undertaken in all areas of the dredge channel (Figure 3.1) by the Trailing Suction Hopper Dredge (TSHD) *Gateway*. In total 53 trips were completed in this period. The TSHD *Gateway* was supported by the sweep vessel *Molly Grace* from the 15th of June until the 19th of June. Due to inefficiency of the *Molly Grace* it was layed up on the 19th of June in the afternoon and will recommence at a later stage of the project.

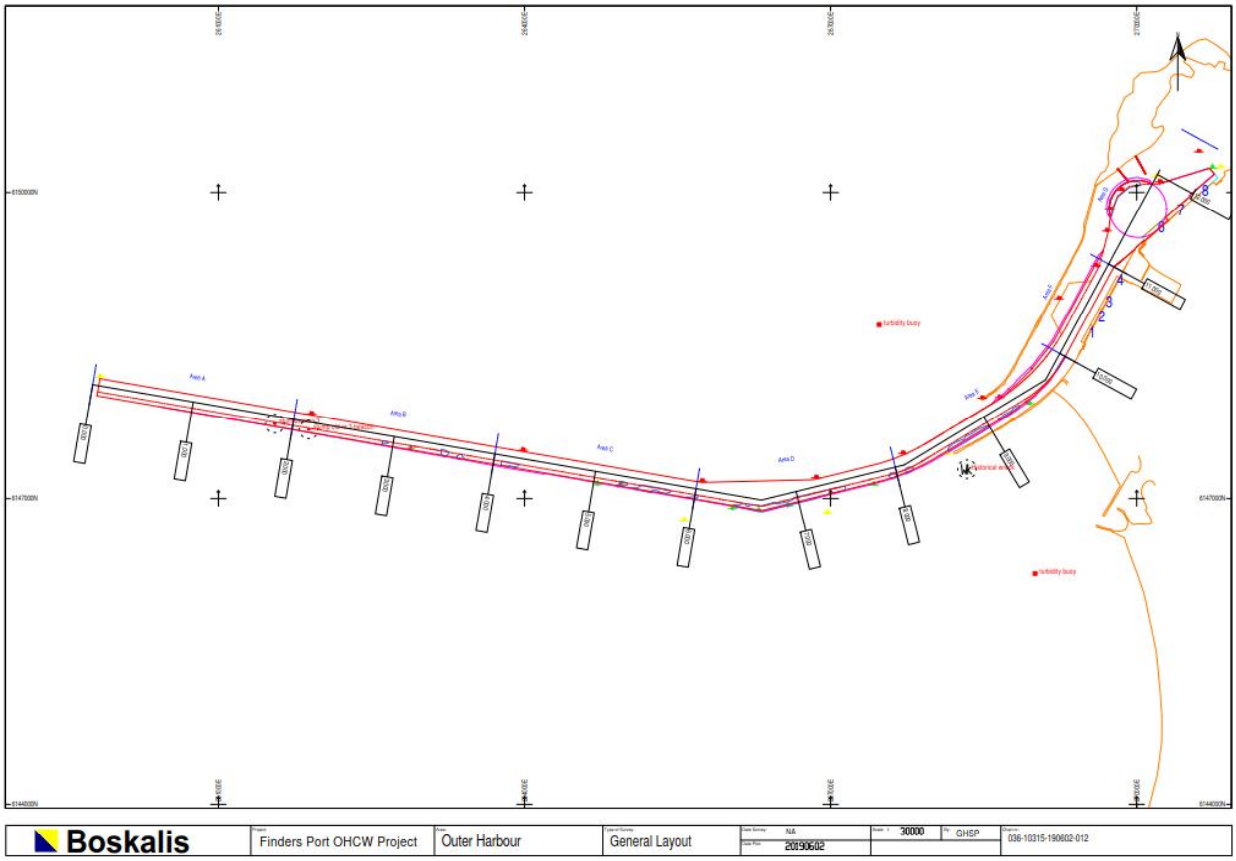


Figure 3.1: Overview dredge area including chainages and area numbering

A total volume of 433,500 m3 was dredged and disposed at the Dredge Material Placement Area (DMPA). Figure 3.2 gives an overview of the areas dredged based on survey on the 29th of June compared to the pre-survey, where red/pink indicates large dredge volumes and blue small volumes.

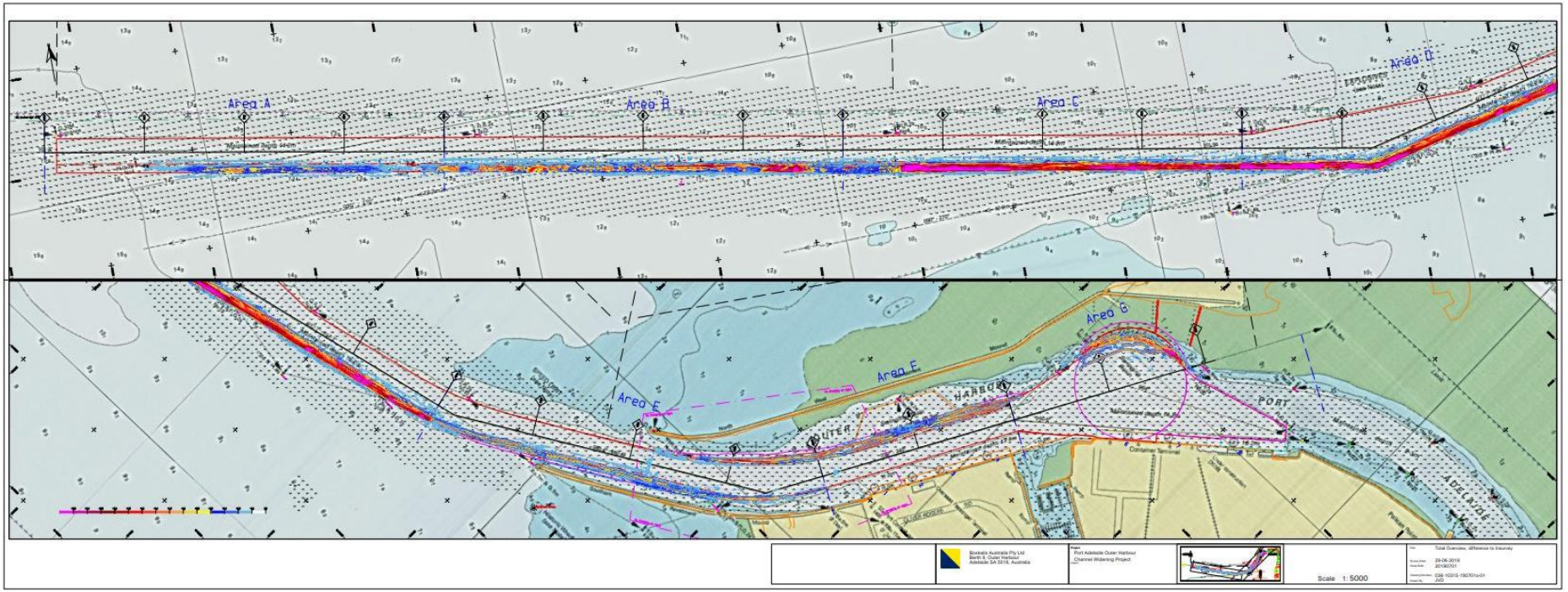


Figure 3.2: Difference in pre-survey compared to survey on the 29th of June

4. TURBIDITY

4.1. Turbidity Exceedances

Table 4.1 provides an overview of turbidity exceedances occurred during this reporting period and actions taken. For an overview of dredge areas, see Figure 3.1. For the turbidity data reference is made to [11].

Table 4.1: Turbidity exceedances in month of June 2019 and actions taken

Turbidity station with exceedance	Level of Exceedance	Start date and time exceedance	Stop date and time exceedance	Actions taken
D2	ALARM 15-day rolling median	09-06-2019 03:40:00	13-06-2019 18:40:00	▪ Dredging further outside of the Channel (from KP2-6) at start of exceedance. ▪ Dredging sequence afterwards in general: - Rising tide in area D (KP 6-8) - Falling tide further away from stations in area B-C (KP2-6) ▪ From 12th of June dredging started inside in turning basin. During low/falling tide dredging in area B-C (KP2-6)
D1	ALARM 15-day rolling median	10-06-2019 04:40:00	10-06-2019 22:40:00	▪ Exceedance mainly as a result of storm event occurred 26th to 30th of May, reduced quickly.
D2	ALARM 15-day rolling median	17-06-2019 11:40:00	26-06-2019 15:40:00	▪ Dredging in area D during rising tide and in area A,B & C during falling tide ▪ On the 18th of June as a response to the strong southerly winds dredging was shifted more inside the breakwaters to area E and F.

The first ALARM exceedance received was a combination of dredge induced turbidity during first days of the dredging works and a storm event occurred from the 26th to the 30th of May with severe weather (Southerly winds for a few days on average 20-30 knots) which were still taken into account in the 15-day rolling median values. In addition on the 10th of June strong northerly winds occurred resulting in higher turbidity values. As management actions were taken (see Table 4.1), weather conditions eased and the storm event from 26th to 30th of May was no more included in the 15-day rolling median, turbidity levels dropped below ALARM level.

The second ALARM exceedance occurred for the 15-day rolling median of station D1. This was mainly as a result of the storm event occurred between the 26th until the 30th of May. Similar actions were taken as described above, and turbidity levels dropped within one day below ALARM level.

The third ALARM exceedance of the 15-day rolling median at station D2 was received on the 17th of June. As strong southerly winds occurred in combination with spring tides, turbidity levels rised. Dredging was

shifted towards inside the breakwaters (area E & F). As weather calmed down and turbidity levels dropped the general sequence with dredging in area D with rising tide and during falling tide in area A to C was continued. In addition, bunkering took place from the 20th until the 21st of June which reduced turbidity levels further.

In conclusion, the turbidity station D2 seems to be most effected by the dredging activities. After a few days of dredging, a general work method was adopted by dredging in area D with rising tide only and shifting more towards the outer part of the channel during falling tide and shifting inside the breakwaters or at the outer part of the channel during strong weather events. In general, strong weather events, with southerly winds being most extreme, and spring tides tend to increase turbidity levels. It is observed that strong weather events tend to occur every 10 days, causing for approximately 5 days higher rolling 15-day median values as both periods with higher turbidity values are taken into account.

4.2. Additional Handheld Monitoring

This period two additional hand measurement campaigns were undertaken. At first, on the 9th of June water samples were taken simultaneous with turbidity measurements in order to verify the assumed TSS-NTU relationship. This resulted in a relationship of 1 NTU = 2.2 mg/l instead of assumed relationship of 1 NTU = 3 mg/l. For further details reference is made to [16].

Furthermore, on the 11th of June readings at the measuring station were verified with a handheld turbidity sensor, similar to the sensor installed on the monitoring stations (for details see Attachment 5.1.). The handheld sensor was lowered to a depth of approximately 1m below the water surface, at similar level as the buoy sensors, for a period of approximately 1 minute. The results of the readings are given in Table 4.2. It can be seen that the handheld sensor readings are below the buoy measurements with 0.3 to 1 NTU, however still within the margin of accuracy of turbidity sensors.

Table 4.2: Turbidity buoy verification measurements

Monitoring station	Time measurement	Buoy reading [NTU]	Average value handheld reading [NTU]
D1	11-06-2019 13:35	At 13:40: 0.82 At 13:50: 0.81	0.52
D2	11-06-2019 13:48	At 13:30: 4.04 At 13:40: 4.28	3.0

It should be noted that these measurements were not conducted for compliance, but were taken for information only.

5. MARINE MAMMAL OBSERVATIONS

In this reporting period a total number of 18 marine mammals have been observed. Per dredge equipment the following count is made:

- Gateway: 15
- Molly Grace: 3

Most of the observations were dolphins located in the port river and observed while dredging inside the breakwaters and in the turning basin. In addition, two whale sightings were made on the 17th of June

No incidents with marine mammals occurred.

For full details of the marine mammal sightings, reference is made to Attachment 5.2.

6. WEEKLY SITE INSPECTIONS

In this period three weekly site inspections were undertaken. For full details of the weekly site inspections reference is made to Attachment 5.2.

No corrective actions were required.

7. NON-CONFORMANCES

In this period an environmental audit was undertaken by Client's Environmental Representative (BMT) on the 17th of June. The EPA visited the TSHD *Gateway* on the 19th of June. In addition, Flinders Ports Health, Safety & Environment Manager undertook a site safety audit on the 20th of June. All inspections were positive and no observation was made.

8. REMOVAL OF CAULERPA TAXIFOLIA

On the 12th of June during trip 15 areas with medium to high density *Caulerpa Taxifolia,* as identified in the baseline survey [10], were removed by the TSHD *Gateway* without overflow as indicated in Figure 8.1 to Figure 8.5.

