Metocean Data Report - Six Months

Douglas Shoal Remediation Project

Great Barrier Reef Marine Park Authority

8 November 2019

12 Creek Street
Brisbane. QLD. 4000

301001-02112-EN-REP-0006

Advisian
Worley Group

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1 Introduction

This document provides a factual report of the wave and current data collected at Douglas Shoal by using Acoustic Doppler Current Profilers (ADCPs) for the Great Barrier Reef Marine Park Authority (GBRMPA) Douglas Shoal Remediation Project. The data have been collected at two locations which are named ADCP Site 1 (ADCP1) and ADCP Site 2 (ADCP2). Please refer to Appendix A for current and wave monitoring locations (ADCP1 and ADCP2). Figure 1-1 below shows one of the deployed ADCP units at site ADCP2. This report covers three deployment periods as presented in Table 1-1 whereby two ADCP instruments were deployed per period. Deployment period 1 collected wave data and current data at ADCP1 and only current data at ADCP2. Deployments 2 and 3 collected both wave and current data at both deployment locations. More detail on the ADCP component of the Douglas Shoal Remediation Project can be found in Sampling and Analysis Plan – Douglas Shoal Remediation Project (Advisian 2019)

Table 1-1 ADCP deployment periods

<table>
<thead>
<tr>
<th>Deployment Period</th>
<th>Deployment Date</th>
<th>Recovery Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>17/01/2019</td>
<td>14/03/2019</td>
</tr>
<tr>
<td>2</td>
<td>16/03/2019</td>
<td>13/06/2019</td>
</tr>
<tr>
<td>3</td>
<td>14/06/2019</td>
<td>25/08/2019</td>
</tr>
</tbody>
</table>

1.1 Study datum

Geographical positions are provided in geographic (Latitude/Longitude) coordinates unless stated otherwise. Exact seabed elevation relative to a specified datum is not provided. Reported water depths are as measured by each instrument.
1.2 Units and conventions

All units are in standard SI units unless otherwise stated, with all bearings and directions provided in degrees True North.
2 Deployment information

2.1 Deployment frames

The ADCP’s are deployed in a custom-built frame. The ADCP frame is fitted with an Acoustic Release Pop-Up-Buoy (PUB) for subsequent recovery. A picture of the ADCP frame with the fitted acoustic release on deck is shown in Figure 2-1.

![Figure 2-1 ADCP frame and acoustic release](image)

During deployment, a digital tilting sensor (accelerometer), owned and developed by Advisian, was used to ensure the frame was in an upright position within the acceptable range required (normally within 8 degrees of the vertical).

2.2 Deployment and retrieval method

The deployment of the ADCPs and weighted frames was undertaken using a lifting crane and the ‘endless rope method’. The frames are first lowered to the water using the crane, a rope is slipped through 2 D shackles placed on the top of the frame and secured to the vessel on two separate
bollards, taking the weight of the frame. The crane hook is lowered until all the weight is taken up by the rope and the crane hook is then removed. To lower the frame, one end of the rope remains attached to the vessel (bollard) and the other end is released from the other bollard and gently let-out to control the descent of the frame. All efforts are made to ensure the ADCP settles on a flat area of seafloor devoid of corals. Once the frame hits the seabed the rope is disconnected from the bollard end and pulled up from the opposite end through the D shackles. The ADCP is anchored to the seafloor using a plough anchor attached to the ADCP via chain up to 10m in length. The anchor is lowered to the seafloor using the same endless rope method ensuring the line between the ADCP and anchor is taut as possible. Deployment takes approximately 30mins per ADCP unit if all operations run smoothly.

To retrieve the ADCPs, the vessel holds position 100m from the GPS location of the ADCP and frame unit. The acoustic release mechanism on the frame is triggered remotely from the vessel by sending a ‘release’ signal from the acoustic buoy control box on board the vessel via a transducer hanging over the side of the vessel. The buoy is released to the surface and is attached via a cable to the frame on the seafloor. The cable has a lifting capacity of 1000kg which is more than sufficient to support a fully laden ADCP frame and any additional weights on the frame plus anchor and chain.

Depending upon the weather and at the skipper discretion, the vessel may either:

- Approach the buoy, attach the buoy to a crane hook, maintain position and retrieve the frame, ADCP and anchor
- Anchor in proximity to the ADCP Buoy, drift back onto the buoy and use a boat hook to capture the buoy or deploy a tender and crew to retrieve the buoy and return the buoy to the main vessel for connection to the crane hook.

Depending upon the method used and weather retrieval takes between 1 and 2 hours.

### 2.3 Deployment location

Details regarding the as-deployed location and depth range during each deployment period are provided in Table 2-1. All deployments at the ADCP1 and ADCP2 were within approximately 10m of target location.

<table>
<thead>
<tr>
<th>Deployment Period</th>
<th>Location</th>
<th>Latitude (WGS 84)</th>
<th>Longitude (WGS 84)</th>
<th>Accuracy</th>
<th>Approximate depth range (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ADCP 1</td>
<td>23° 06.017' S</td>
<td>151° 39.588' E</td>
<td>within 10m</td>
<td>13-15</td>
</tr>
<tr>
<td>1</td>
<td>ADCP 2</td>
<td>23° 05.726' S</td>
<td>151° 39.117' E</td>
<td>within 10m</td>
<td>11-14</td>
</tr>
<tr>
<td>2</td>
<td>ADCP 1</td>
<td>23° 06.030' S</td>
<td>151° 39.597' E</td>
<td>within 10m</td>
<td>13-15</td>
</tr>
<tr>
<td>2</td>
<td>ADCP 2</td>
<td>23° 05.730' S</td>
<td>151° 39.132' E</td>
<td>within 10m</td>
<td>12-15</td>
</tr>
</tbody>
</table>
### Deployment configuration

The ADCPs were configured to measure current during all three deployments at both ADCP1 and ADCP2 locations. The ADCPs were configured to measure wave parameters during all three deployments at ADCP1 and for deployment periods two and three at location ADCP2. Table 2-2 and Table 2-3 below provide configuration information for ADCP deployments at ADCP1 and ADCP2 respectively.
### Table 2-2 ADCP1 deployment configuration information

