Gladstone Turbidity Data Summary

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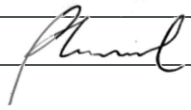
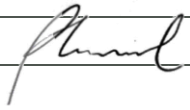
Synopsis: This report summarises the available turbidity and suspended sediment data that has been collected within the Port of Gladstone. The quality and usefulness of each dataset is discussed, and the data is analysed in the context of ambient conditions in the Port.

REVISION/CHECKING HISTORY

Revision Number	Date	Checked by		Issued by	
00	01/05/2019	PAG		PAG	

DISTRIBUTION

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	0	1	2	3	4	5	6	7	8	9	10
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Contents

List of Figures

1 Introduction

The turbidity and suspended sediment levels within Port Curtis have been the subject of a large number of field measurement campaigns, and this report summarises the timing, quality, location and depth of each measurement record.

A timeline of measurements within the Port has been constructed, together with information on the timing of relevant dredging activities and significant weather events that could have influenced each of the measurement records. The refined dataset will be used to inform the Quantitative Sediment Budget and further calibrate the TUFLOW FV model.

Interpretation of the data records included:

- the use of suitable quality control and quality assurance protocols, inclusive of relevant metadata information, and
- an analysis of the data to understand the temporal and spatial variability and relative influence of metocean conditions and/or dredging activities

The datasets will enable a recalculation and refinement of the sediment budget created for the GBR-wide sediment budget produced for the Queensland Ports Association (BMT, 2018), when used together with the upgraded BMT TUFLOW FV model of Port Curtis.

2 Data Overview

Turbidity and suspended sediment datasets have been collected using a variety of measurement techniques and equipment. Long term deployments of bottom-mounted and surface-mounted instruments are preferred over spot measurements, due to the significant temporal variability of the turbidity within the Port. The following sections describe the different types of datasets that have been collected, and the timing of the data capture in relation to significant weather and dredging events in Gladstone. Not all historical datasets are included in this summary, since many are no longer useful due to major changes in Port bathymetry and infrastructure. For a comprehensive summary of all turbidity data collected in Port Curtis, refer to Appendix H1 of the Gatcombe and Golding Cutting Channel Duplication Project Environmental Impact Statement (EIS) (Aurecon, 2019).

2.1 Timeline of Data Capture

An overall timeline of the most important turbidity datasets in the Port of Gladstone is presented in Figure 2-1 and Figure 2-2. The table includes continuous turbidity measurements undertaken between 2009 and 2019. Datasets collected prior to 2009 (and which are not representative of current Port conditions) are described in Appendix K of the Western Basin Dredging and Disposal Project EIS (GHD, 2009).

The measurement locations are shown in Figure 2-3.

