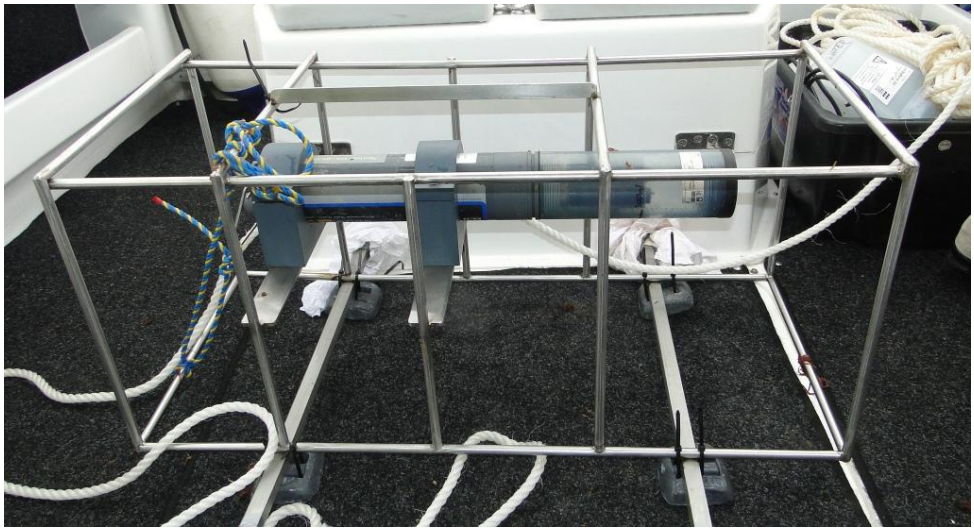
# ADELAIDE DESALINATION PROJECT



## Water temperature, pH and dissolved oxygen water quality data from the ADP marine exclusion zone

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Report prepared by

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# 1 Introduction

In December 2007, the South Australian Government announced the proposal to construct a reverse osmosis seawater desalination plant at Port Stanvac. The Adelaide Desalination Project was initiated to provide metropolitan Adelaide with a sustainable and secure supply of drinking water. The project aims to deliver a climate independent water source that will supplement and secure the metropolitan area's water supply and reduce the reliance on traditional water sources, such as the River Murray.

A multi-national consortium, AdelaideAqua, compromising McConnell Dowell Constructors, Abigroup Contractors, ACCIONA Agua, and Trility, were awarded the contract to design, build, operate and maintain the plant for 20 years. As of December 2012, the plant has become fully operational producing drinking water which is used by SA Water to supply metropolitan Adelaide.

Port Stanvac was selected as the preferred site for the Adelaide Desalination Plant (ADP) due to accessibility of relatively deep seawater, good oceanographic dispersion characteristics, its proximity to the water supply network, suitable land availability and lower construction costs.

The initial development phase of the Adelaide Desalination Project identified a number of important environmental issues to take into consideration when operating the plant (EIS 2008), in particular minimising the impact of discharging saline concentrate into the sea.

Concerns were raised by the public, in the initial development of the project, in regards to the potential reduction of dissolved oxygen at the seabed due to the discharge of saline concentrate into the region (EIS Response Document 2009). The risk of depleting oxygen on the seabed was considered low but to provide assurance that dissolved oxygen (DO) concentrations in the region were remaining above 6 mg/L (EPA Water Quality criteria for the protection of marine ecosystems), it was proposed that *in situ* measurments of DO concentrations should be incorporated into the monitoring program.

The EPA Licence (26902) granted to Adelaide Aqua to operate the desalination plant stipulates that DO and pH must be monitored twice per month for at least 24 hours under a variety of different operational modes and receiving environment conditions.

The scope of this study is to characterise ambient DO and pH concentrations on the seafloor, approximately 100 metres from the ADP diffuser, for periods greater than 24 hours under different plant operational modes and receiving environment conditions.