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mobilisation Trip (Period 1)</th>
<th>Service Trip 1 (Period 2)</th>
<th>Service Trip 2 (Period 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument</td>
<td>Workhorse Sentinel</td>
<td>Workhorse Sentinel</td>
<td>Workhorse Sentinel</td>
</tr>
<tr>
<td>Frequency</td>
<td>614400</td>
<td>614400</td>
<td>614400</td>
</tr>
<tr>
<td>Water Profile</td>
<td>YES</td>
<td>YES</td>
<td>Yes</td>
</tr>
<tr>
<td>Bottom Track</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>High Res. Modes</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>High Rate Pinging</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Shallow Bottom Mode</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Wave Gauge</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Lowered ADCP</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
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<tr>
<td>Ice Track</td>
<td>NO</td>
<td>NO</td>
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<tr>
<td>Surface Track</td>
<td>NO</td>
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<td>NO</td>
</tr>
<tr>
<td>Beam angle</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Temperature</td>
<td>27.00</td>
<td>26.00</td>
<td>24.00</td>
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<tr>
<td>Deployment hours</td>
<td>2400.00</td>
<td>2400.00</td>
<td>2160.00</td>
</tr>
<tr>
<td>Battery packs</td>
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<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Automatic TP</td>
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<td>YES</td>
<td>Yes</td>
</tr>
<tr>
<td>Memory size [MB]</td>
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<td>448</td>
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<td>Saved Screen</td>
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<td>3</td>
<td>3</td>
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<td>First cell range</td>
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<tr>
<td>Last cell range</td>
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<td>25.60 m</td>
<td>25.60 m</td>
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<tr>
<td>Max range</td>
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<td>34.37 m</td>
<td>35.57 m</td>
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<tr>
<td>Standard deviation</td>
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<td>1.93 cm/s</td>
<td>1.93 cm/s</td>
</tr>
<tr>
<td>Ensemble size</td>
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<tr>
<td>Storage required</td>
<td>117.68 MB</td>
<td>117.68 MB</td>
<td>105.91 MB</td>
</tr>
<tr>
<td>Power usage</td>
<td>429.95 Wh</td>
<td>429.98 Wh</td>
<td>387.04 Wh</td>
</tr>
<tr>
<td>Battery usage</td>
<td>1.0</td>
<td>1.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Samples / Wv Burst</td>
<td>600</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Min NonDir Wave Per</td>
<td>2.20 s</td>
<td>2.20 s</td>
<td>2.20 s</td>
</tr>
<tr>
<td>Min Dir Wave Period</td>
<td>3.48 s</td>
<td>3.48 s</td>
<td>3.48 s</td>
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<td>Bytes / Wave Burst</td>
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<td>15 min</td>
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<td>No. Cells</td>
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<td>Max Depth</td>
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<td>20 m</td>
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<td>Cell Size</td>
<td>0.5 m</td>
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<tr>
<td>Wave Interval</td>
<td>60 min</td>
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<tr>
<td>Wave sampling rate</td>
<td>5 min</td>
<td>5 min</td>
<td>5 min</td>
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</table>

### Table 2-3 ADCP2 deployment configuration information

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mobilisation Trip (Period 1)</th>
<th>Service Trip 1 (Period 2)</th>
<th>Service Trip 2 (Period 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument</td>
<td>Workhorse Sentinel</td>
<td>Workhorse Sentinel</td>
<td>Workhorse Sentinel</td>
</tr>
<tr>
<td>Parameter</td>
<td>Mobilisation Trip (Period 1)</td>
<td>Service Trip 1 (Period 2)</td>
<td>Service Trip 2 (Period 3)</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------</td>
<td>--------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Frequency</td>
<td>614400</td>
<td>614400</td>
<td>614400</td>
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<tr>
<td>Water Profile</td>
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<td>YES</td>
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<tr>
<td>Bottom Track</td>
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<td>NO</td>
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<tr>
<td>High Res. Modes</td>
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<td>NO</td>
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<tr>
<td>High Rate Pinging</td>
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<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Shallow Bottom Mode</td>
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<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Wave Gauge</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Lowered ADCP</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
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<td>Ice Track</td>
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<tr>
<td>Beam angle</td>
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<tr>
<td>Temperature</td>
<td>27.00</td>
<td>26.00</td>
<td>24.00</td>
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<tr>
<td>Deployment hours</td>
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<td>2400.00</td>
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<tr>
<td>Battery packs</td>
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<tr>
<td>Automatic TP</td>
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<td>YES</td>
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<tr>
<td>Last cell range</td>
<td>20.60 m</td>
<td>25.60 m</td>
<td>25.60 m</td>
</tr>
<tr>
<td>Max range</td>
<td>33.75 m</td>
<td>34.37 m</td>
<td>35.57 m</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>1.93 cm/s</td>
<td>1.93 cm/s</td>
<td>1.93 cm/s</td>
</tr>
<tr>
<td>Ensemble size</td>
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<td>1134 bytes</td>
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<tr>
<td>Storage required</td>
<td>8.55 MB</td>
<td>117.68 MB</td>
<td>105.91 MB</td>
</tr>
<tr>
<td>Power usage</td>
<td>100.24 Wh</td>
<td>429.98 Wh</td>
<td>387.04 Wh</td>
</tr>
<tr>
<td>Battery usage</td>
<td>0.2</td>
<td>1.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Samples / Wv Burst</td>
<td>N/A</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Min NonDir Wave Per</td>
<td>N/A</td>
<td>2.20 s</td>
<td>2.20 s</td>
</tr>
<tr>
<td>Min Dir Wave Period</td>
<td>N/A</td>
<td>3.48 s</td>
<td>3.48 s</td>
</tr>
<tr>
<td>Bytes / Wave Burst</td>
<td>N/A</td>
<td>46880</td>
<td>46880</td>
</tr>
<tr>
<td>Profile Interval</td>
<td>15 min</td>
<td>15 min</td>
<td>15 min</td>
</tr>
<tr>
<td>No. Cells</td>
<td>49</td>
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<td>49</td>
</tr>
<tr>
<td>Max Depth</td>
<td>0.5 m</td>
<td>20 m</td>
<td>20 m</td>
</tr>
<tr>
<td>Cell Size</td>
<td>20 m</td>
<td>0.5 m</td>
<td>0.5 m</td>
</tr>
</tbody>
</table>
3 Results and summary

3.1 Quality assurance and control

3.1.1 Compass calibration

A compass calibration was performed for both ADCP units prior to the first deployment for period one. The same ADCP units were used for the following deployments and did not require compass calibration again for deployments two and three. The ADCP internal compass is factory calibrated prior to purchase or re-calibrated during any servicing events. Once the ADCP is attached to the frame the influence of the metal frame and any other attachments need to be accounted for which influence the internal compass, prior to deployment.

The re-calibration of the ADCP is carried out on land prior to initial deployment by lifting the frame of the ground (1-2m) with the ADCP unit attached into the air using a crane. The ADCP is switched on and placed into the calibration mode then the frame is manually spun slowly and steadily around in a clockwise direction making sure there are no tilting motions. The directional data collected by the ADCP are then compared to the original directional data prior to the ADCP unit being attached to the frame and the data adjusted accordingly.

The process is then repeated, and an error is calculated between the adjusted initial results and the new results. As per the manufacturer’s recommendations, if the overall error is less than 2 degrees, the unit is ready for deployment. If the error is >2 degrees, the procedure should be repeated.