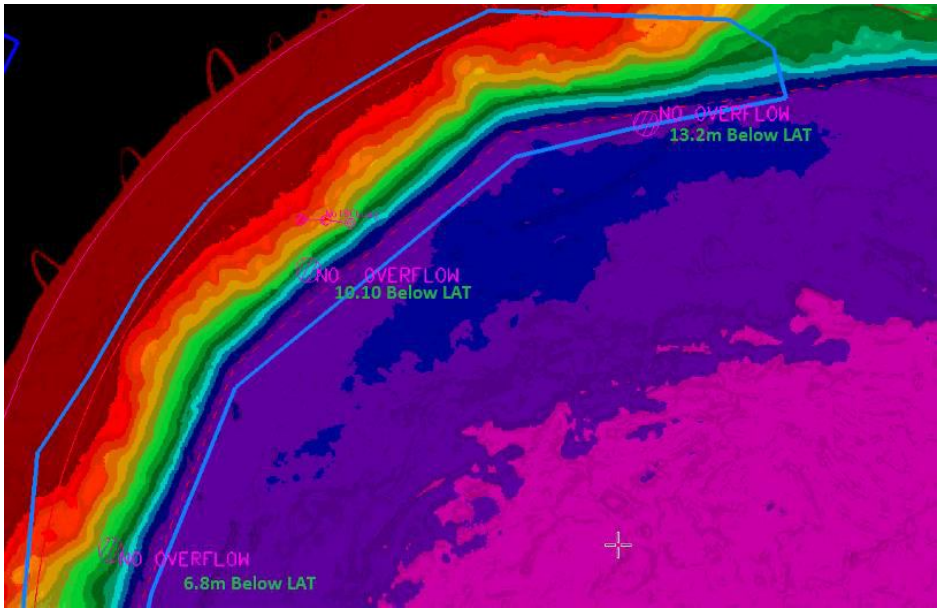


Figure 8.1: Areas identified with Caulerpa Taxifolia (circles marked with 'no overflow')

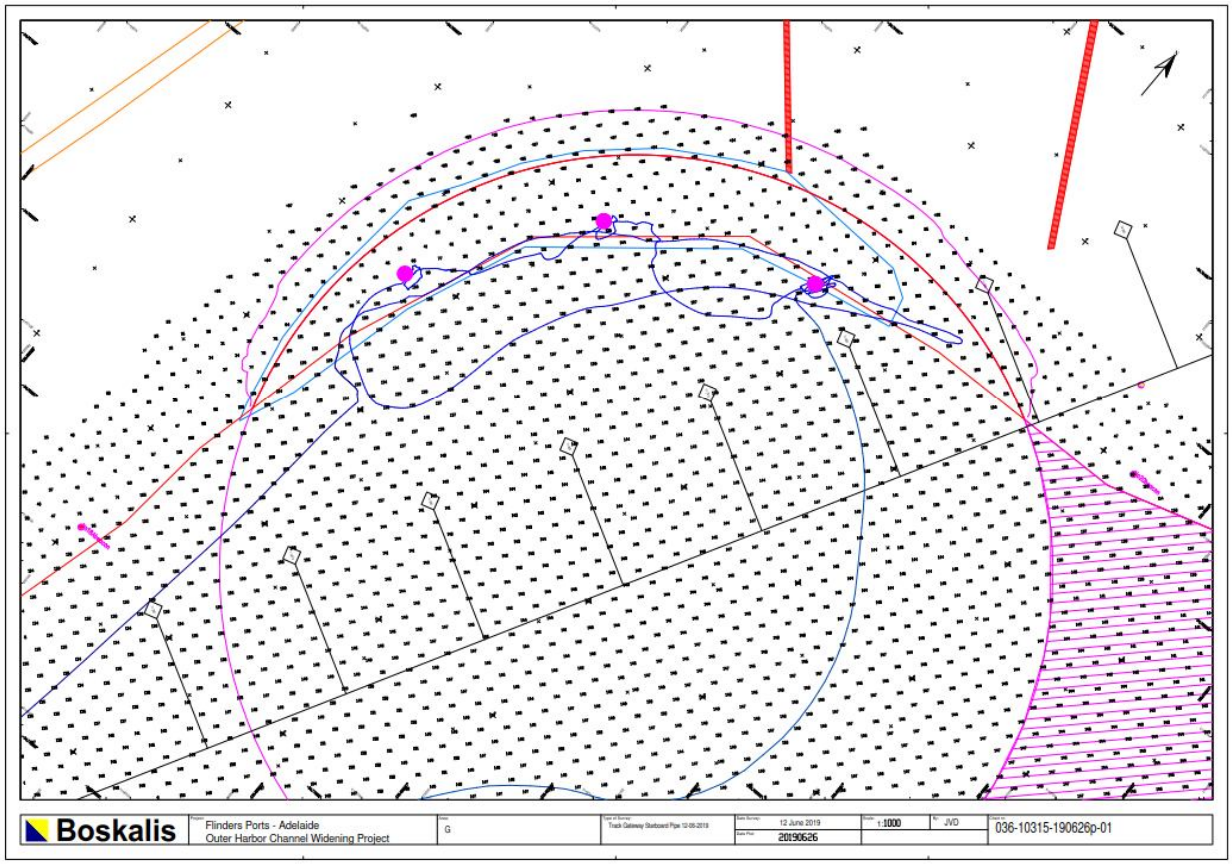


Figure 8.2: Track plot trip number 15, removal of Caulerpa Taxifolia

Figure 8.3: TSHD Gateway dredging in turning basin, removing Caulerpa Taxifolia

Figure 8.4: TSHD Gateway sailing away from the turning basin to the DMPA after dredging until overflow

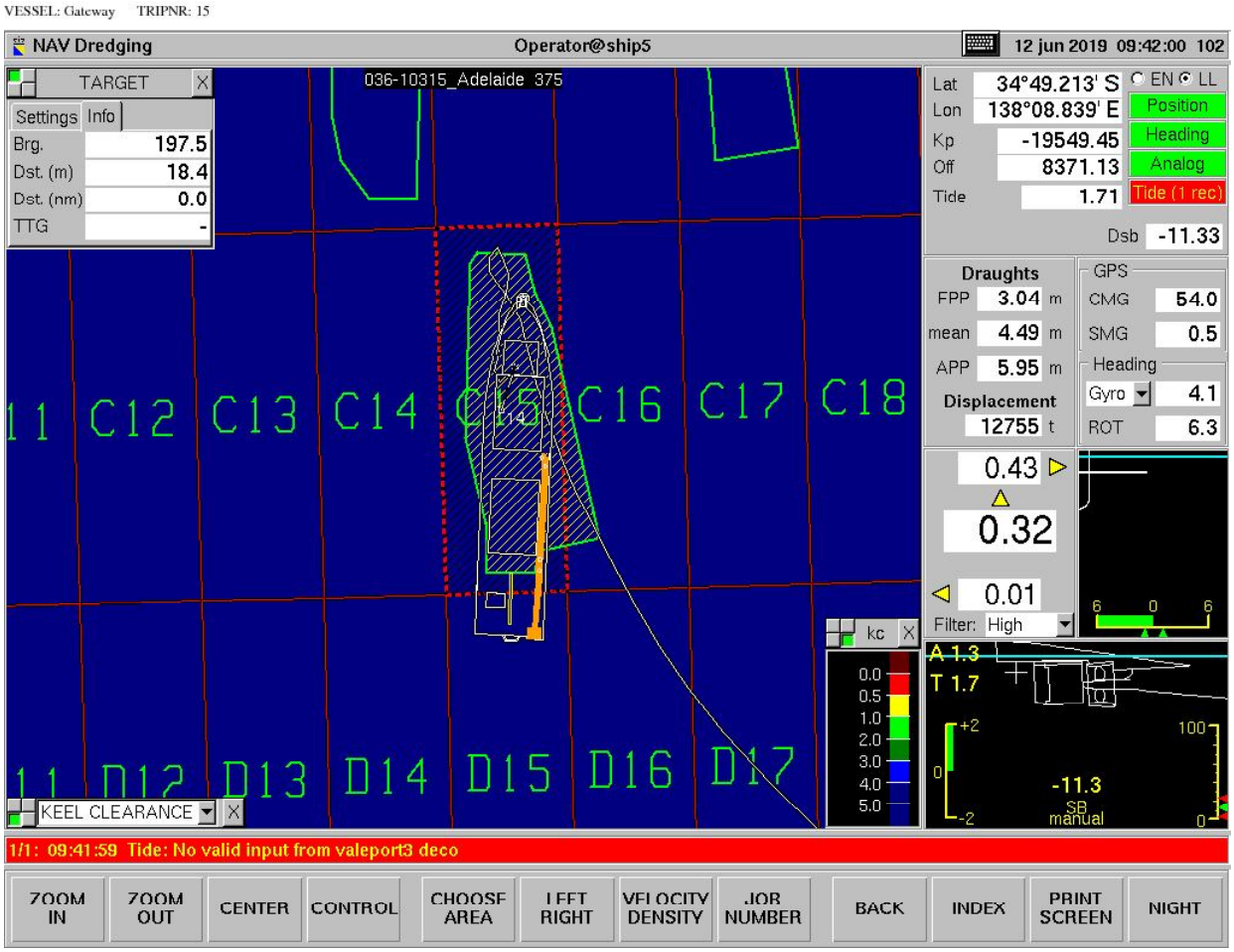


Figure 8.5: Deposition box in which the dredge material with Caulerpa Taxifolia was placed

4. REFERENCES, ABBREVIATIONS, DEFINITIONS

4.1. References

Controlled Legislation		
No.	**Document No.**	**Document Title**
[1]		Licence No. 50556 Flinders Ports Pty Limited issued 12 March 2019
[2]		Development Approval Outer Harbor Channel and Swing Basin Widening

Client Documents		
No.	**Document No.**	**Document Title**
[3]	R.B22346.010.02	Adelaide Outer Harbor Channel Widening Project: Environmental Monitoring Program
[4]	R.B22346.008.03	Adelaide Outer Harbor Channel Widening Project: Seagrass Monitoring Program
[5]		Outer Harbor Channel Widening Project Community Engagement Plan
[6]	R.B22346.009.00	Adelaide Outer Harbor Channel Widening Project: POMS Management Plan
[7]	253257-00	Closure Plan
[8]	ADD-01	Outer Harbor Channel Widening Project Addendum 1: DMP/EMP
[9]	R.B22346.012.01	Adelaide Outer Harbor Channel Widening Project: Baseline Seagrass Survey
[10]	L.B22346.017	Caulerpa Taxifolia Survey
[11]		Water Quality Monitoring and Validation Report June 2019 (BMT)

Contractor Documents		
No.	**Document No.**	**Document Title**
[12]	036-10315-02-003	Dredge Management Plan
[13]	50556_036-10315-02-013	Addendum to DMP 036-10315-02-003 No. 2
[14]	036-10315-02-001	Work, Health and Safety Management Plan
[15]	036-10315-14-004	TSS-NTU Method Statement
[16]	036-10315-01-003	TSS-NTU Report

Other Documents		
No.	**Document No.**	**Document Title**

4.2. Abbreviations

Abbreviation	Full meaning
ADS	Adelaide Dolphin Sanctuary
DMP	Dredge Management Plan
DMPA	Dredge Material Placement Area
EMP	Environmental Monitoring Program
EPA	Environment Protection Agency
FP	Flinders Ports Pty Ltd (Client)
MMO	Marine Mammal Observation
NTU	Nephelometric Turbidity Units
Rev	Revision
TSHD	Trailing Suction Hopper Dredge
TSS	Total Suspended Solids

4.3. Definitions

Definition	Full meaning
Client	Flinders Ports Pty Ltd
Client's Engineering Consultant	Arup
Client's Environmental Representative	BMT
Contractor	Boskalis Australia Pty. Ltd.
Project	Port Adelaide Outer Harbor Channel Widening
Project number	036-10315
Subcontractor	Companies contracted by Contractor to perform a specific portion of the work.