# 2 Methods

## 2.1 *In situ* water quality assessment

*In situ* water quality is assessed using a YSI 6600 series V4 sonde (instrument specifications provided in Table 1), that measures a variety of different parameters. The parameters measured include:

- Dissolved Oxygen (mg/L and percent saturation);
- pH; and
- Water temperature (degrees Celsius)

The sonde is fixed within a stainless steel cage (see cover photo) and lowered to the seafloor, approximately 100 metres south of the ADP diffuser. Water quality data are logged and stored every ten minutes, which includes the instruments depth (metres). The depth data provides information on tidal movement during day, as the instrument is fixed 0.50 m above the seafloor, thus any change in depth is directly related to either tidal or swell patterns during the day.

## 2.2 Instrument Specifications

Table 1. **YSI 6600 series V4 sonde specifications detailing range, accuracy and resolution**

| Parameter | Sensor Type | Range | Accuracy | Resolution |
|---|---|---|---|---|
| **Water temperature** | Thermistor | -5 to 45 $^{o}$C | +/- 0.15 $^{o}$C | 0.01 $^{o}$C |
| **Dissolved Oxygen** | Optical, Luminescence lifetime | 0-50 mg/L | +/- 1% of reading or 0.1 mg/L (whichever is greater) | 0.01 mg/L |
| **pH** | Glass combination electrode | 0-14 units | +/- 0.2 | 0.01 units |

## 2.3 Quality Control/Assurance

Individual sensors are calibrated before each sampling trip, using procedures outlined in the YSI technical manual. pH standards are prepared by AWQC's Analytical Quality Control Laboratory to ISO 9001 requirements.

## 2.4 Data analysis

The data are presented in a graphical format comparing changes in tidal variation to changes in pH (pH units), DO (% saturation) and water temperature ($^{o}$C).

The water quality data are summarised for each sampling period as:

- Maximum and minimum average daily range
- Maximum daily variation
- Average daily variation

# 3 Results

## 3.1 Plant operations

A YSI sonde was remotely deployed on the seafloor, 100 metres from the Adelaide Desalination Plant outfall, from the 1st March to the 14th March 2014. During this period, the desalination plant was operational, producing on average 286 ML of drinking water per day. The saline concentrate discharged to the marine environment during this time, had an average salinity concentration of 71 ppt. Daily volumes of saline concentrate discharged into the marine environment during the sonde deployment ranged from minimum 226 MLD (1st March) to a maximum of 330 MLD (9th March).

## 3.2 Dissolved oxygen

The average daily percent oxygen saturation ranged between 103 % to 107 %. Maximum daily variation was 14 % (4th March; Figure 2). Average daily variation was 9 %.