3.1.2 Data interrogation

Advisian’s standard method of Quality Assurance / Quality Control (QA/QC) involves a first pass analysis of the raw hydrodynamic and wave information retrieved from the unit. This process involves:

- Confirming the pitch and roll on the unit is within the “accurate range” of within 8 degrees to the vertical (with values preferably less than 5)
- Ensuring wave period, and associated wave parameters, calculated from the spectral binary files, is within acceptable ranges and removing all parameters over the corresponding time if not.

The data presented in the appendices has undergone this standard QA/QC check. Data screening and visual inspection ensure that records determined to be erroneous have been removed from the datasets provided. The data was not adjusted for Magnetic declination.

For the purpose of this report and data presentation, the full velocity profile for current measurements has been included in the dataset (from ADCP unit to the surface); however, a small portion of this profile could be affected by ‘side-lobe interference’ (approximately 10% of the profile closest to the surface).

3.2 Current and water levels

A summary of the hydrodynamic components captured by the ADCP unit that has been deployed at ADCP1 are presented in Appendix B and Appendix C. A summary of the hydrodynamic components captured by the ADCP unit that has been deployed at ADCP2 are presented in Appendix D and Appendix E. These summaries include the following:
• Current and water level time series plots
• Current speed rose plots
• Current velocity scatter (current speed against direction)
• Current joint frequency tables of current speed compared to current direction
• U and V velocity component scatter plots.

3.3 Waves

A summary of the wave parameters captured by the ADCP unit that has been deployed at ADCP1 are presented in Appendix F and Appendix G. A summary of the wave parameters captured by the ADCP unit that has been deployed at ADCP2 are presented in Appendix H and Appendix I. These summaries include the following:

• Wave parameter time series plots
• Significant wave height rose plots
• Peak period rose plots
• Current joint frequency tables of current speed compared to current direction.
4 Lessons learned

The fieldwork provided the opportunity to gain valuable knowledge regarding conditions at Douglas Shoal that are likely to be relevant to future activity for the remediation project. Involving the deployments and retrieval of instruments. A summary of these is provided in Table 4-1 as ‘lessons learned’.

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Issue</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open nature of Douglas Shoal</td>
<td>Activities at the Shoal are impacted upon by wind, waves and currents during most of the year, causing delays in mobilisations and can make deployment/retrieval of ADCP’s difficult.</td>
<td>Service visits are scheduled during calm periods and during the neap tide period if possible. The slack period of the tide is utilised for retrieval and deployment</td>
</tr>
<tr>
<td>Anchoring on Douglas Shoal</td>
<td>Anchoring can be difficult during certain conditions due to very loose substrate and large areas of smooth rock which did not provide adequate anchoring points.</td>
<td>Smaller (lighter) vessels used during the retrieval of the ADCP and frame. Utilise the slack period of the tidal cycle to limit current impacts on anchoring</td>
</tr>
<tr>
<td>Simultaneous operations nearby</td>
<td>Anchor line from another work vessel dragged over the ADCP frame and turned over the frame</td>
<td>Use divers/snorkellers to right the frame Trigger the remote buoy on the ADCP, retrieve and reset the buoy then redeploy the unit Ensure no other boating activities involving anchoring of vessels occur nearby during the deployment of the ADCPS Ensure the ADCP on the seafloor is well clear of the vessel anchor line</td>
</tr>
<tr>
<td>Abundant fauna</td>
<td>Interactions with fauna</td>
<td>Limit vessel speeds in sensitive locations. Ensure protocols for interactions with fauna are communicated and adhered too. For example, maintain look out and slow speeds when on the Shoal and when approaching or leaving the Shoal.</td>
</tr>
</tbody>
</table>
5 References

Appendix A
Current and Wave Monitoring Locations
While every care is taken to ensure the accuracy of this data, WorleyParsons makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.

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Appendix B
ADCP1: Current and Water Level Time Series Plots
Water Depth

Depth Averaged Current Speed

Depth Averaged Current Direction

Wave Summary January 2019

Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP1 Period1 [151° 39.588E , 23° 06.017S]
Data source: ADCP1 Period 1
Data summary: January 2019

Key Data Statistics:
Max Curr Spd: 0.92 m/s
Mean Curr Spd: 0.34 m/s
StdDev. Curr Spd: 0.19 m/s

Advisian
Worley Group
Data Information:
Project: 301001–02112 Douglas Shoal Remediation Project
Location: ADCP1 Period1 [151° 39.588E , 23° 06.017S]
Data period: February 2019 (01−Feb−2019 to 28−Feb−2019)
Data source: ADCP1 Period 1
Data summary: February 2019

Key Data Statistics:
Max Curr Spd: 0.92 m/s
Mean Curr Spd: 0.34 m/s
StdDev. Curr Spd: 0.19 m/s

Wave Summary February 2019
Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP1 Period1 [151° 39.588E, 3° 06.017S]
Data source: ADCP1 Period 1
Data summary: March 2019

Key Data Statistics:
Max Curr Spd: 0.92 m/s
Mean Curr Spd: 0.34 m/s
StdDev. Curr Spd: 0.19 m/s
Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP1 Period2 [151° 39.597E , 23° 06.030S]
Data source: ADCP1 Period 2
Data summary: March 2019

Key Data Statistics:
Max Curr Spd: 0.92 m/s
Mean Curr Spd: 0.34 m/s
StdDev. Curr Spd: 0.19 m/s

Wave Summary March 2019
Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP1 Period2 [151° 39.597E , 23° 06.030S]
Data period: April 2019 (01−Apr−2019 to 30−Apr−2019)
Data source: ADCP1 Period 2
Data summary: April 2019

Key Data Statistics:
Max Curr Spd: 0.92 m/s
Mean Curr Spd: 0.34 m/s
StdDev. Curr Spd: 0.19 m/s

Wave Summary April 2019

Water Depth

Depth Averaged Current Speed

Depth Averaged Current Direction
**Data Information:**
Project: 301001–02112 Douglas Shoal Remediation Project
Location: ADCP1 Period 2 [151° 39.597E, 23° 06.030S]
Data source: ADCP1 Period 2
Data summary: May 2019

**Key Data Statistics:**
- Max Curr Spd: 0.92 m/s
- Mean Curr Spd: 0.34 m/s
- StdDev. Curr Spd: 0.19 m/s

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**Wave Summary May 2019**

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Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP1 Period2 [151° 39.597E , 23° 06.030S]
Data period: June 2019 (01−Jun−2019 to 13−Jun−2019)
Data source: ADCP1 Period 2
Data summary: June 2019

Key Data Statistics:
Max Curr Spd: 0.92 m/s
Mean Curr Spd: 0.34 m/s
StdDev. Curr Spd: 0.19 m/s
Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP1 Period3 [151° 39.602E, 23° 06.030S]
Data period: June 2019 (14−Jun−2019 to 30−Jun−2019)
Data source: ADCP1 Period 3
Data summary: June 2019