5. ATTACHMENTS

5.1. Specifications hand-held turbidity sensor

ProDSS Features

"For spot sampling and profiling this is an excellent multiparameter instrument. The size and functionality knocks it out of the park…**now I see the ProDSS as the standard for spot sampling.**"

ProDSS User

ProDSS Sensor Specifications

Sensor/Parameter	Range	Resolution	Accuracy
Temperature	-5 to 70 °C (temperature compensation range for DO mg/L measurement: -5 to 50 °C)	0.1 °C or 0.1 °F (user selectable)	±0.2 °C
pH	0 to 14 pH units	0.01 pH units	±0.2 pH units
ORP	-1999 to 1999 mV	0.1 mV	±20 mV
Dissolved Oxygen	0 to 500%, 0 to 50 mg/L	0.01 mg/L and 0.1%, or 0.1 mg/L and 1% (user selectable)	0 to 200%: ±1% of reading or 1% saturation, whichever is greater 200 to 500%: ±8% of reading 0 to 20 mg/L: ±0.1 mg/L or 1% of reading, whichever is greater 20 to 50 mg/L: ±8% of reading
Barometer	375 to 825 mmHg	0.1 mmHg	±1.5 mmHg from 0 to 50 °C
Conductivity	0 to 200 mS/cm	0.001, 0.01 or 0.1 µS/cm (range dependent)	0 - 100 mS/cm: ±0.5% of reading or .001 mS/cm, whichever is greater 100 - 200 mS/cm: ±1.0% of reading
Specific Conductance*	0 to 200 mS/cm	0.001, 0.01, 0.1 mS/cm	0 - 100 mS/cm: ±0.5% of reading or .001 mS/cm, whichever is greater 100 - 200 mS/cm: ±1.0% of reading. User selectable reference temperature (15 to 25 °C; default 25 °C) and compensation coefficient (0 to 4%/°C; default 1.91%)
Salinity*	0 to 70 ppt	0.01 ppt	±1.0% of reading or ±0.1 ppt, whichever is greater
Total Dissolved Solids (TDS)*	0 to 100 g/L	0.001, 0.01, 0.1 g/L	Calculated from specific conductance and a user-selectable TDS multiplier (0.30 to 1.00; default 0.65)
Resistivity*	0 to 2 Mohms	0.001, 0.01, 0.1 ohms	±0.1% Full Scale
Seawater Density*	0.0 to 50.0 sigma, sigma T	0.1 sigma or sigma T	-
Turbidity	0 to 4000 FNU	0.1 FNU	0 to 999 FNU: 0.3 FNU or ±2% of reading, whichever is greater 1000 to 4000 FNU: ±5% of reading
TAL-Chlorophyll	0 to 100 RFU or 0 to 400 µg/L chl	0.01 RFU or 0.01 µg/L	Linearity: $r^2 \geq 0.999$ for Rhodamine WT across full range
TAL-Phycocyanin	0 to 100 RFU or 0 to 400 µg/L PC		
TAL-Phycoerythrin	0 to 100 RFU or 0 to 400 µg/L PE		
Ammonium**	0 to 200 mg/L NH_4-N	0.01 mg/L	±10% of reading or 2 mg/L, whichever is greater
Ammonia*	0 to 200 mg/L NH_3-N	0.01 mg/L	-
Chloride**	0 to 18000 mg/L Cl	0.01 mg/L	±15% of reading or 5 mg/L, whichever is greater
Nitrate**	0 to 200 mg/L NO_3-N	0.01 mg/L	±10% of reading or 2 mg/L, whichever is greater
Depth	0 to 328 feet (0 to 100 m)	0.001 m or 0.01 ft	±0.004 m for 1, 4, and 10 m cables ±0.04 m for cables 20 m and longer

*Derived/calculated parameter
**ISEs for freshwater only; 20-meter maximum depth

5.2. Marine Mammal Observation Logsheets

5.2.1. Gateway

Date - Time	Position/dredge section of vessel at time of sight	Direction of animal(s) compared to vessel [N-E-S-W]	Distance of animal(s) from vessel (m)	Direction of travel of animals [N-E-S-W]	No. and type of animal (whale, dolphin, turtle)	Observer (name, position)	Action taken (e.g. evasive moment, speed reduction)
7/06/2019	Sailing to spoil ground	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
8/6/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
9/6/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
10/6/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
11/6/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
12/6/2019 12:46	Breakwater	SW	50m	E	2 Dolphins	B. Francey	Vessel already at slow speed, Dolphins crossed clear ahead.
13/6/2019	Turning Basin - Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
14/6/2019 16:51	Swing Basin	W	100m	Various, feeding and diving	2 Dolphins	Ben Francey	No action, dredging at slow speed
15/6/2019 17:03	Beacon 18A	Various	50m	Various	3 Dolphins	Ben Francey	Stopped
16/6/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
17/6/2019 11:00	Beacon 8	W	500m	At first West then North	2 Whales Southern right	P .van der Heden	Nil
18/6/2019	Breakwater	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
19/6/2019 09:30	Breakwater	NE	200m	N	3 Dolphins	M. van der Sar	Dredging at slow speed, keep watch

20/6/2019	Steaming	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
21/6/2019 10:30	End of Northern Breakwater	N	100m	NE	3 Bottle Nosed Dolphins	M. van der Sar	None, seen as we passed slowly.
21/6/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
23/6/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
24/6/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
25/6/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
26/6/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
27/6/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
28/6/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
29/6/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil
30/6/2019	Outer Channel	Nil Sightings	N/A	N/A	0	M. Pointon	Nil

5.2.2. Molly Grace

Date - Time	Position/dredge section of vessel at time of sight	Direction of animal(s) compared to vessel [N-E-S-W]	Distance of animal(s) from vessel (m)	Direction of travel of animals [N-E-S-W]	No. and type of animal (whale, dolphin, turtle)	Observer (name, position)	Action taken (e.g. evasive moment, speed reduction)
15/6/2019	Area F	Nil sightings	N/A	N/A	0	Lee Mckeown	None required
16/6/2019 10:10	Area G (turning basin)	SE	20m	SW	2 dolphins	Lee Mckeown	Vessel drifting – slow speed
17/6/2019	Area G (turning basin)	Nil sightings	N/A	N/A	0	Lee Mckeown	None required
18/6/2019	Area G (turning basin)	S	100m	SW	1 dolphin	Lee Mckeown	Vessel sweeping at slow speed
19/6/2019	Area G (turning basin)	Nil sightings	N/A	N/A	0	Lee Mckeown	None required

5.3. Weekly Site Inspections

Boskalis

LOCATION: Adelaide office
DATE: 14 / 06 / 19 Time: 10:00

ENVIRONMENTAL INSPECTION

☑ = Complies ☒ = Does Not Comply N/A = Not Assessed

No.	ITEM	COMPLIANCE ACHIEVED ✓	✗	N/A	COMMENTS
1	Actions taken in case of ALARM or HOLD turbidity criteria exceedance	✓			Actions taken for ALARM exceed.
2	MMO observation carried out on dredge vessels	✓			
3	MMO sightings recorded on logsheets daily	✓			
4	Actions taken in case of marine mammals observed in caution zones (300m for whale, 150m for dolphin, pause/delay BHD in case of dolphin sighting within 50m)	✓			NA.
5	Adherence to exclusion zones of 10km around commercial oyster growing areas	✓			
6	Record and resolve any complaints received	✓			NA
7	Dredging conducted in footprint of dredge area and disposal within boundaries of the DMPA in a uniform matter	✓			
8	Solid and hydrocarbon wastes disposed onshore at approved facilities	✓			
9	Spill kits in place in direct vicinity of areas where liquid wastes are stored	✓			
10	Segregation of solid waste for recycling	✓			
11	Waste bins are labelled to designate their waste stream	✓			
12	Refuelling occurs in designated areas and spill prevention measures are in place	✓			
13	No spill incidents	✓			
14	Maintenance or changes to management measures required?			9	

Required Action by Who and by When:

Inspection Team:

Name:	Signature:	Name:	Signature:
Name: Irena Otcis	Signature:	Name:	Signature:
Name: Gary Beer	Signature:	Name:	Signature:

Boskalis

LOCATION: Adelaide
DATE: 22 / 06 / 19 Time: 13:35

ENVIRONMENTAL INSPECTION

☑ = Complies ☒ = Does Not Comply N/A = Not Assessed

No.	ITEM	COMPLIANCE ACHIEVED ✓	✗	N/A	COMMENTS
1	Actions taken in case of ALARM or HOLD turbidity criteria exceedance	X			Dising, area C dropping. Inside during strong southerly winds.
2	MMO observation carried out on dredge vessels	X			2 whales spotted 19-06
3	MMO sightings recorded on logsheets daily	X			
4	Actions taken in case of marine mammals observed in caution zones (300m for whale, 150m for dolphin, pause/delay BHD in case of dolphin sighting within 50m)	X			
5	Adherence to exclusion zones of 10km around commercial oyster growing areas	X			
6	Record and resolve any complaints received			X	
7	Dredging conducted in footprint of dredge area and disposal within boundaries of the DMPA in a uniform matter	X			
8	Solid and hydrocarbon wastes disposed onshore at approved facilities	X			new hydrocarbon bin on Gateway
9	Spill kits in place in direct vicinity of areas where liquid wastes are stored	X			
10	Segregation of solid waste for recycling	X			
11	Waste bins are labelled to designate their waste stream	X			
12	Refuelling occurs in designated areas and spill prevention measures are in place	X			bunkering Gateway 20/21 June
13	No spill incidents	X			
14	Maintenance or changes to management measures required?			X	

Required Action by Who and by When:

Inspection Team:

Name:	Signature:	Name:	Signature:
Irena Dacts			
Name: T Bell	Signature:	Name:	Signature:

Boskalis
Dredging & Marine Experts

Boskalis

LOCATION: Adelaide site office
DATE: 29 / 06 / 2019 Time: 11:30

ENVIRONMENTAL INSPECTION

☑ = Complies ☒ = Does Not Comply N/A = Not Assessed

No.	ITEM	COMPLIANCE ACHIEVED			COMMENTS
		✓	✗	N/A	
1	Actions taken in case of ALARM or HOLD turbidity criteria exceedance	✓			rising tide Area D, falling tide A – C
2	MMO observation carried out on dredge vessels	✓			
3	MMO sightings recorded on logsheets daily	✓			
4	Actions taken in case of marine mammals observed in caution zones (300m for whale, 150m for dolphin, pause/delay BHD in case of dolphin sighting within 50m)	✓			
5	Adherence to exclusion zones of 10km around commercial oyster growing areas	✓			
6	Record and resolve any complaints received			✓	none received.
7	Dredging conducted in footprint of dredge area and disposal within boundaries of the DMPA in a uniform matter	✓			
8	Solid and hydrocarbon wastes disposed onshore at approved facilities	✓			
9	Spill kits in place in direct vicinity of areas where liquid wastes are stored	✓			
10	Segregation of solid waste for recycling	✓			
11	Waste bins are labelled to designate their waste stream	✓			
12	Refuelling occurs in designated areas and spill prevention measures are in place	✓			Bunker inspection Union Topaz
13	No spill incidents	✓			
14	Maintenance or changes to management measures required?	✓			Addendum 2 - DMP approved

Required Action by Who and by When:

Inspection Team:

Name: Irma Doets	Signature: [signature]	Name:	Signature:
Name: Garry Beel	Signature: [signature]	Name:	Signature:

Adelaide Outer Harbor Channel Widening Project: June Water Quality Monitoring and Validation Report

Reference: R.B22346.014.01.WQMPV Report
Date: July 2019
Confidential

Document Control Sheet

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Author:	Lisa McKinnon, BMT
Client:	Flinders Ports
Client Contact:	Lee Kolokas
Client Reference:	
Synopsis:	

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1 Introduction

Flinders Ports Pty Ltd (Flinders Ports) is currently conducting dredging to widen the Adelaide Outer Harbor Channel (Outer Harbour Channel Widening Project – OHCW). A detailed Development Application (DA) Report was submitted in July 2017 in accordance with the *Development Act 1993*, as a Section 49 application given this project is defined as *public infrastructure*. Sponsorship for this application was received from the Minister for Transport and Infrastructure prior to lodgement in May 2017. Flinders Ports DA 010/V048/17 received approval on 28th May 2018.

Subsequently, a dredge licence was issued by the Environmental Protection Authority (EPA) in 2019, and an Environmental Monitoring Program (EMP) prepared which outlined water quality monitoring to be undertaken for the duration of the dredge campaign.

Condition 3.4.2 (f) requires a water quality monitoring report to be provided to the EPA on the 7th of each month, that includes Schedule 1 parameters, and all calculations, assessments and calibration required under this condition. Condition 3.5.2 (a) also requires that a monthly zone validation report is provided.

This document reports on compliance with the Water Quality Monitoring Plan and the Zone Validation Plan.

Dredging commenced on the 7th June 2019 and works for the month have been undertaken solely by the Trailer Suction Hopper Dredge (TSHD) Gateway; the Backhoe Dredge (BHD) Magnor did not undertake any work during the month of June. The sweeper vessel Molly Grace also operated between the 15th and 19th June. In total, 433,500m^3 of material was removed during the period of the 7th to 30th June. This report therefore reports on water quality from the 7th to 30th June.

1.1 Project Location

Figure 1-1 below provides an overview of the area to be dredged within the Port and the approved Dredge Material Placement Area (DMPA).