Data Overview

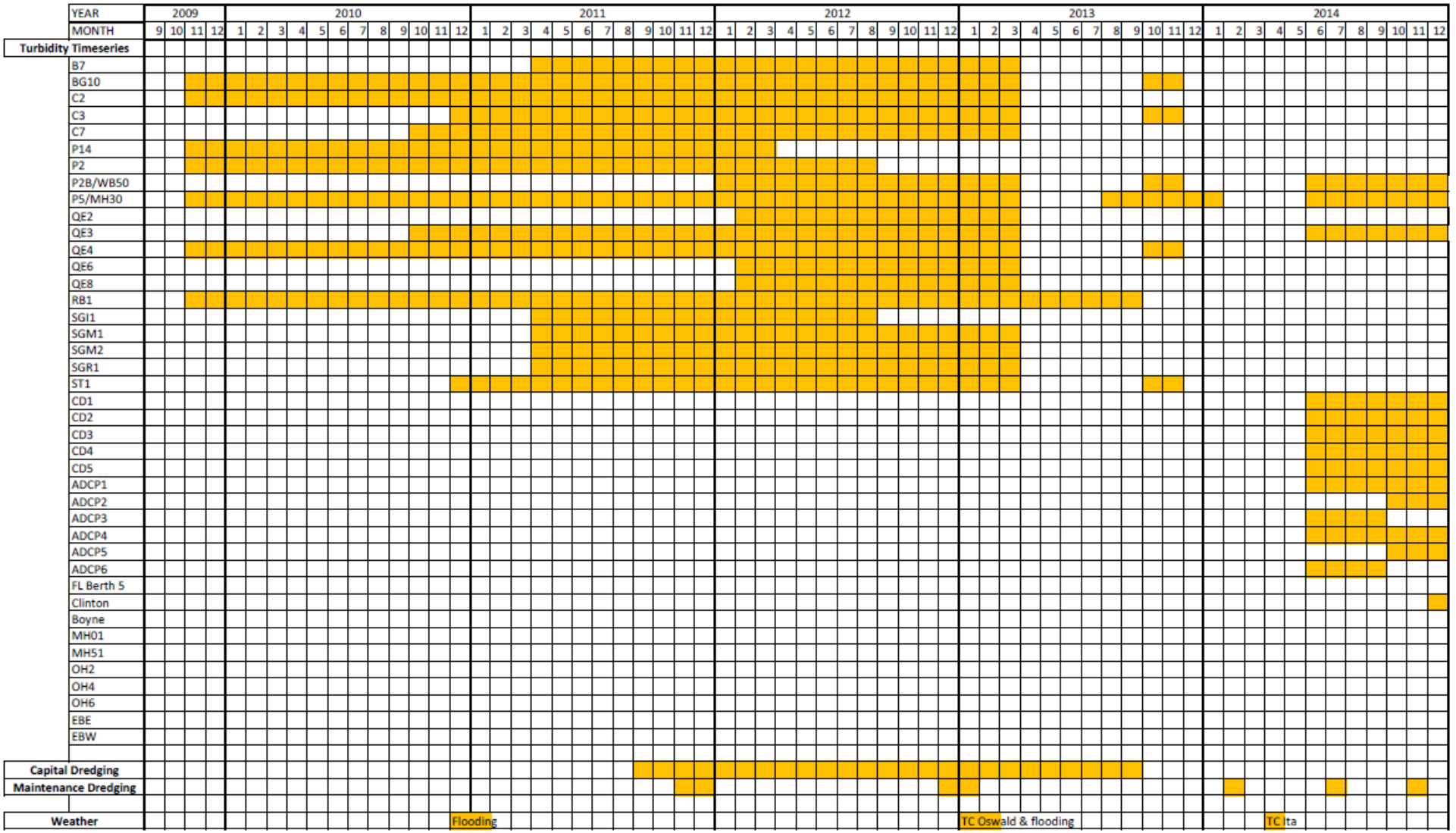


Figure 2-1 Data Capture Summary (2009 – 2014)