Key Data Statistics:
Max Curr Spd: 1.10 m/s
Mean Curr Spd: 0.33 m/s
StdDev. Curr Spd: 0.18 m/s

Wave Summary June 2019
Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP1 Period3 [151° 39.602E, 23° 06.030S]
Data period: July 2019 (01−Jul−2019 to 31−Jul−2019)
Data source: ADCP1 Period 3
Data summary: July 2019

Key Data Statistics:
Max Curr Spd: 1.10 m/s
Mean Curr Spd: 0.33 m/s
StdDev. Curr Spd: 0.18 m/s

Wave Summary July 2019
Wave Summary August 2019

Data Information:
Project: 301001–02112 Douglas Shoal Remediation Project
Location: ADCP1 Period3 [151° 39.602E, 23° 06.030S]
Data source: ADCP1 Period 3
Data summary: August 2019

Key Data Statistics:
Max Curr Spd: 1.10 m/s
Mean Curr Spd: 0.33 m/s
StdDev. Curr Spd: 0.18 m/s
Appendix C
ADCP1: Current Rose, Velocity Scatter and Joint Frequency Table Plots
Current Speed for ADCP1 Location

Period 1

Directional Distribution

Velocity Scatter

JFT (%) of Current Speed against Direction for the entire period 17-Jan-2019 to 14-Mar-2019

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**SubTot.** 0.43 0.43 0.71 1.75 14.60 21.57 4.52 1.79 1.17 1.45 1.93 5.88 34.77 7.12 1.06 0.76

**Total** 0.43 0.43 0.71 1.75 14.60 21.57 4.52 1.79 1.18 1.46 1.94 5.88 34.78 7.13 1.06 0.77

**Cumul.** 0.43 0.86 1.58 3.33 17.93 30.60 44.03 55.82 46.99 48.46 50.39 56.27 91.04 98.17 99.23 100.00

Data Information:
Project: 301001-02112
Location: ADCP1 [151° 39.588' E , 23° 06.017' S ]
Data period: All data (17-Jan-2019 to 14-Mar-2019)
Data source: ADCP1 Period 1
Data summary: Complete
Number of Records: 5378
Missing data (%): 0.00
Calm (% < 0.01 m/s): 0.07

Key Data Statistics:
Max Curr Spd: 0.92 m/s
Mean Curr Spd: 0.34 m/s
StdDev. Curr Spd: 0.19 m/s
ADCP1 Period 1: U-Velocity vs V-Velocity
Current Speed for ADCP1 Location

### Directional Distribution

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JFT (%) of Current Speed against Direction for the entire period 16-Mar-2019 to 13-Jun-2019

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* denotes values less than 0.01%  
- denotes no records in bin  
** includes the calm winds which are evenly distributed amongst the directional bins

Data Information:
- Project: 301001-02112
- Location: ADCP1 [151° 39.597' E, 23° 06.030' S]
- Data summary: Complete
- Number of Records: 8524
- Missing data (%): 0.00
- Calm (% < 0.01m/s): 0.09

Key Data Statistics:
- Max Curr Spd: 0.92 m/s
- Mean Curr Spd: 0.34 m/s
- StdDev. Curr Spd: 0.19 m/s

Metocean Data Report - Six Months  
Douglas Shoal Remediation Project  
301001-02112-EN-REP-0006
Current Speed for ADCP1 Location

Directional Distribution

Period 3

Velocity Scatter

JFT (%) of Current Speed against Direction for the entire period 14-Jun-2019 to 25-Aug-2019

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N denotes values less than 0.01%; - denotes no records in bin
** includes the calm winds which are evenly distributed amongst the directional bins

Data Information:
- Project: 301001-02112
- Location: ADCP1 [151° 39.900' E, 23° 08.030' S]
- Data period: All data (14-Jun-2019 to 25-Aug-2019)
- Data source: ADCP1 Period 3
- Data summary: Complete
- Number of Records: 6644
- Missing data (%): 0.00
- Calm (% < 0.01m/s): 0.12

Key Data Statistics:
- Max Curr Spd: 1.10 m/s
- Mean Curr Spd: 0.33 m/s
- StdDev. Curr Spd: 0.16 m/s

Advisian
Worley Group
Appendix D
ADCP2: Current and Water Level Time Series Plots
Wave Summary January 2019

Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP2 Period1 [151° 39.117 , 23° 05.726S]
Data period: January 2019 (17−Jan−2019 to 31−Jan−2019)
Data source: AWAC
Data summary: January 2019

Key Data Statistics:
Max Curr Spd: 0.90 m/s
Mean Curr Spd: 0.35 m/s
StdDev. Curr Spd: 0.19 m/s
Wave Summary March 2019

Data Information:
Project: 301001–02112 Douglas Shoal Remediation Project
Location: ADCP2 Period1 [151° 39.117, 23° 05.726S]
Data source: AWAC
Data summary: March 2019

Key Data Statistics:
Max Curr Spd: 0.90 m/s
Mean Curr Spd: 0.35 m/s
StdDev. Curr Spd: 0.19 m/s
Data Information:
Project: 301001–02112 Douglas Shoal Remediation Project
Location: ADCP2 Period2 [151° 39.132E , 23° 05.730S]
Data source: AWAC
Data summary: March 2019

Key Data Statistics:
Max Curr Spd: 0.83 m/s
Mean Curr Spd: 0.33 m/s
StdDev. Curr Spd: 0.18 m/s

Wave Summary March 2019
Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP2 Period2 [151° 39.132E , 23° 05.730S]
Data period: April 2019 (01−Apr−2019 to 30−Apr−2019)
Data source: AWAC
Data summary: April 2019

Key Data Statistics:
Max Curr Spd: 0.83 m/s
Mean Curr Spd: 0.33 m/s
StdDev. Curr Spd: 0.18 m/s

Wave Summary April 2019
Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP2 Period2 [151° 39.132E , 23° 05.730S]
Data period: May 2019 (01−May−2019 to 31−May−2019)
Data source: AWAC
Data summary: May 2019

Key Data Statistics:
Max Curr Spd: 0.83 m/s
Mean Curr Spd: 0.33 m/s
StdDev. Curr Spd: 0.18 m/s
Water Depth

Depth Averaged Current Speed

Depth Averaged Current Direction

Data Information:
Project: 301001–02112 Douglas Shoal Remediation Project
Location: ADCP2 Period2 [151° 39.132E, 23° 05.730S]
Data period: April 2019 (01–Apr–2019 to 30–Apr–2019)
Data source: AWAC
Data summary: April 2019