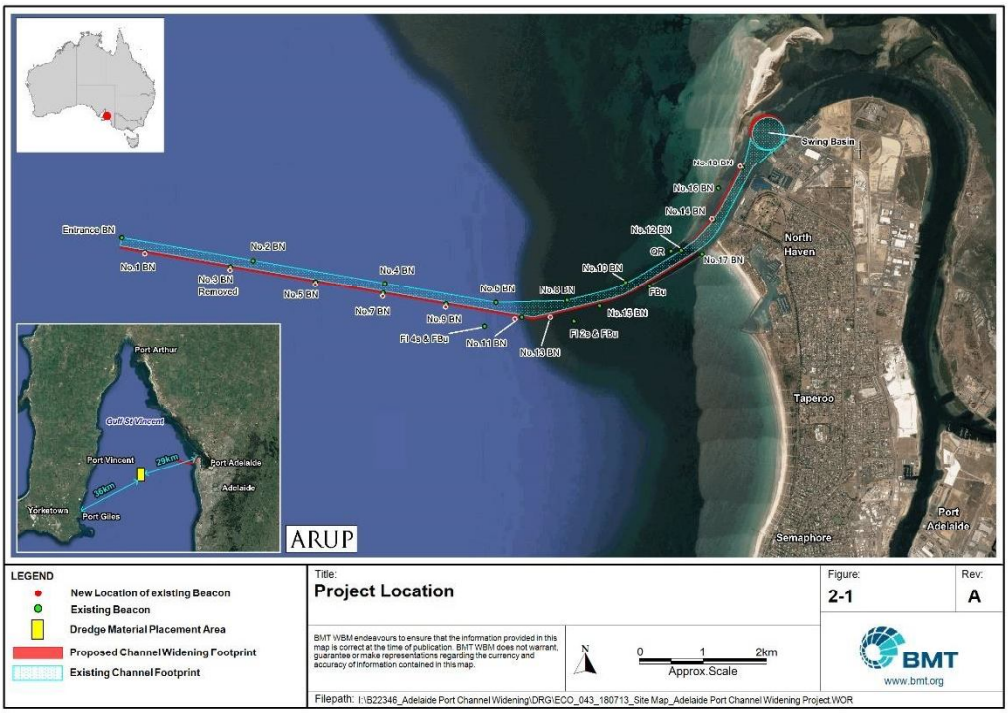


Figure 1-1 OHCW Project Location

2 Purpose, Scope and Objectives

The purpose of this report is to demonstrate compliance with the water quality criteria set for the project and validate plume impact predictions made in water quality modelling.

The objectives of this report are:

- To report on water quality parameters outlined in Schedule 1 of the dredge licence;
- To report any exceedance of either ALARM or HOLD turbidity triggers;
- To outline any actions taken to reduce turbidity in response to trigger exceedances; and
- To provide data validating modelling predictions.

3 Background

This section provides a summary of how the zones of impact and water quality triggers used for the project were derived, to enable comparison and validation of the modelling performed.

3.1 Water Quality Risk Assessment

3.1.1 Methodology

A water quality risk assessment methodology was applied to the project, using the outputs from the predictive dredge plume numerical model. The zones adopted for the water quality risk assessment, include the following:

- Zone of High Impact = water quality impacts resulting in predicted mortality of ecological receptors with recovery time greater than 24 months.
- Zone of Low to Moderate Impact = water quality impacts resulting in predicted sub-lethal impacts to ecological receptors and/or mortality with recovery between 6 months (lower end of range) to 24 months (upper end of range).
- Zone of Influence = extent of detectable[1] plume, but no predicted ecological impacts.

The adopted turbidity thresholds for this project are provided in Table 3-1.

Table 3-1 Impact thresholds for above ambient turbidity

Impact Zone	Turbidity (NTU) thresholds above background[2]			
Zone of High Impact	3	5	15	-
Zone of Low to Moderate Impact	1	2	5	-
Zone of Influence	-	0.5	2	5

The turbidity impact map for the selected case winter scenario is shown in Figure 3-1; the impact map includes the seagrass extent as surveyed in May 2019.

[1] 'Detectable' plume in terms of detectable above background conditions by instrumentation deployed in the water column
[2] Background is defined as turbidity measures in real-time during dredging at the background buoy (B1). Background measurements will be collected and report to provide an indication of whether turbidity is a result of dredging, or reflective of naturally occurring weather events.

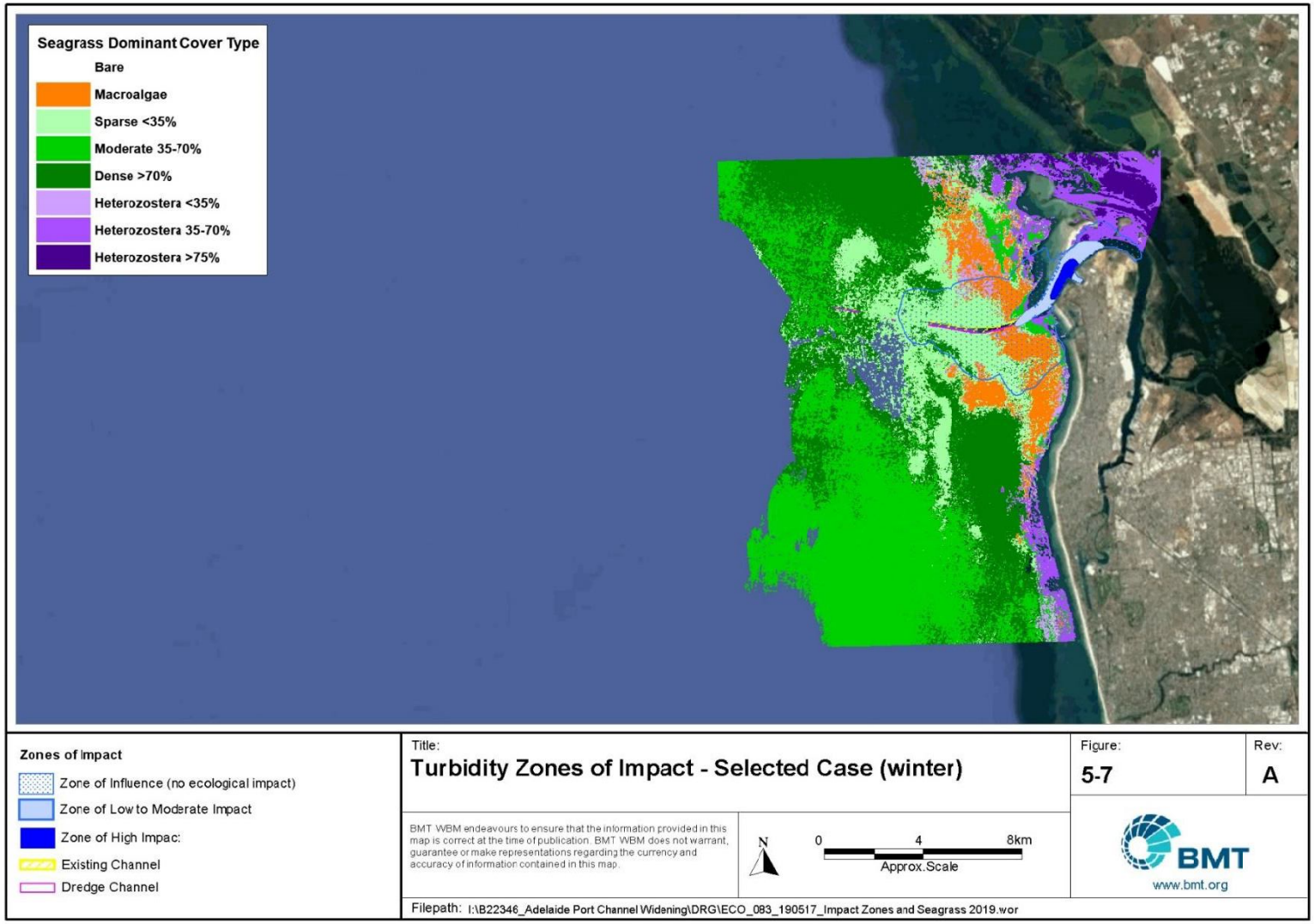


Figure 3-1 Turbidity Zones of Impact

3.2 Water Quality Limits

3.2.1 Data Collection

Water quality monitoring is being undertaken at three (3) sites to collect water quality data as follows:

- Two 'dredge plume monitoring' sites – one site located to the north of the channel (D1) and one site to the south of the channel (D2). These sites are located near to seagrass meadows and within the predicted zone of influence as indicated by dredge plume modelling.
- One 'background' site - located approximately 5.5 km from the channel dredging area and representing background conditions.

The monitoring sites are shown in Figure 3-2. All three sites are located in a water depth of approximately -8 m LAT.

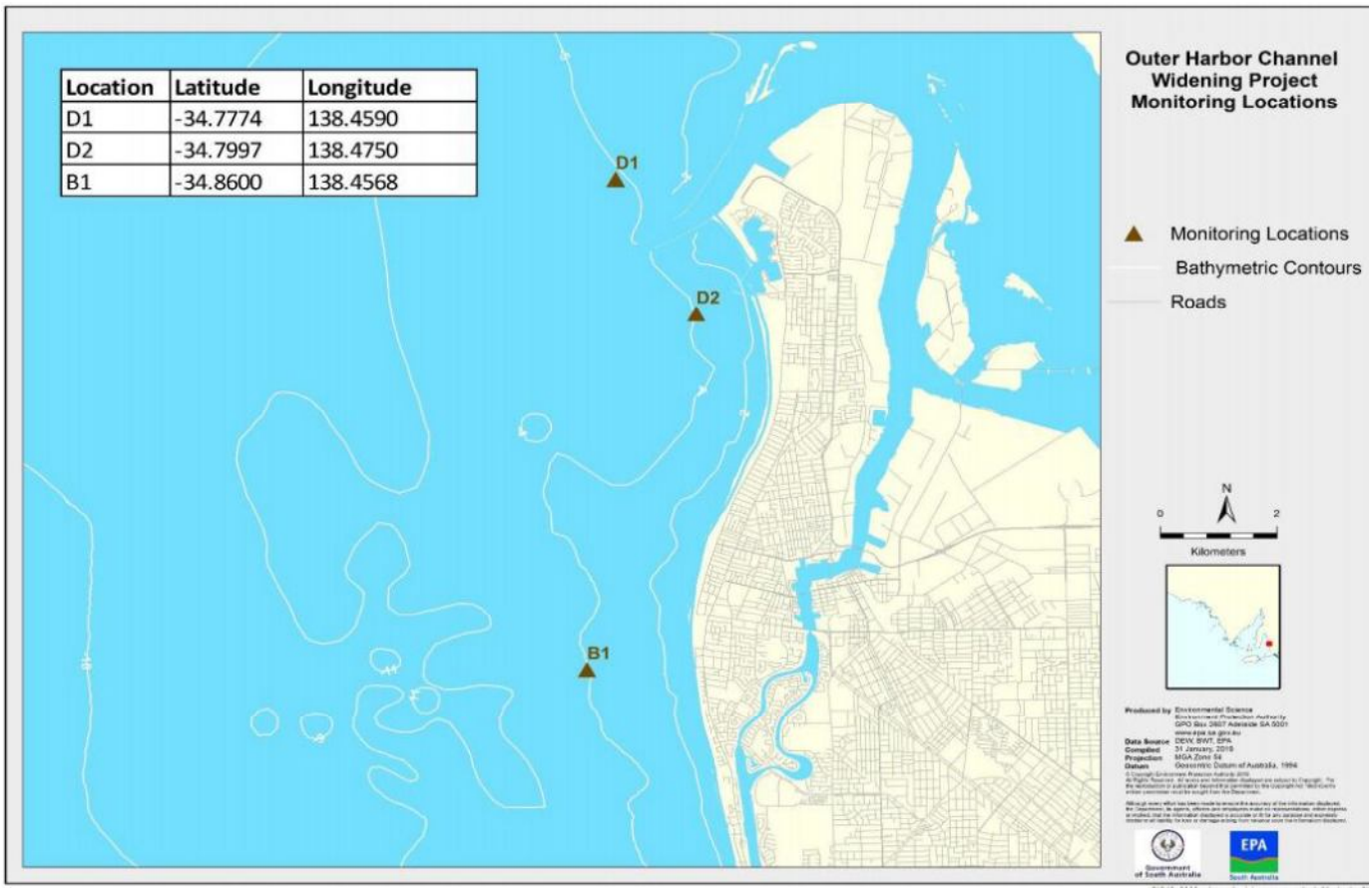


Figure 3-2 Water quality monitoring locations

The following parameters are being continuously measured (i.e. data logged every 10 minutes) during baseline and dredging phases:

- Turbidity - as measured by optical scatter via a nephelometer giving readings in Nephelometric Turbidity Units (NTU). Turbidity provides a proxy for suspended sediments within the water column.

- Photosynthetically Active Radiation (PAR) – benthic PAR measured on the seafloor to represent that part of the light spectrum that is available to benthic photosynthetic organisms (e.g. seagrass) to utilise.
- Dissolved oxygen, pH, salinity and temperature – water quality instruments at each site are fitted with sensors to measure these additional parameters.