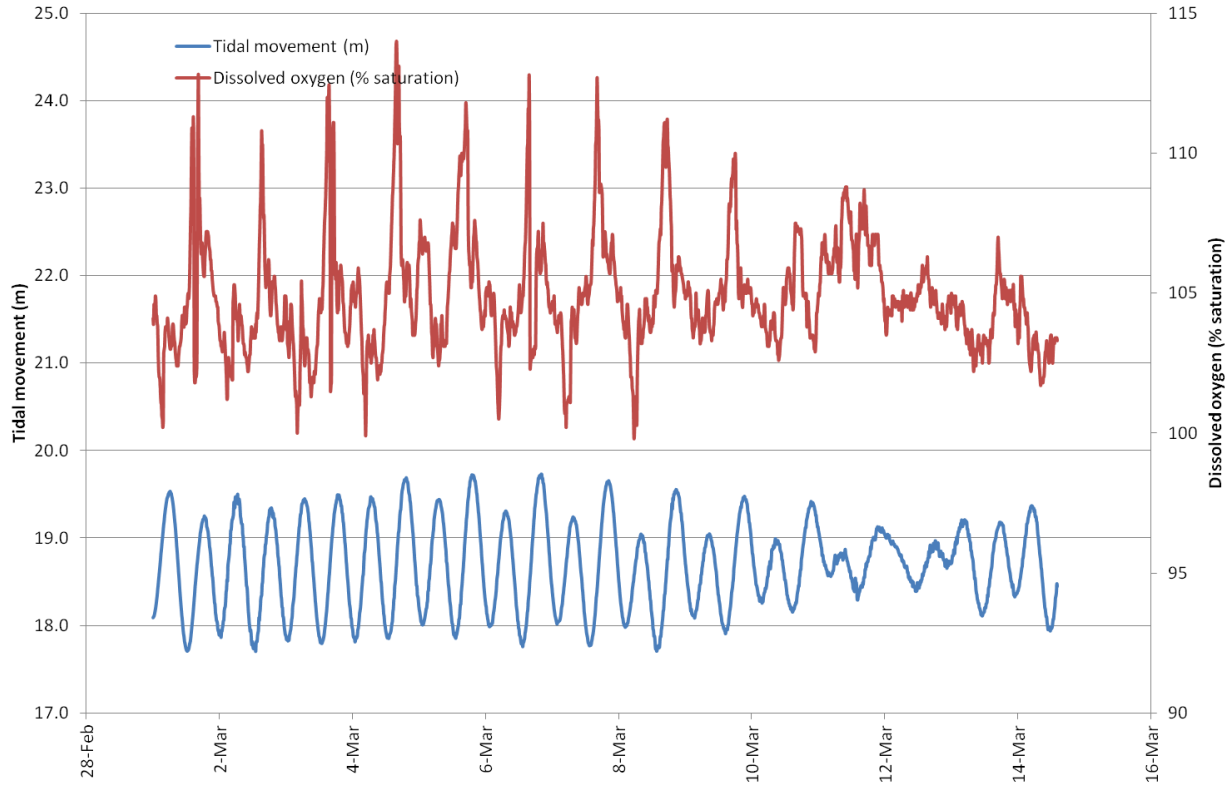


**Figure 2**. Changes in dissolved oxygen (%) with tidal movement (m) over 14 days, from 1st March to 14th March 2014.

The daily average dissolved oxygen concentration ranged between 7.3 mg/L to 7.4 mg/L. Maximum daily variation was 1.1 mg/L (4th March; Figure 3). Average daily variation was 0.6 mg/L.