Key Data Statistics:
Max Curr Spd: 0.83 m/s
Mean Curr Spd: 0.33 m/s
StdDev. Curr Spd: 0.18 m/s

Wave Summary April 2019
Data Information:
Project: 301001–02112 Douglas Shoal Remediation Project
Location: ADCP2 Period2 [151° 39.132 E, 23° 05.730 S]
Data source: AWAC
Data summary: June 2019

Key Data Statistics:
Max Curr Spd: 0.83 m/s
Mean Curr Spd: 0.33 m/s
StdDev. Curr Spd: 0.18 m/s

Wave Summary June 2019
**Data Information:**
Project: 301001-02112 Douglas Shoal Remediation Project
Location: ADCP2 Period3 [151° 39.140E, 23° 05.734S]
Data source: AWAC
Data summary: June 2019

**Key Data Statistics:**
Max Curr Spd: 0.99 m/s
Mean Curr Spd: 0.31 m/s
StdDev. Curr Spd: 0.17 m/s

---

**Wave Summary June 2019**
Worley Group

Wave Summary July 2019

Data Information:
Project: 301001-02112 Douglas Shoal Remediation Project
Location: ADCP2 Period3 [151° 39.140E, 23° 05.734S]
Data period: July 2019 (01-Jul-2019 to 31-Jul-2019)
Data source: AWAC
Data summary: July 2019

Key Data Statistics:
Max Curr Spd: 0.99 m/s
Mean Curr Spd: 0.31 m/s
StdDev. Curr Spd: 0.17 m/s
Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP2 Period3 [151° 39.140E , 23° 05.734S]
Data source: AWAC
Data summary: August 2019

Key Data Statistics:
Max Curr Spd: 0.99 m/s
Mean Curr Spd: 0.31 m/s
StdDev. Curr Spd: 0.17 m/s

Wave Summary August 2019
Appendix E
ADCP2: Current Rose, Velocity Scatter and Joint Frequency Table Plots
Current Speed for ADCP2 Location

### Period 1

**Directional Distribution**

- **N**: 40
- **E**: 20
- **W**: 10
- **S**: 0

**Velocity Scatter**

- **1 m/s**
- **0.5 m/s**

---

### JFT (%) of Current Speed against Direction for the entire period 17-Jan-2019 to 14-Mar-2019

<table>
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<th>NNE</th>
<th>NE</th>
<th>ENE</th>
<th>E</th>
<th>ESE</th>
<th>SE</th>
<th>SSE</th>
<th>S</th>
<th>SSW</th>
<th>SW</th>
<th>WSW</th>
<th>W</th>
<th>WNW</th>
<th>NW</th>
<th>NNW</th>
<th>Total</th>
<th>Cumulated</th>
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<td>1.92</td>
<td>1.06</td>
<td>0.24</td>
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</table>

* JFT (%) denotes values less than 0.01%.
* 0% denotes no records in bin.
* **Total** includes the calm winds which are evenly distributed amongst the directional bins.

---

**Data Information:**
- Project: 301001-02112
- Location: ADCP2 [151° 39.1170' E, 23° 05.7268' S]
- Data period: 17-Mar-2019 to 14-Mar-2019
- Data source: ADCP2 Period 1
- Data summary: Complete
- Number of Records: 5378
- Missing data (%): 0.00
- Calm (% < 0.01 m/s): 0.00

**Key Data Statistics:**
- Max Curr Spd: 0.90 m/s
- Mean Curr Spd: 0.36 m/s
- StdDev. Curr Spd: 0.19 m/s
ADCP2 Period 1: U-Velocity vs V-Velocity
Current Speed for ADCP2 Location

Directional Distribution

Period 2

Velocity Scatter

JFT (%) of Current Speed against Direction for the entire period 16-Mar-2019 to 13-Jun-2019

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<th>ESE</th>
<th>SE</th>
<th>SSE</th>
<th>S</th>
<th>SSW</th>
<th>SW</th>
<th>WSW</th>
<th>W</th>
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| subTot. | 0.78 | 1.09 | 1.74 | 5.09 | 23.32 | 10.79 | 2.41 | 1.03 | 0.94 | 1.15 | 1.98 | 8.31 | 32.24 | 6.34 | 1.65 | 1.01 |
| Total ** | 0.79 | 1.10 | 1.75 | 5.10 | 23.33 | 10.80 | 2.42 | 1.04 | 0.94 | 1.15 | 1.99 | 8.32 | 32.25 | 6.35 | 1.66 | 1.01 |
| Cumul. | 0.79 | 1.89 | 3.64 | 6.74 | 32.07 | 42.87 | 45.29 | 46.33 | 47.27 | 48.42 | 50.41 | 58.73 | 90.98 | 97.33 | 98.99 | 100.00 |

* denotes values less than 0.01%
- denotes no records in bin
** includes the calm winds which are evenly distributed amongst the directional bins

Data Information:
- Project: 301001-02112
- Location: ADCP2 [151° 30' 13" E, 23° 05' 30" S]
- Data summary: Complete
- Number of Records: 8562
- Missing data (%): 0.20
- Calm (% < 0.01 m/s): 0.13

Key Data Statistics:
- Max Curr Spd: 0.83 m/s
- Mean Curr Spd: 0.33 m/s
- StdDev. Curr Spd: 0.16 m/s
ADCP2 Period 2: U-Velocity vs V-Velocity
Current Speed for ADCP2 Location

Directional Distribution

Period 3

Velocity Scatter

JFT (%) of Current Speed against Direction for the entire period 14-Jun-2019 to 25-Aug-2019

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<th>0.2-0.3</th>
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<th>0.4-0.5</th>
<th>0.5-0.6</th>
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</tbody>
</table>

* denotes values less than 0.01%  
** includes the calm winds which are evenly distributed amongst the directional bins

Data Information:
Project: 301001-02112
Location: ADCP2 [151° 39.140' E, 23° 05.734' S]
Data period: All date (14-Jun-2019 to 25-Aug-2019)
Data source: ADCP2 Period 3
Data summary: Complete
Number of Records: 6901
Missing data (%): 0.00
Calm (% < 0.01m/s): 0.04

Key Data Statistics:
Max Curr Spd: 0.99 m/s
Mean Curr Spd: 0.31 m/s
StdDev. Curr Spd: 0.17 m/s
ADCP2 Period 3: U-Velocity vs V-Velocity
Appendix F
ADCP1: Wave Time Series Plots
Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP1 Period1 [151° 39.588E , 23° 06.017S]
Data source: ADCP1 Period 1
Data summary: January 2019
Number of Records: 350
Missing data (%): 0.00

Key Data Statistics:
Max Hs: 1.87 m
Mean Hs: 1.11 m
StdDev. Hs: 0.25 m
Max Tp: 9.30 s
Mean Tp: 6.63 s
StdDev. Tp: 1.08 s
Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP1 Period1 [151° 39.588E , 23° 06.017S]
Data period: February 2019 (01−Feb−2019 to 28−Feb−2019)
Data source: ADCP1 Period 1
Data summary: February 2019
Number of Records: 672
Missing data (%): 0.00