To supplement the continuously logged data, and to give independent measures of turbidity, water samples were collected at the three monitoring sites during a servicing trip on the 25th June for the following parameters:

- Total suspended solids;
- Turbidity; and
- Chlorophyll-a.

Water samples were sent to a NATA accredited laboratory to be analysed; they are not yet available but will be forwarded separately when received.

3.2.2 Turbidity Limits

Table 3-2 documents the turbidity limits that were set in Schedule 2 of the dredge licence; these were derived from the impact thresholds (Refer to Table 3-1) plus an additional allowance for average background turbidity of 0.8 NTU (determined from water quality monitoring in place for 11 months prior to dredging commencement).

Table 3-2 Turbidity Limits for the project set by the Dredge Licence

Level	Criteria
ALARM	2.8 NTU on a 15 day rolling median; or 5.8 NTU on a 6 day rolling median
HOLD	5.8 NTU on a 15 day rolling median; or 15.8 NTU based on a 6 day rolling median

4 Water Quality Results

4.1 Turbidity

Figure 4-2 provides raw turbidity readings (NTU) at each of the three monitoring locations (B1, D1 and D2). Generally, turbidity was well below 10NTU, with occasional spikes, particularly at D2. The highest recorded turbidity reading was 22.4 NTU on the 29th June, which coincided with a high westerly wind event (speeds of 27 knots recorded at the buoy, and 40 knots as measured on the Gateway), which elevated turbidity at the other two locations as well.

The 15-day rolling median turbidity (chronic condition) is shown in Figure 4-3, with the range of medians provided in Table 4-1. Figure 4-4 shows the 6-day rolling median turbidity (acute condition) for the month of June.

The HOLD criteria was not exceeded in the month of June at either D1 or D2.

The ALARM criteria for the 15-day rolling median was exceeded twice at D2, between the periods of the 9th to 13th of June and the 17th to 26th of June. The first event was due to an earlier high wind event (between the 26th to 30th May) that increased turbidity at all locations. The second event is likely attributable to dredging, as D2 was elevated higher than 20% above background. It did coincide with a windy period however, which likely also contributed.

The ALARM criteria was also exceeded at D1 on the 10th June for a short period; similar to above, this was attributed to a high wind event that occurred in late May, just prior to dredging.

The *Monthly Environment Report – June 2019* (Boskalis, 2019) reports the corrective measures undertaken by the dredge vessel upon exceedance. This include:

- Moving the TSHD Gateway from mid-channel to outer channel, inner channel or swing basin areas, away from the monitoring locations to allow turbidity to dissipate in affected area.
- Altering the dredge sequence so that dredging coincided with a rising (flood) tide near Area D (near the channel bend) and a falling (ebb) tide near Areas B and C.

D2 is consistently recording higher turbidity reading than D1, likely due to predominant southerly currents at this time of year.

Background turbidity (B1) was higher towards the end of the month; this is believed to be due to high westerly wind conditions, rather than as a result of dredging. Background turbidity has since returned to baseline conditions.

Table 4-1 Rolling Medians

Location	Lowest Value	Highest Value
15 Day Rolling Median		
B1	1.15	2.37
D1	1.18	2.89
D2	1.25	3.6
6 Day Rolling Median		
B1	0.97	3.68
D1	0.75	3.67
D2	2.20	4.25

4.2 Dissolved Oxygen

Dissolved Oxygen was steady throughout the month of June, ranging between 94 and 104% saturation as shown in Figure 4-1, which is within the default trigger value range for marine waters (ANZECC, 2000). There was no significant difference in DO between monitoring locations. Note that there were some signal failures in the data set below.

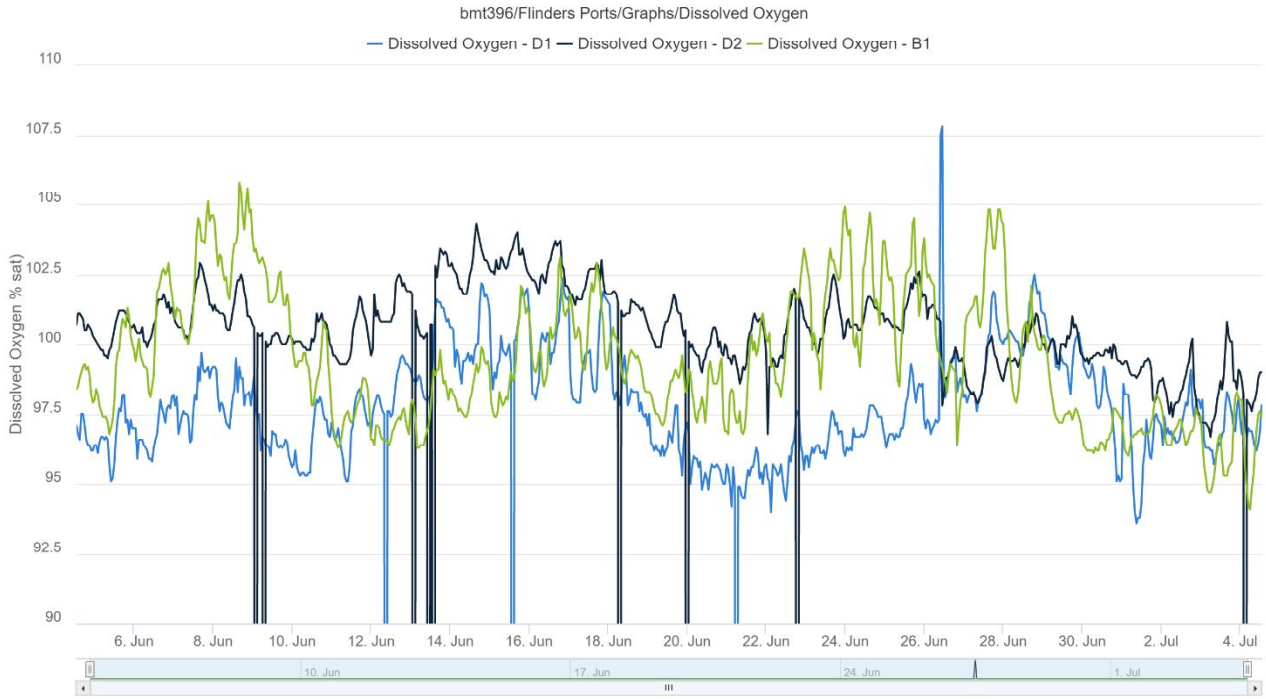


Figure 4-1 Dissolved Oxygen (% saturation) at B1, D1 and D2 – June 2019

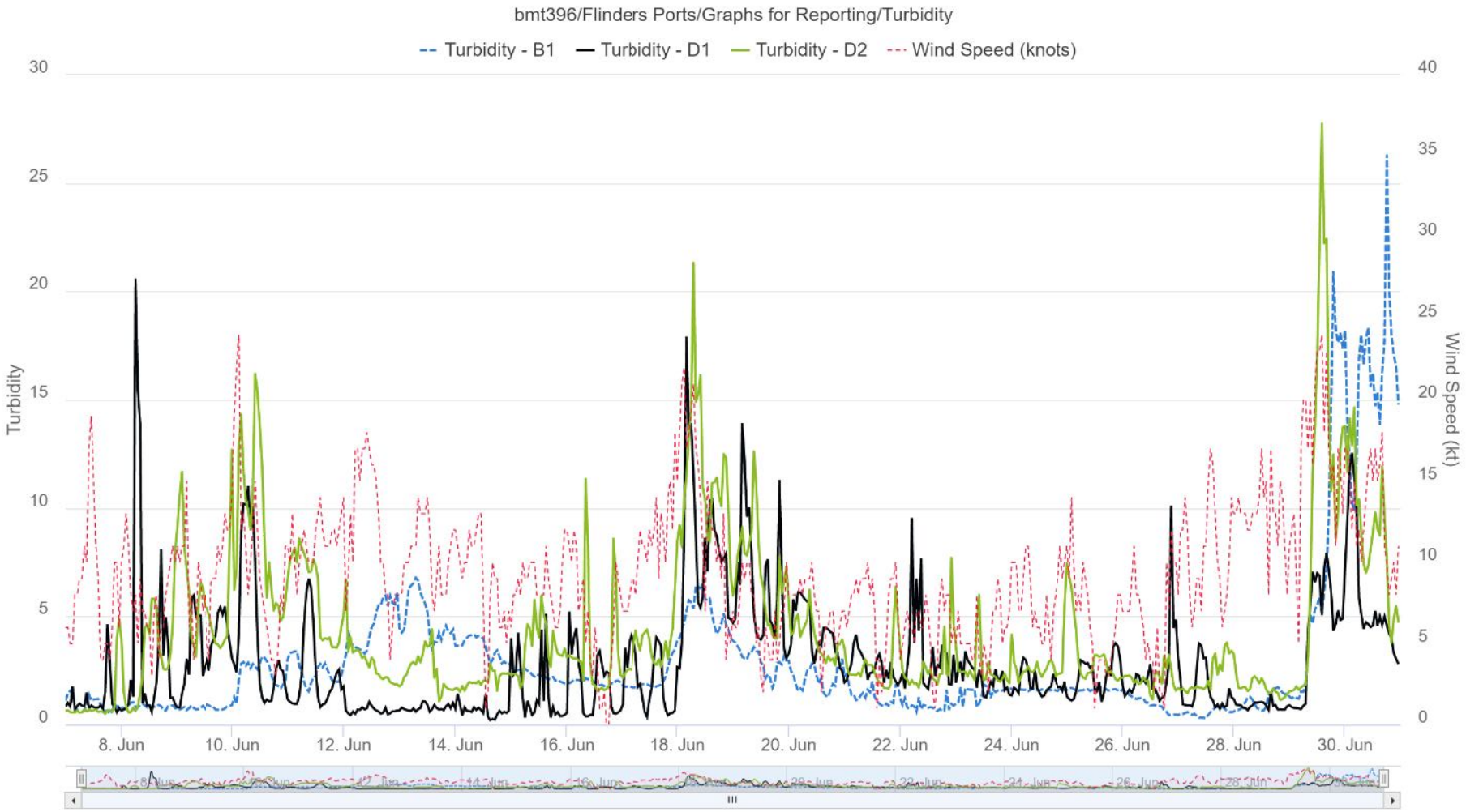


Figure 4-2 Raw turbidity data (NTU) for B1, D1 & D2 (7th June-30th June)

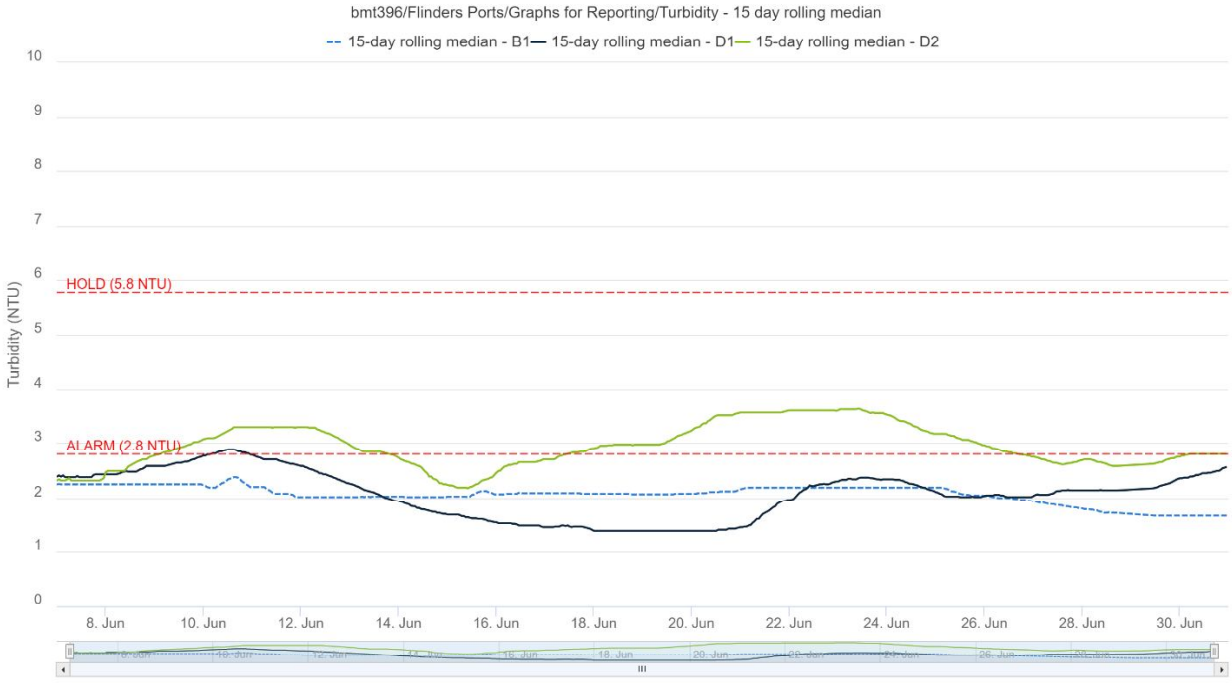


Figure 4-3 15 day rolling median QA' ed turbidity data (NTU) for B1, D1 and D2 – June 2019