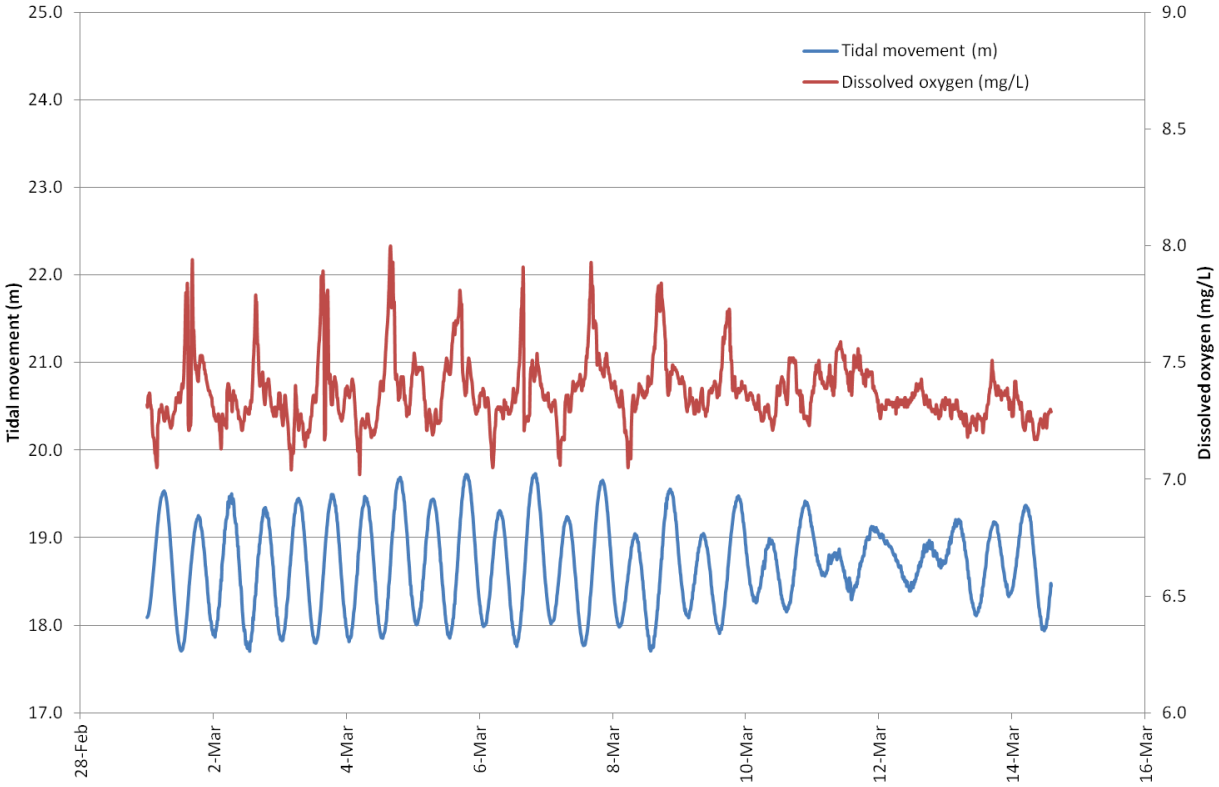


**Figure 3**. Changes in dissolved oxygen (mg/L) with tidal movement (m) over 14 days, from 1st March to 14th March 2014.

## 3.3 pH

The daily average pH was 8.0. Maximum daily variation was < 0.1 (Figure 4). Average daily variation was < 0.1.