Key Data Statistics:
Max Hs: 4.07 m
Mean Hs: 1.67 m
StdDev. Hs: 0.58 m
Max Tp: 16.50 s
Mean Tp: 9.09 s
StdDev. Tp: 2.58 s

Wave Summary February 2019
Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP1 Period1 [151° 39.588E , 23° 06.017S]
Data source: ADCP1 Period 1
Data summary: March 2019
Number of Records: 323
Missing data (%): 0.00

Wave Summary March 2019
Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP1 Period2 [151° 39.597E, 23° 06.030S]
Data source: ADCP1 Period 2
Data summary: March 2019
Number of Records: 373
Missing data (%): 0.00

Key Data Statistics:
Max Hs: 1.52 m  Max Tp: 14.60 s
Mean Hs: 0.70 m  Mean Tp: 7.86 s
StdDev. Hs: 0.23 m  StdDev. Tp: 2.48 s
Wave Summary April 2019

Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP1 Period2 [151° 39.597E, 23° 06.030S]
Data period: April 2019 (01−Apr−2019 to 30−Apr−2019)
Data source: ADCP1 Period 2
Data summary: April 2019
Number of Records: 699
Missing data (%): 0.00

Key Data Statistics:
Max Hs: 3.14 m    Max Tp: 14.60 s
Mean Hs: 1.54 m    Mean Tp: 7.43 s
StdDev. Hs: 0.40 m    StdDev. Tp: 2.19 s
Wave Summary May 2019

Data Information:
Project: 301001–02112 Douglas Shoal Remediation Project
Location: ADCP1 Period2 [151° 39.597E , 23° 06.030S]
Data source: ADCP1 Period 2
Data summary: May 2019
Number of Records: 707
Missing data (%): 0.00

Key Data Statistics:
Max Hs: 2.77 m  Max Tp: 13.10 s
Mean Hs: 1.30 m  Mean Tp: 7.40 s
StdDev. Hs: 0.51 m  StdDev. Tp: 1.80 s
**Data Information:**
- Project: 301001−02112 Douglas Shoal Remediation Project
- Location: ADCP1 Period2 [151° 39.597E , 23° 06.030S]
- Data period: June 2019 (01−Jun−2019 to 13−Jun−2019)
- Data source: ADCP1 Period 2
- Data summary: June 2019
- Number of Records: 287
- Missing data (%): 0.00

**Key Data Statistics:**
- Max Hs: 2.02 m
- Mean Hs: 1.15 m
- StdDev. Hs: 0.35 m
- Max Tp: 14.60 s
- Mean Tp: 5.73 s
- StdDev. Tp: 1.69 s

**Wave Summary June 2019**

![Significant Wave Height/ 1/10 Wave Height](chart_1)

![Peak Wave Period/ Mean Wave Period](chart_2)

![Peak Wave Direction/ Mean Wave Period](chart_3)
Wave Summary June 2019

Data Information:
Project: 301001–02112 Douglas Shoal Remediation Project
Location: ADCP1 Period3 [151° 39.602E, 23° 06.030S]
Data period: June 2019 (14−Jun−2019 to 30−Jun−2019)
Data source: ADCP1 Period 3
Data summary: June 2019
Number of Records: 393
Missing data (%): 0.00

Key Data Statistics:
- Max Hs: 2.69 m, Max Tp: 13.80 s
- Mean Hs: 1.07 m, Mean Tp: 6.81 s
- StdDev. Hs: 0.62 m, StdDev. Tp: 2.65 s
Wave Summary July 2019

Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP1 Period3 [151° 39.602E , 23° 06.030S]
Data period: July 2019 (01−Jul−2019 to 31−Jul−2019)
Data source: ADCP1 Period 3
Data summary: July 2019
Number of Records: 735
Missing data (%): 0.00

Key Data Statistics:
Max Hs: 3.70 m  Max Tp: 17.70 s
Mean Hs: 1.11 m  Mean Tp: 9.14 s
StdDev. Hs: 0.63 m  StdDev. Tp: 3.58 s
Significant Wave Height / 1/10 Wave Height

Peak Wave Period / Mean Wave Period

Peak Wave Direction / Mean Wave Period

Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP1 Period3 [151° 39.602E , 23° 06.030S]
Data source: ADCP1 Period 3
Data summary: August 2019
Number of Records: 577
Missing data (%): 0.00

Key Data Statistics:
Max Hs: 1.83 m Max Tp: 13.80 s
Mean Hs: 0.95 m Mean Tp: 6.70 s
StdDev. Hs: 0.37 m StdDev. Tp: 3.09 s

Wave Summary August 2019
Appendix G
ADCP1: Wave Rose, Histogram and Joint Frequency Table Plots
Wave Height for ADCP1 Location

Period 1

JFT (%) of Hs against Direction for the period 17-Jan-2019 to 14-Mar-2019

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* denotes values less than 0.01%
- denotes no records in bin

Data Information:
Project: 301001-02112
Location: ADCP1 [151° 39.588 E, 23° 06.017" S]
Data period: All data (17-Jan-2019 to 14-Mar-2019)
Data source: ADCP1 Period 1
Data summary: Complete
Number of Records: 1345
Missing data (%): 0.00
Calm (% < 0.01m): 0.00

Key Data Statistics:
Max Hs: 4.07 m
Mean Hs: 1.46 m
StdDev. Hs: 0.59 m

Advisian
Worley Group
Wave Period for ADCP1 Location

Period 1

Directional Distribution

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Cumuli: 0.45, 2.38, 11.38, 41.26, 81.93, 94.87, 97.40, 97.92, 97.99, 98.07, 98.14, 98.22, 99.41, 100.00

* denotes values less than 0.01%  - denotes no records in bin

Data Information:
Project: 301001-02112
Location: ADCP1 (151° 39.588 E, 23° 06.017 S)
Data period: All data (17-Jan-2019 to 14-Mar-2019)
Data source: ADCP1 Period 1
Data summary: Complete
Number of Records: 1345
Missing data (%): 0.00

Key Data Statistics:
Max Tp: 16.50 s
Mean Tp: 8.20 s
StdDev. Tp: 2.47 s
Wave Height for ADCP1 Location
Period 2

JFT (%) of Hs against Direction for the period 16-Mar-2019 to 13-Jun-2019

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* denotes values less than 0.01%  
- denotes no records in bin

Data Information:
Project: 301001-02112
Location: ADCP1 [151° 39.597’ E, 23° 06.030’ S ]
Data source: ADCP1 Period 2
Data summary: Complete
Number of Records: 2066
Missing data (%): 0.00
Calm (% < 0.01m): 0.00