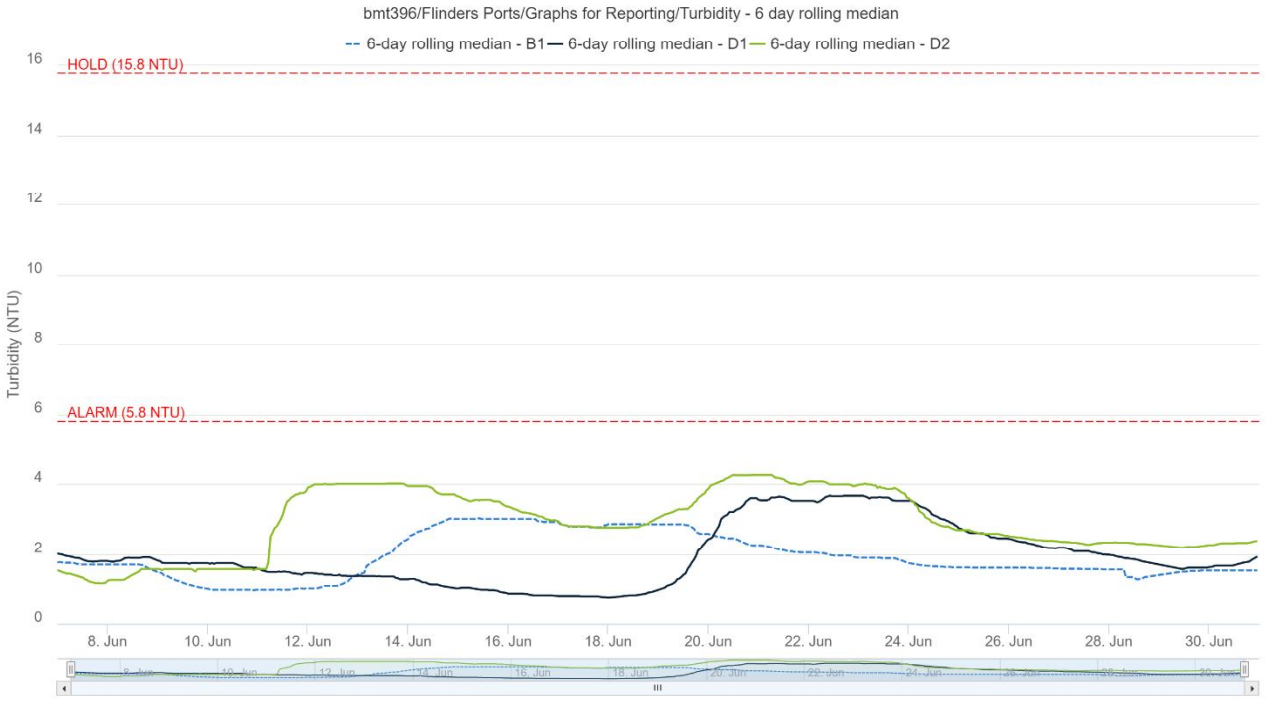


Figure 4-4 6 day rolling median QA'ed turbidity data (NTU) for B1, D1 and D2 – June 2019

4.3 pH

pH was quite uniform throughout the month of June, ranging between 8.2 and 8.4 as shown in Figure 4-5 which is within the default trigger value range for marine waters (ANZECC, 2000). There was no significant difference in pH between monitoring locations.

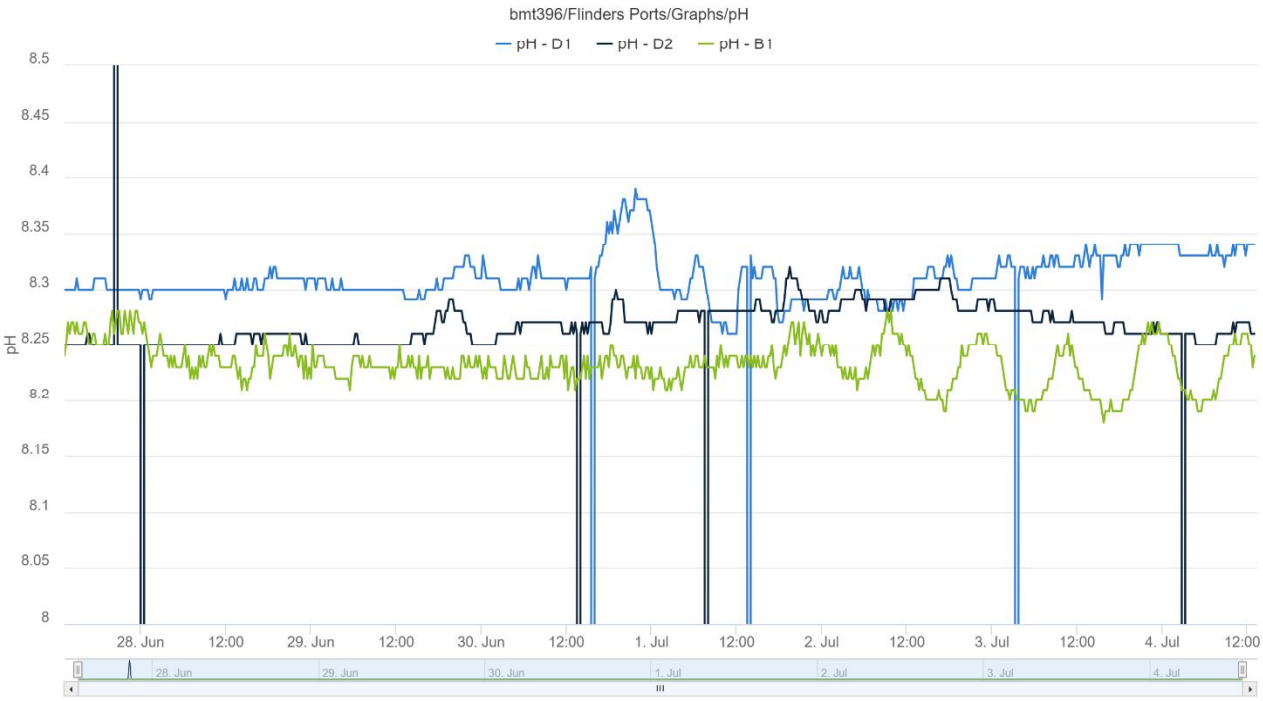


Figure 4-5 pH at B1, D1 and D2 – June 2019

4.4 Electrical Conductivity

Electrical Conductivity (EC) ranged between 56,000 and 57,500µS/cm, as shown in Figure 4-6.

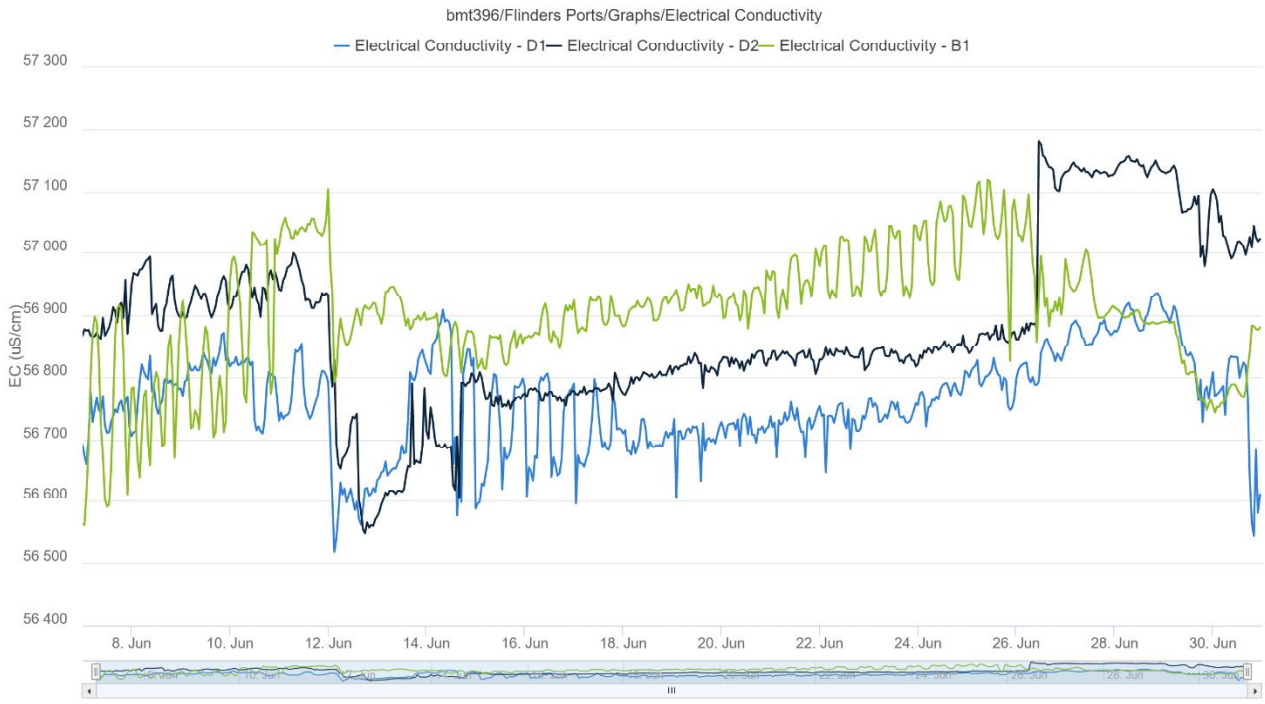


Figure 4-6 Electrical Conductivity (µs/cm) for B1, D1 and D2 – June 2019

4.5 Water Temperature

Water temperature has been steady, ranging from between 13.8ºC at the beginning of June, to 11.7ºC at the end of the month, as shown in Figure 4-7.

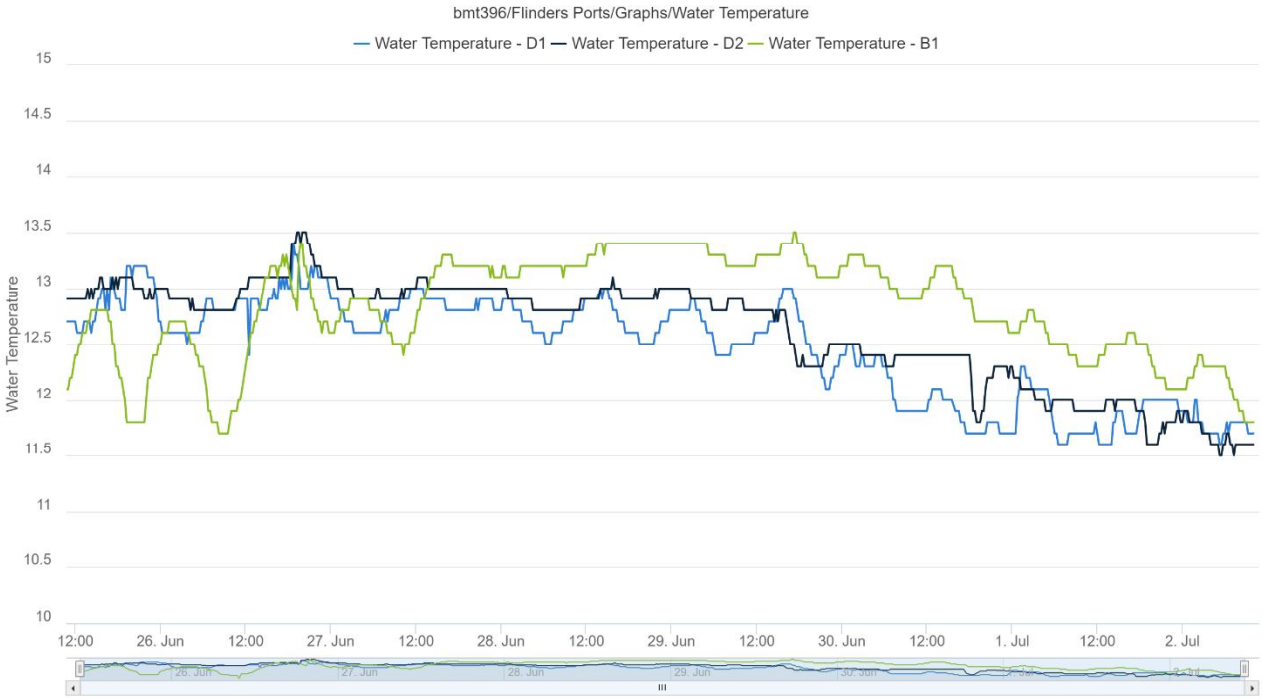


Figure 4-7 Temperature (ºC) for B1, D1 and D2 – June 2019

4.6 PAR

As one of the primary drivers of seagrass condition and resilience to disturbance, understanding the light available, and any loss of light for a prolonged period of time is important. Photosynthetically Available Radiation (PAR) is a way of measuring light available to seagrass. PAR is naturally lower in winter months when daylight hours are reduced. For seagrass loss to occur, light must be limited for a significant period, although the exact duration after which seagrass loss occurs is not well studied in South Australia. South Australian seagrasses would be naturally adapted to low light levels during the winter months.