Data Overview

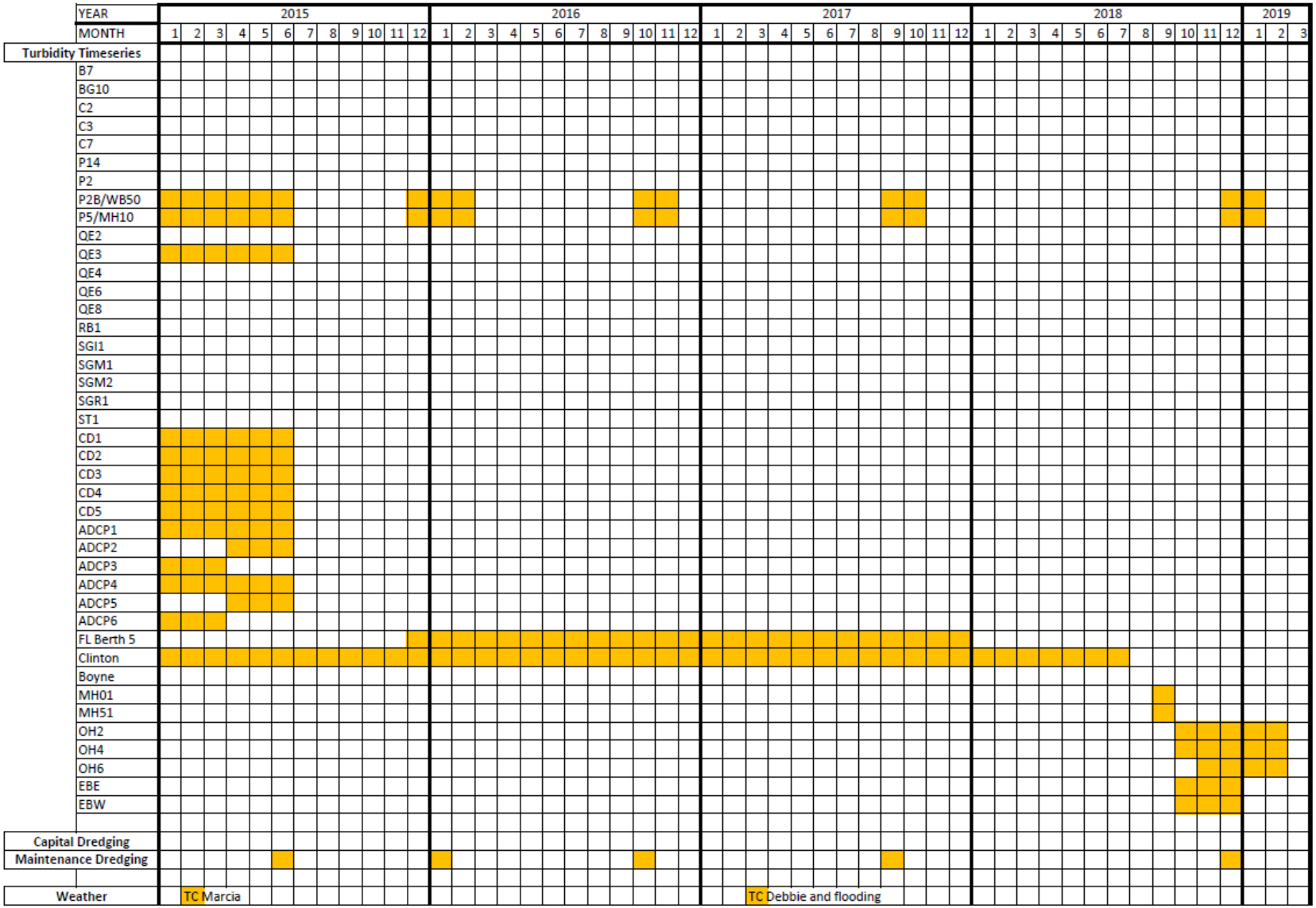
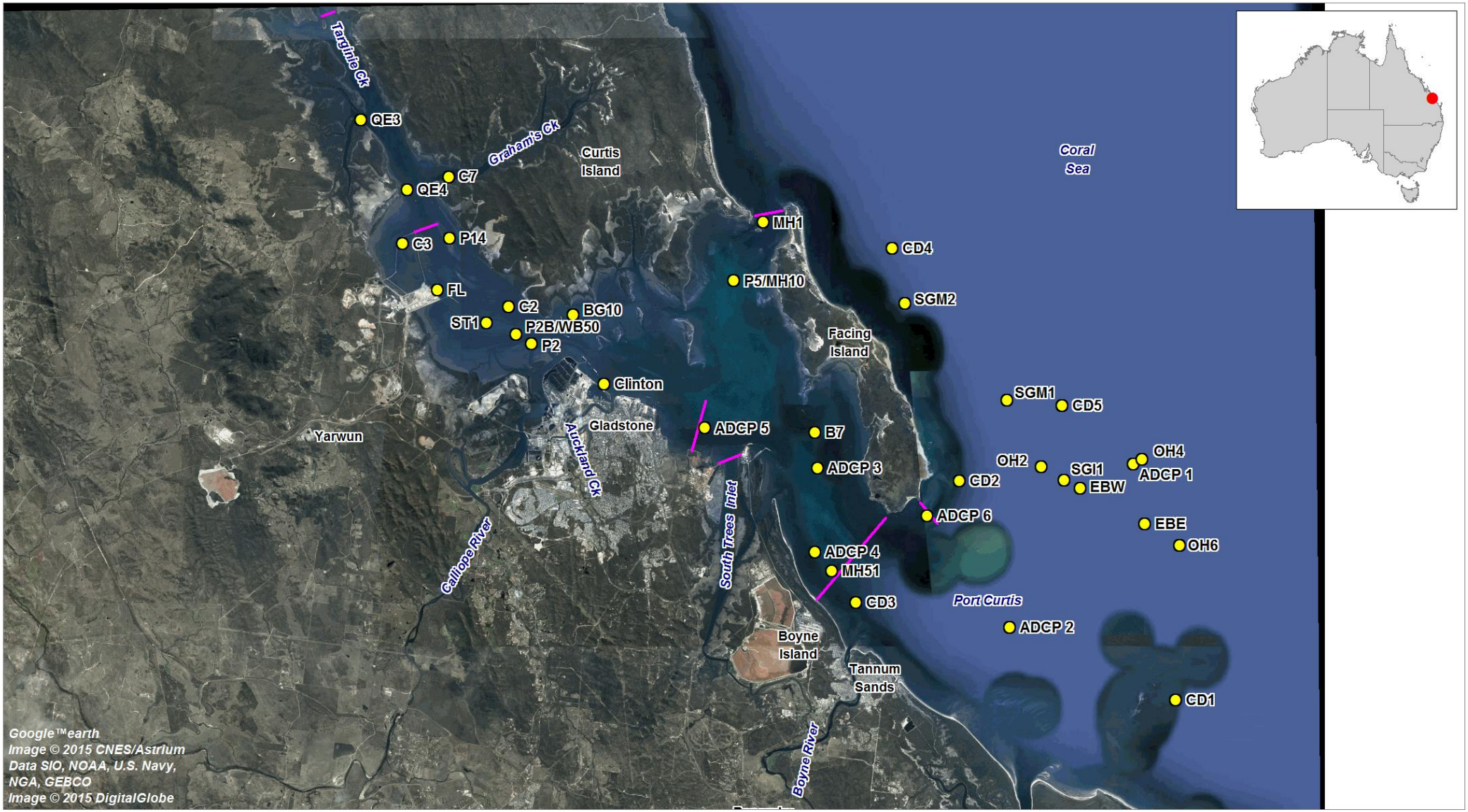