Key Data Statistics:
Max Hs: 3.14 m
Mean Hs: 1.26 m
StdDev. Hs: 0.50 m
Wave Period for ADCP1 Location

Period 2

Directional Distribution

Wave Period Distribution

JFT (%) of Tp against Direction for the period 16-Mar-2019 to 13-Jun-2019

Data Information:
Project: 301001-02112
Location: ADCP1 [151° 39.597" E, 23° 06.030" S]
Data sources: ADCP1 Period 2
Data summary: Complete
Number of Records: 2066
Missing data (%): 0.00

Key Data Statistics:
Max Tp: 14.60 s
Mean Tp: 7.28 s
StdDev. Tp: 2.15 s

* denotes values less than 0.01%
- denotes no records in bin
Wave Height for ADCP1 Location

Directional Distribution

Period 3

Wave Height Distribution

JFT (%) of $H_s$ against Direction for the period 14-Jun-2019 to 25-Aug-2019

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* denotes values less than 0.01%  - denotes no records in bin

Data Information:
- Project: 301001-02112
- Location: ADCP1 [151° 39.602' E , 23° 06.030' S ]
- Data period: All data (14-Jun-2019 to 25-Aug-2019)
- Data source: ADCP1 Period 3
- Data summary: Complete
- Number of Records: 1705
- Missing data (%): 0.00
- Calm (% < 0.01m): 0.00

Key Data Statistics:
- Max $H_s$: 3.70 m
- Mean $H_s$: 1.05 m
- StdDev. $H_s$: 0.56 m
Wave Period for ADCP1 Location

JFT (%) of Tp against Direction for the period 14-Jun-2019 to 25-Aug-2019

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* denotes values less than 0.01%  
- denotes no records in bin

Data Information:
- Project: 301001-02112
- Location: ADCP1 [151° 39.602' E , 23° 06.030' S ]
- Data period: All data (14-Jun-2019 to 25-Aug-2019)
- Data source: ADCP1 Period 3
- Data summary: Complete
- Number of Records: 1705
- Missing data (%): 0.00

Key Data Statistics:
- Max Tp: 17.70 s
- Mean Tp: 7.78 s
- StdDev. Tp: 3.43 s
Appendix H
ADCP2: Wave Time Series Plots
Data Information:
Project: 301001-02112 Douglas Shoal Remediation Project
Location: ADCP2 Period2 [151° 39.132E, 23° 05.730S]
Data source: AWAC
Data summary: March 2019
Number of Records: 373
Missing data (%): 0.00

Key Data Statistics:
Max Hs: 1.75 m
Mean Hs: 0.84 m
StdDev. Hs: 0.26 m
Max Tp: 11.90 s
Mean Tp: 7.72 s
StdDev. Tp: 2.03 s

Wave Summary March 2019
Significant Wave Height / 1/10 Wave Height

Peak Wave Period / Mean Wave Period

Peak Wave Direction / Mean Wave Period

Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP2 Period2 [151° 39.132E , 23° 05.730S]
Data period: April 2019 (01−Apr−2019 to 30−Apr−2019)
Data source: AWAC
Data summary: April 2019
Number of Records: 720
Missing data (%): 0.00

Key Data Statistics:
Max Hs: 3.59 m  MaxTp: 14.60 s
Mean Hs: 1.84 m  Mean Tp: 7.74 s
StdDev. Hs: 0.45 m  StdDev. Tp: 1.95 s

Wave Summary April 2019
Wave Summary May 2019

Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP2 Period2 [151° 39.132E , 23° 05.730S]
Data period: May 2019 (01−May−2019 to 31−May−2019)
Data source: AWAC
Data summary: May 2019
Number of Records: 744
Missing data (%): 0.00

Key Data Statistics:
Max Hs: 3.42 m  Max Tp: 13.10 s
Mean Hs: 1.54 m  Mean Tp: 7.54 s
StdDev. Hs: 0.58 m  StdDev. Tp: 1.69 s
Significant Wave Height / 1/10 Wave Height

Peak Wave Period / Mean Wave Period

Peak Wave Direction / Mean Wave Period

Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP2 Period2 [151° 39.132E, 23° 05.730S]
Data period: June 2019 (01−Jun−2019 to 13−Jun−2019)
Data source: AWAC
Data summary: June 2019
Number of Records: 299
Missing data (%): 0.00

Key Data Statistics:
Max Hs: 2.34 m    Max Tp: 13.10 s
Mean Hs: 1.35 m   Mean Tp: 5.85 s
StdDev. Hs: 0.40 m StdDev. Tp: 2.08 s
Significant Wave Height / 1/10 Wave Height

Peak Wave Period / Mean Wave Period

Peak Wave Direction / Mean Wave Period

Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP2 Period3 [151° 39.140E , 23° 05.734S]
Data period: June 2019 (14−Jun−2019 to 30−Jun−2019)
Data source: AWAC
Data summary: June 2019
Number of Records: 397
Missing data (%): 0.00

Key Data Statistics:
Max Hs: 3.87 m  Max Tp: 14.60 s
Mean Hs: 1.25 m  Mean Tp: 6.94 s
StdDev. Hs: 0.76 m  StdDev. Tp: 2.60 s
**Significant Wave Height / 1/10 Wave Height**

- **Metros (m)**

**Peak Wave Period / Mean Wave Period**

- **Seconds (s)**

**Peak Wave Direction / Mean Wave Period**

- **Degrees (°)**

---

**Data Information:**
- Project: 301001-02112 Douglas Shoal Remediation Project
- Location: ADCP2 Period3 [151° 39.140 E, 23° 05.734 S]
- Data period: July 2019 (01-Jul-2019 to 31-Jul-2019)
- Data source: AWAC
- Data summary: July 2019
- Number of Records: 744
- Missing data (%): 0.00

**Key Data Statistics:**
- Max Hs: 3.92 m
- Mean Hs: 1.29 m
- StdDev. Hs: 0.76 m
- Max Tp: 16.50 s
- Mean Tp: 9.17 s
- StdDev. Tp: 3.25 s

---

**Wave Summary July 2019**
Significant Wave Height / 1/10 Wave Height

Peak Wave Period / Mean Wave Period

Peak Wave Direction / Mean Wave Period

Data Information:
Project: 301001−02112 Douglas Shoal Remediation Project
Location: ADCP2 Period3 [151° 39.140E , 23° 05.734S]
Data source: AWAC
Data summary: August 2019
Number of Records: 584
Missing data (%): 0.00

Key Data Statistics:
Max Hs: 2.17 m    Max Tp: 14.60 s
Mean Hs: 1.09 m    Mean Tp: 6.63 s
StdDev. Hs: 0.42 m    StdDev. Tp: 2.82 s