Although a PAR target has not been set, BMT have been recording PAR data at the three monitoring stations. These have been converted to total daily PAR (mol/m^2/day) to enable a comparison of light availability. This data will be utilised when examining post-dredging seagrass survey results.

It can generally be observed that PAR is following weather patterns and reduces when surface radiation is lowest (i.e. when cloudy). On most days, PAR is highest at the background location and lowest at D2, which has been observed to be experiencing a higher average turbidity than D1 or B1.

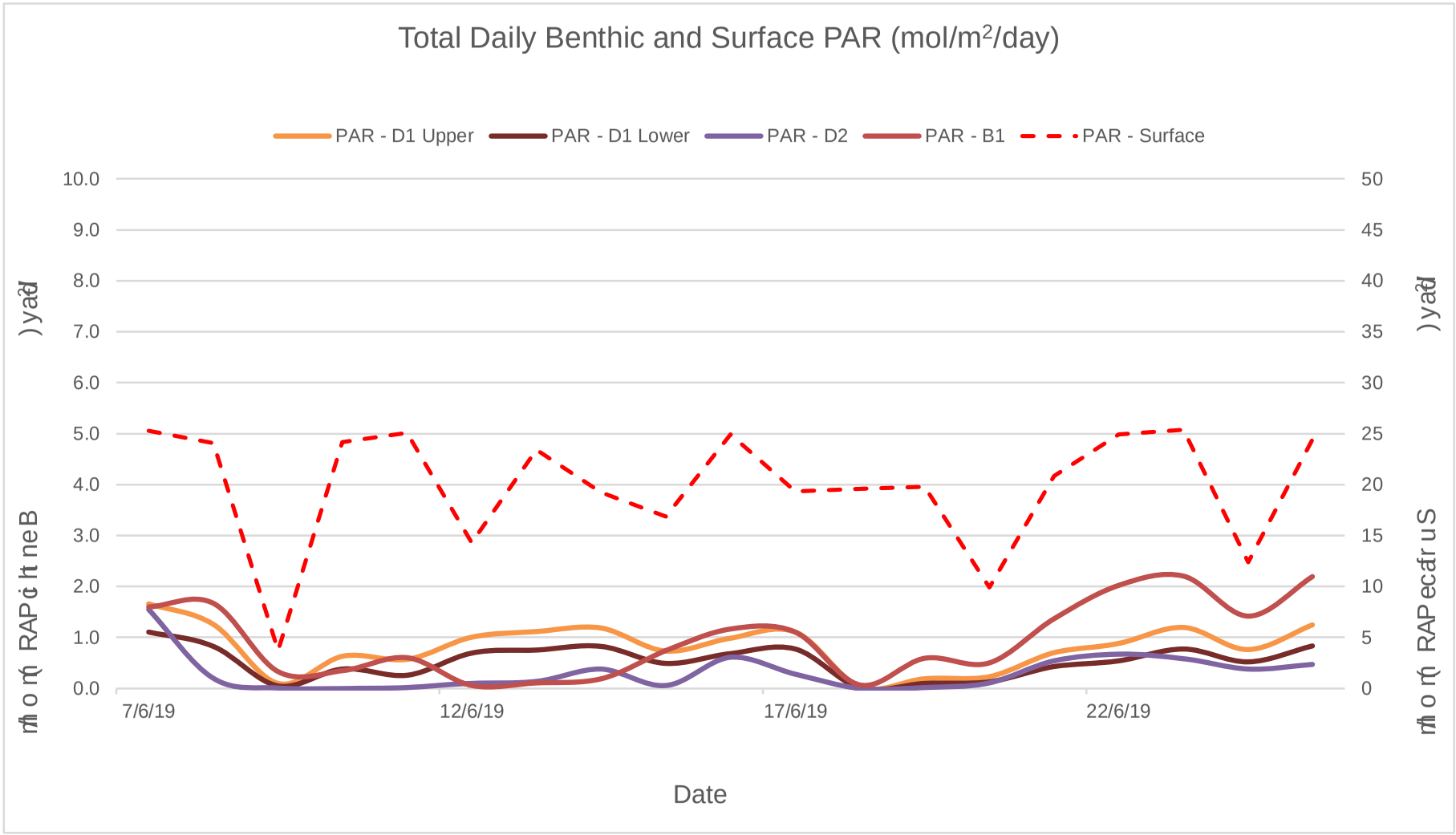


Figure 4-8 Total Daily PAR at B1, D1 and D2 (mol/m²/day) – June 2019

5 Plume Zone Validation

A dredge plume model validation review was undertaken using the satellite imagery collected as part of the dredge plume monitoring program. The review has considered satellite images collected between project commencement and the end of June 2019 (Table 5-1), utilising those images that contained the least cloud cover. Model predictions from the "selected dredging scenario" (M.B22346.012.01, December 2018) have been compared against the satellite images. The selected dredging scenario was based on advice provided by the contractor and was run for a seasonally representative period from April-July 2014. Snapshots of model predictions were selected for comparison based on roughly similar dredging operations (type and location of dredge), tidal conditions and wind conditions to those from the actual dredging campaign during June 2019. The satellite image turbidity (which includes background turbidity) and the model predictions (which only include dredging contributions, and don't include background) are compared in Figure 5-1. The dredge sequence modelled is also not always reflective of the dredge position at the time the satellite imagery was taken. There is generally reasonably good agreement between the satellite images and model predictions.

Algorithms used to determine NTU ranges from the satellite imagery are not as accurate in shallow coastal waters as it has difficulty differentiating between shallow water and turbidity. It is hypothesised that this is causing the derived NTU images to show high turbidity north of Bird Island and the coastline northwards when in fact this is not the case.

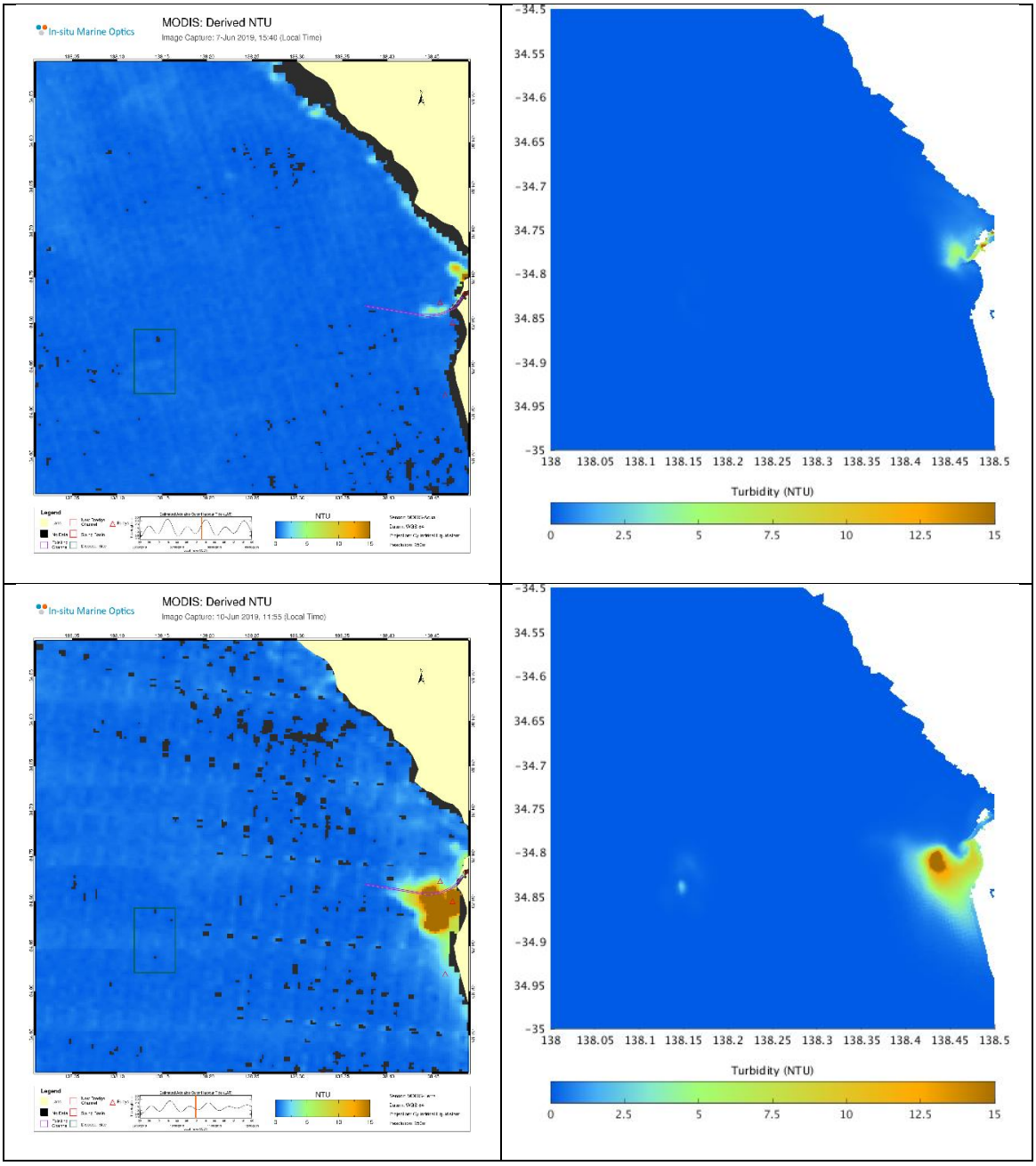
The model used a TSS:NTU ratio of 3:1. Correlation testing of the dredge plume was undertaken by Boskalis, with the ratio identified as being 2.16:1. This should also be taken into consideration when comparing modelled and actual NTU derived from satellite images or water quality instruments.

The satellite image did not record any elevated NTU at the Dredge Material Placement Area (DMPA).

Table 5-1 Satellite image times and monitoring buoy turbidity

Date	D1 turbidity [NTU]		D2 turbidity [NTU]		B1 turbidity [NTU]	
	Monitoring Equipment	Satellite Derived	Monitoring Equipment	Satellite Derived	Monitoring Equipment	Satellite Derived
7th June, 3:40pm	0.53	1-2	0.24	0-1	0.41	0-1
10th June, 11:55am	2.15	5-6	13.5	>15	1.89	1-2
16th June, 11:20am	0.35	0-1	1.53	4-5	1.2	1-2
21st June, 3:50pm	2.28	3-4	1.17	NR	0.95	0-1
25th June, 11:10am	2.04	2-3	2.44	4-5	0.81	0-1
28th June, 11:45am	1.04	1-2	1.95	1-2	0.66	0-1

Plume Zone Validation



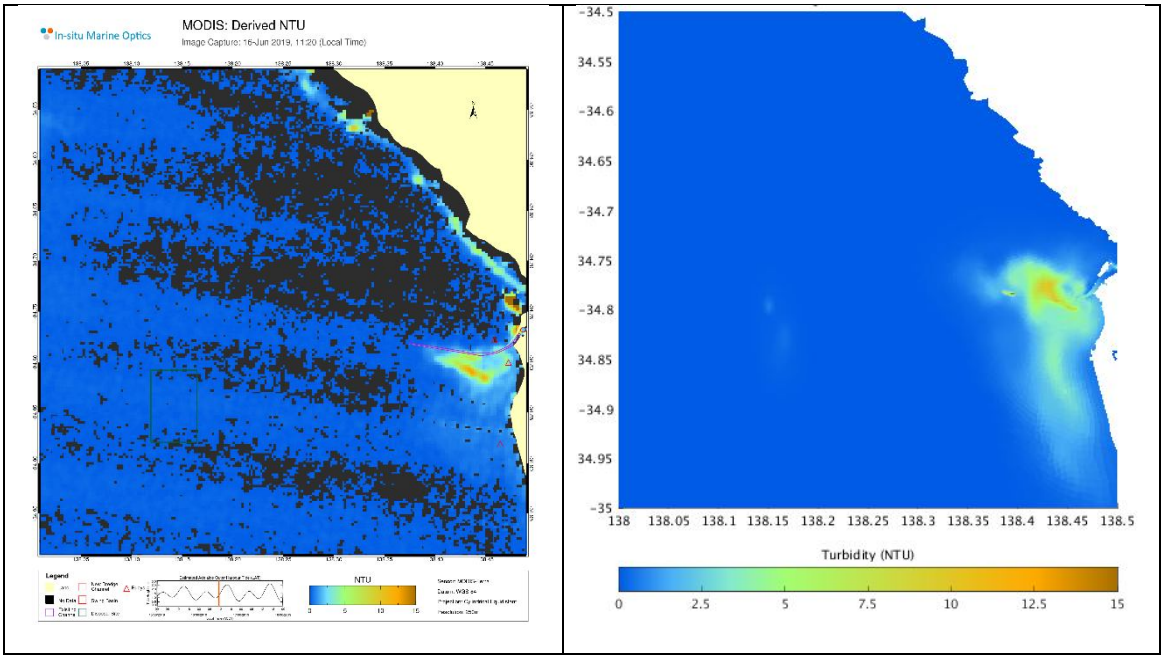


Figure 5-1 Comparison of June 2019 satellite image derived turbidity (including background) and model turbidity predictions (excluding background)

6 Conclusion and Summary

There were no exceedances of the turbidity HOLD criteria during the month of June, although the 15-day ALARM criteria were exceeded on a number of occasions at both D1 and D2. Where required, Boskalis undertook appropriate mitigation measures (e.g. changing dredge location or sequence) which resulted in turbidity reducing back below the ALARM criteria. Some of the exceedance can be attributed to adverse weather conditions, where strong onshore winds were experienced, although background turbidity data was usually more than 20% below the dredge monitoring station(s).