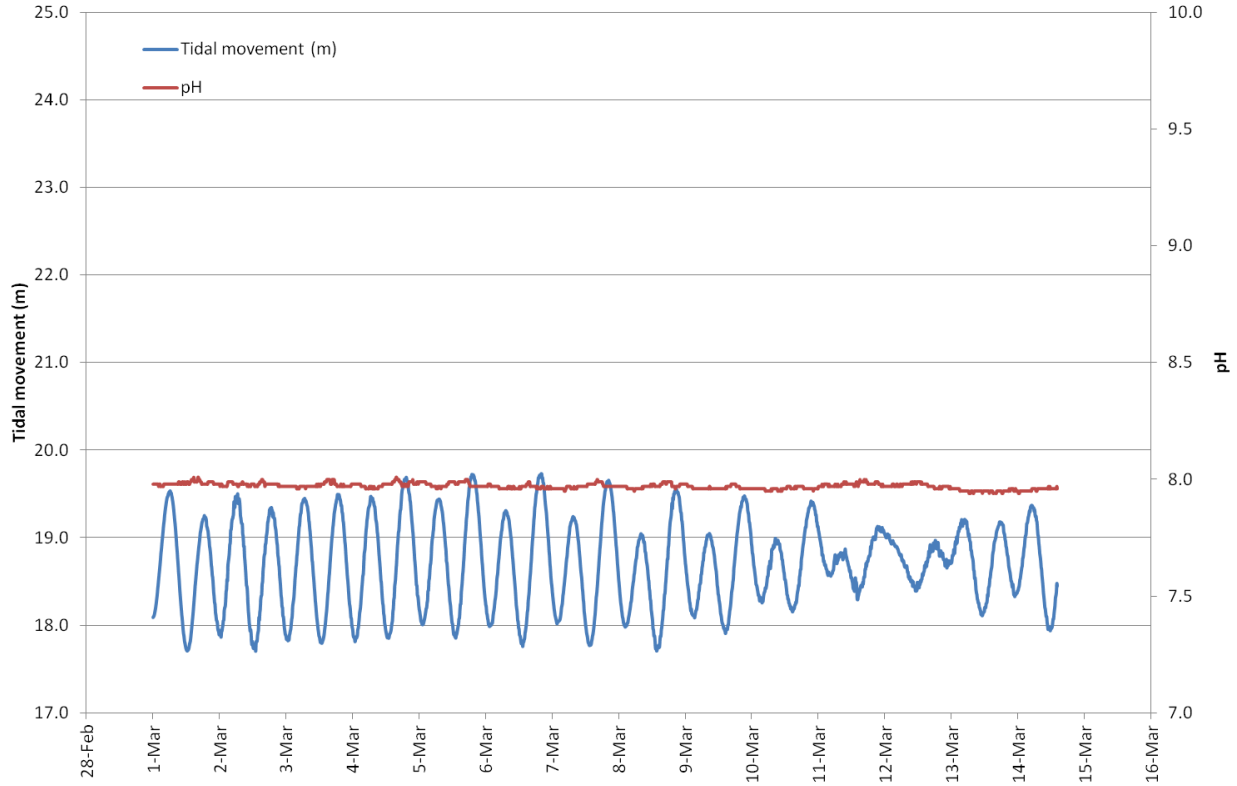


**Figure 4**. Changes in pH with tidal movement (m) over 14 days, from 1st March to 14th March 2014.

## 3.4 Water temperature

The daily average temperature value ranged between 21.0°C and 21.6°C. Maximum daily variation was 0.6°C (11th March; Figure 5). Average daily variation was 0.3°C.

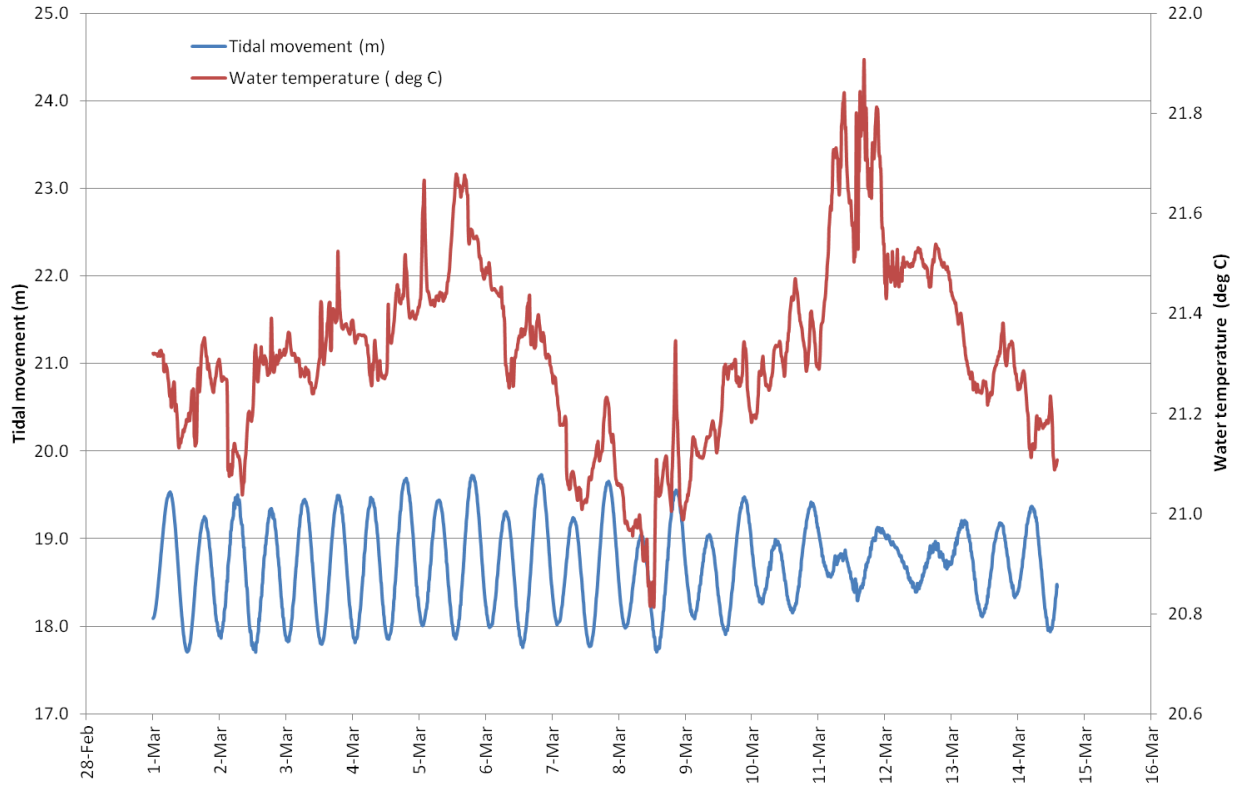


**Figure 5**. Changes in dissolved temperature (°C) with tidal movement (m) over 14 days, from 1st March to 14th March 2014.