Wave Summary August 2019
Appendix I
ADCP2: Wave Rose, Histogram and Joint Frequency Table Plots
**Wave Height for ADCP2 Location**

**Period 2**

**Directional Distribution**

**Wave Height Distribution**

---

### JFT (%) of Hs against Direction for the period 16-Mar-2019 to 13-Jun-2019

| N=2140 | N  | NNE | NE  | ENE | E   | ESE | SE  | SSE | S   | SSW | SW  | WSW | W   | WWN | NW  | NNW | Total | Cumul. |
|--------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|--------|
| 0-1    | 0.05 | 0.80 | 5.43 | 11.32 | 4.82 | 0.80 | 0.42 | 0.61 | 0.09 | 0.09 | 0.05 | 0.09 | 0.09 | 0.09 | 0.09 | 25.08 | 100.00 |
| 1-2    | 0.14 | 1.82 | 8.94 | 20.68 | 12.63 | 2.62 | 1.68 | 2.06 | 1.22 | 0.19 | 0.23 | -   | 0.14 | 0.14 | 0.14 | 0.14 | 0.05  | 52.69 | 74.92 |
| 2-3    | 0.05 | 1.22 | 4.73 | 7.44  | 6.79 | 1.40 | 0.19 | 0.19 | 0.05 | -   | -   | -   | -   | -   | -   | -   | 22.04 | 22.23 |
| 3-4    | -   | -   | 0.09 | 0.09 | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | 0.19  | 0.19  |
| 4-5    | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     |
| 5-6    | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     |
| 6-7    | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     |
| 7-8    | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     |
| 8-9    | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     |
| 9-10   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     |
| >10    | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -     | -     |
| Total  | 0.23 | 3.84 | 19.19 | 39.54 | 24.24 | 4.82 | 2.29 | 2.85 | 1.36 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.14  | -     | -     |
| Cumul. | 0.23 | 4.07 | 23.26 | 62.80 | 92.04 | 91.86 | 94.15 | 97.01 | 98.36 | 98.64 | 98.92 | 99.03 | 99.30 | 99.58 | 99.86 | 100.00 | -     | -     |

* denotes values less than 0.01%  
- denotes no records in bin

**Data Information:**
- Project: 301001-02112
- Location: ADCP2 [151° 38.132' E, 23° 06.730' S]
- Data source: ADCP2 Period 2
- Data summary: Complete
- Number of Records: 2140
- Missing data (%): 0.00
- Calm (% < 0.01m): 0.00

**Key Data Statistics:**
- Max Hs: 3.59 m
- Mean Hs: 1.46 m
- StdDev. Hs: 0.56 m
**Wave Period for ADCP2 Location**

**Period 2**

---

### JFT (%) of Tp against Direction for the period 16-Mar-2019 to 13-Jun-2019

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<th>3-6</th>
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<th>18-21</th>
<th>21-24</th>
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</tbody>
</table>

* denotes values less than 0.01%  
- denotes no records in bin

---

**Data Information:**
- **Project:** 301001-02112
- **Location:** ADCP2 [151° 39.132' E, 23° 05.730' S]
- **Data period:** All data (16-Mar-2019 to 13-Jun-2019)
- **Data source:** ADCP2 Period 2
- **Data summary:** Complete
- **Number of Records:** 2140
- **Missing data (%):** 0.00

**Key Data Statistics:**
- **Max Tp:** 14.60 s
- **Mean Tp:** 7.41 s
- **SkewDev. Tp:** 2.61 s

---

**Advisian**
Worley Group
Wave Height for ADCP2 Location
Period 3

Directional Distribution

Wave Height Distribution

JFT (%) of Hs against Direction for the period 14-Jun-2019 to 25-Aug-2019

Data Information:
Project: 301001-02112
Location: ADCP2 [151° 39.140' E, 23° 05.734' S]
Data period: All data (14-Jun-2019 to 25-Aug-2019)
Data source: ADCP2 Period 3
Data summary: Complete
Number of Records: 1725
Missing data (%): 0.00
Calm (% < 0.01m): 0.00

Key Data Statistics:
Max Hs: 3.92 m
Mean Hs: 1.21 m
StdDev. Hs: 0.87 m
Wave Period for ADCP2 Location

Period 3

Directional Distribution

Wave Period Distribution

JFT (%) of Tp against Direction for the period 14-Jun-2019 to 25-Aug-2019

| Period | N  | NNE | NE  | ENE | E   | ESE | SE  | SSE | S   | SSW | SW  | WSW | W   | WNW | NW  | NNW | Total | Cumul |
|--------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-------|
| 0-3    | 0.06 | -   | 0.12 | 0.70 | 0.70 | 0.23 | 0.12 | -   | 0.23 | 0.17 | 0.06 | 0.23 | 0.06 | -   | 0.17 | 0.06 | 2.90 | 100.00 |
| 3-6    | -   | 0.06 | 0.64 | 2.72 | 6.67 | 3.54 | 3.01 | 3.42 | 4.12 | 1.86 | 0.58 | 0.87 | 0.58 | 0.70 | 0.87 | 0.12 | 29.74 | 97.10 |
| 6-9    | 0.06 | 0.58 | 3.88 | 10.32 | 12.93 | 3.71 | 0.12 | -   | -   | -   | -   | -   | -   | -   | -   | 0.06 | 31.65 | 67.36 |
| 9-12   | 0.12 | 1.10 | 2.43 | 6.43 | 10.38 | 5.51 | 0.75 | 0.12 | -   | -   | -   | -   | -   | -   | -   | -   | 26.84 | 35.71 |
| 12-15  | 0.17 | 0.23 | 0.64 | 2.26 | 2.32 | 2.26 | 0.70 | 0.06 | -   | -   | -   | -   | -   | -   | -   | -   | 8.64  | 8.87  |
| 15-18  | -   | -   | 0.06 | -   | -   | 0.17 | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | 0.23  | 0.23  |
| 18-21  | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -     |
| 21-24  | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -     |
| 24-27  | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -     |
| >27    | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -     |
| Total  | 0.41 | 1.97 | 7.77 | 22.43 | 32.99 | 15.42 | 4.70 | 3.59 | 4.35 | 2.03 | 0.64 | 1.10 | 0.64 | 0.70 | 1.04 | 0.23 | 4.70  | 99.77 |

* denotes values less than 0.01%  
- denotes no records in bin

Data Information:
Project: 301001-02112  
Location: ADCP2 [151° 39.140’ E , 23° 05.734’ S]  
Data period: All data (14-Jun-2019 to 25-Aug-2019)  
Data source: ADCP2 Period 3  
Data summary: Complete  
Number of Records: 1725  
Missing data (%): 0.00

Key Data Statistics:
Max Tp: 10.50 s  
Mean Tp: 7.80 s  
StdDev Tp: 3.20 s

Advisian
Worley Group