Other parameters recorded (i.e. pH, DO, temperature) were as expected for oceanic waters at this time of year.

The dredge plume extent and turbidity estimated by the satellite imagery was generally in accordance with that predicted by the dredge plume model for the comparable timeframes.

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Flinders Ports
Outer Harbor Channel Widening Project

Monthly Stakeholder Engagement Update - EPA reporting
June 2019

Web page visits
n/a - unavailable due to IT issue
(2,534 accumulative total)

Number of enquiries via website
0
(2 accumulative total)

Number of enquiries via hotline
25
(112 accumulative total)

Number of enquiries via email
3
(43 accumulative total)

Stakeholder meetings/briefings
4
(33 accumulative total)

Stakeholder database growth
16+
(190 accumulative total)

EDM - Dredging progress update (20 June 2019)

Number of people who received it
158

Open rate
51.9%

Milestone	Activities completed
Dredging commencement engagement activities	Website updated with current content, FAQs and monitoring data
	Further boat ramp signage installed
	Facebook posts informing the community of dredging commencement
	EDM sent to database with an update on dredging progress
	Upcoming activities
Community update on dredging progress	Community information session - progress summary sheet and various other material available. Promote through an EDM, Facebook and Messenger advertisements
	EDM with dredging progress update
	Noticeboard poster with project update at various community locations

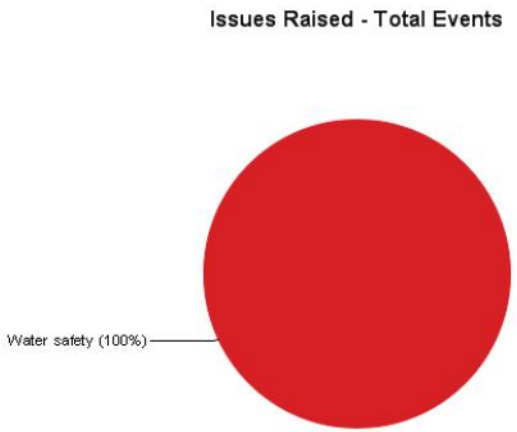
Complaints and engagement register summary

Outer Harbor Channel Widening Project

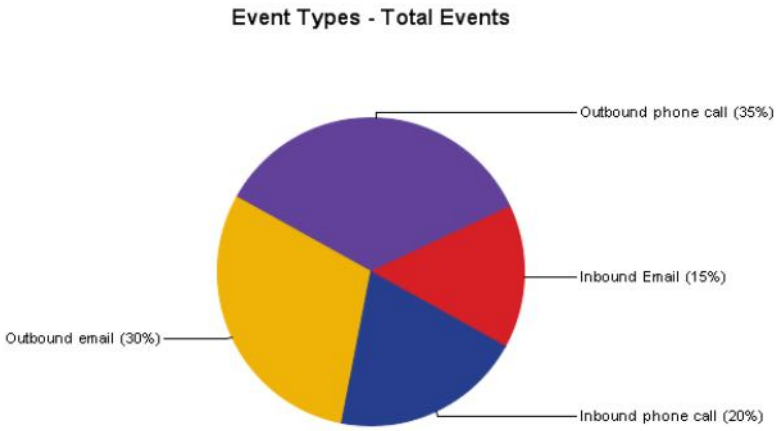
Engagement actions summary: June 2019

*When the word 'Events' is used in the graphs this is referring to 'engagement actions'

Issues	No. of interactions	Stakeholders	
		Individual	Total
Water safety	1	1	1
[No Issues]	19	14	19
Total Event search	**20**	**15**	**20**



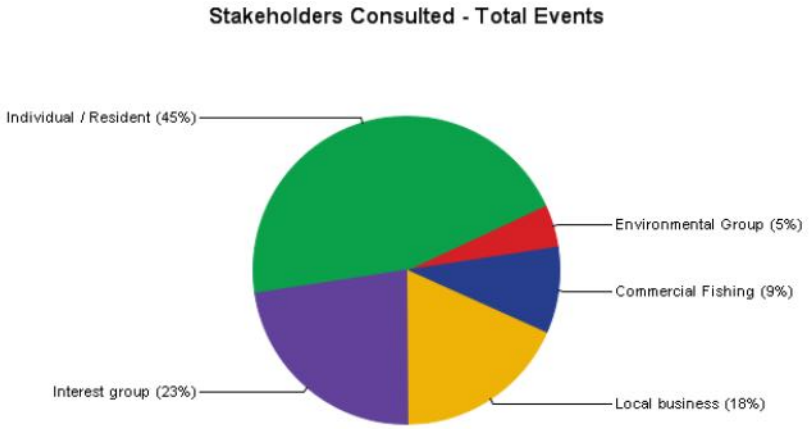
Action types	No. of interactions	Stakeholders	
		Individual	Total
Outbound phone call	7	5	7
Outbound email	6	6	6
Inbound phone call	4	4	4
Inbound Email	3	3	3
Total Event search	**20**	**15**	**20**



Complaints and engagement register summary

Outer Harbor Channel Widening Project

Stakeholder Groups	No. of interactions	Stakeholders	
		Individual	Total
Individual / Resident	10	6	10
Interest group	5	3	5
Local business	4	3	4
Commercial Fishing	2	2	2
Environmental Group	1	1	1
[No Stakeholder Groups]	1	1	1
Total Event search	**20**	**15**	**20**



Flinders Ports
Outer Harbor Channel Widening Project

Monthly Stakeholder Engagement Update - EPA reporting

March - May 2019

Web page visits

851

(2,534 accumulative total)

Number of enquiries via website

2

(2 accumulative total)

Number of enquiries via hotline

49

(87 accumulative total)

Number of enquiries via email

14

(40 accumulative total)

Stakeholder meetings/briefings

10

(29 accumulative total)

Stakeholder database growth

55+

(174 accumulative total)

EDM - Licence conditions (12 March 2019)

No. of people who received it

113

Open rate

50.9%

EDM - Pre-dredge works (22 March 2019)

No. of people who received it

111

Open rate

56.8%

EDM - Seeking interest in pre-dredging engagement session (3 May 2019)

No. of people who received it

127

Open rate

54.8%

EDM - Reminder: deadline for expressions of interest in engagement session (13 May 2019)

No. of people who received it

130

Open rate

n/a (sent via email account)

EDM - Dredging to begin early June (29 May 2019)

No. of people who received it

150

Open rate

54.8%

Milestone	Activities completed
Issuing of licence / contractor announcement	Website updated with content, FAQs and fact sheet
	EDM sent - licence conditions
Other communications	Web copy updated
	Meeting with various stakeholders
	Complaints poilcy developed and distributed to key stakeholders
Licence conditions	Community Engagement Plan uploaded to the website
Pre-dredge engagement activities	Various stakeholder briefings regarding the project commencement
	Port Mall information sessions x3
	Letter distributed to local community
	Boat ramp signage installed
	Website monitoring went live
	EDM sent - pre-dredge works
	EDM sent to database seeking interest in pre-dredge engagement briefing
	EDM sent to database informing them that dredging will commence
	Upcoming activities
Dredging progress	Update website content
	Upload additional FAQs
	Coordinate additional boat ramp signage
	EDM update on dredge activities
	Facebook post updates

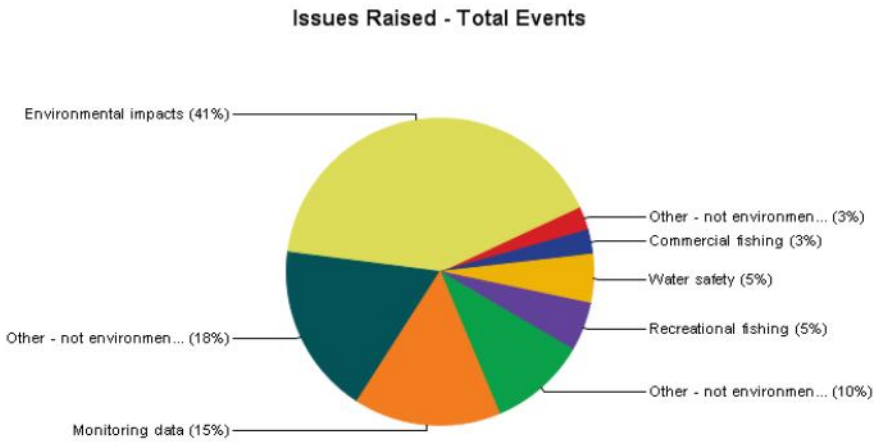
Complaints and engagement register summary

Outer Harbor Channel Widening Project

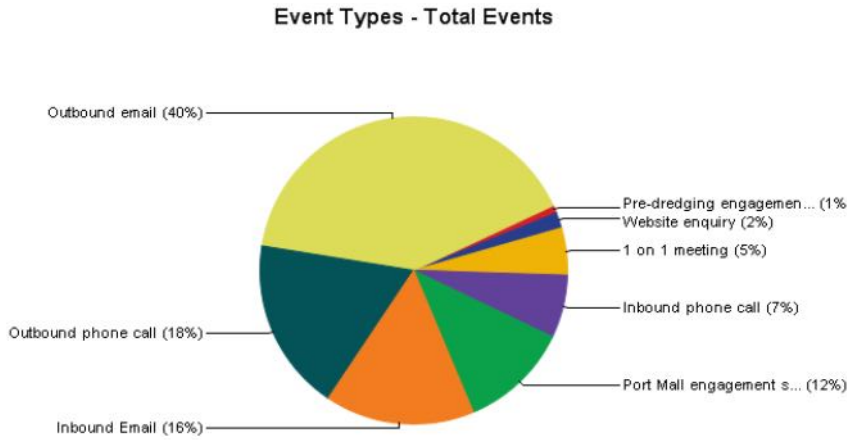
Engagement actions summary: March – May 2019

*When the word 'Events' is used in the graphs this is referring to 'engagement actions'

Issues	No. of interactions	Stakeholders	
		Individual	Total
Environmental impacts	16	15	20
Other - not environmental: Construction / navigation aids	7	1	7
Monitoring data	6	6	7
Other - not environmental: Methodology	4	4	5
Water safety	2	2	2
Recreational fishing	2	1	2
Other - not environmental: Noise	1	1	1
Commercial fishing	1	1	1
[No Issues]	89	47	94
Total Event search	**121**	**57**	**130**



Action types	No. of interactions	Stakeholders	
		Individual	Total
Outbound email	49	38	53
Outbound phone call	22	17	22
Inbound Email	19	13	19
Port Mall engagement session	14	14	14
Inbound phone call	8	8	8
1 on 1 meeting	6	10	10
Website enquiry	2	1	2
Pre-dredging engagement session	1	2	2
Total Event search	**121**	**57**	**130**



Complaints and engagement register summary

Outer Harbor Channel Widening Project

Stakeholder Groups	No. of interactions	Stakeholders	
		Individual	Total
Individual / Resident	47	24	47
Local business	24	5	26
Environmental Group	20	8	20
State Government	6	7	12
Interest group	5	2	5
Commercial Fishing	5	4	5
Local Government	4	3	4
Recreational Fishing	3	3	3
Federal Government	1	1	1
[No Stakeholder Groups]	1	1	8
Total Event search	**121**	**57**	**130**