Figure 2-2 Data Capture Summary (2015-2019)



LEGEND

- Instrument Location
- ADCP Transect

Title:

Measurement Locations

Figure: **2-3**

Rev: **A**

N

0km 5 10

Approx. Scale

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Filepath: I:\B20020.l.clw_Gladstone_Channel_Duplication\DRG\COA_001_150225_Measurement Locations.WOR

2.2 Continuous Turbidity Measurements

2.2.1 Vision Environment Data Capture – November 2009 to September 2010

Prior to the commencement of dredging for the Western Basin Dredging and Disposal Project (WBDDP), turbidity data was collected at a large number of sites in Port Curtis for the purposes of establishing the background water quality conditions. Results from this dataset were used to develop the WBDDP Water Quality Management Plan.

This dataset is representative of typical conditions in Port Curtis, and was not significantly affected by extreme rainfall events or large dredging projects.

2.2.2 Vision Environment Data Capture – October 2010 to March 2013

Turbidity monitoring undertaken during the WBDDP was influenced by large scale dredging operations and turbidity generated associated with construction of the Western Basin Reclamation Area in mid-2011. For this reason it is not preferred for use as a model validation dataset, due to uncertainties surrounding the rate of project-related suspended sediment generation.

2.2.3 Vision Environment Data Capture - June 2014 to July 2015

As part of background monitoring undertaken for the Gatcombe and Golding Cutting Channel Duplication EIS, Vision Environment collected turbidity data at six sites (P2B, P5, QE3, CD1, CD2, CD3, CD4 and CD5) using two Aqualab DS5X water quality sondes approximately 0.75m below the surface of the water column. At the CD sites (1-5), an additional two Aqualab DS5X water quality sondes recorded the turbidity approximately 1m above the seabed.

This dataset is regarded as the most useful source of validation data for the TUFLOW FV model, since it involved the use of co-located nephelometers for quality checking purposes and the background conditions during this period were broadly representative of long-term typical conditions in Port Curtis.

2.2.4 BMT Data Capture - June 2014 to July 2015

BMT deployed nephelometers approximately 1m above the seabed together with bottom-mounted ADCP equipment at the sites labelled ADCP1 to ADCP6 in Figure 2-3. At ADCP1 and ADCP4, twelve months of data was collected, while at the remaining locations six months of data was collected. There is some evidence of fouling-related bias in some of the data collected at these sites after the instrument has been in the water for some time (the servicing interval was three months).

2.2.5 GPC Data Capture – December 2014 to Present

GPC have deployed turbidity measurement devices at the Fishermans Landing and Clinton wharf locations, and the intention is to continue these measurements in the long term, together with another instrument deployed at the Boyne wharf.

2.3 Profile and Spot Measurements

A large number of profile measurements of turbidity, salinity and temperature have been made in association with multiple data collection campaigns undertaken as part of environmental impact assessment work. These datasets are less useful for model calibration purposes because of the high temporal variability of the turbidity within the estuary. However, they serve a very useful purpose when calibrating the vertical variation in salinity and temperature during periods of significant stratification of the water column (usually only significant during floods in Gladstone). It is also useful data for calibrating the variation of the turbidity levels within the water column in the 3D model.

2.4 ADCP Transect Measurements

BMT has undertaken measurements of turbidity within turbid plumes generated during maintenance and capital dredging activities on a number of occasions (July 2011, July-November 2012, February, June and November 2014, September 2017 and December 2018). A boat-mounted ADCP was used in combination with turbidity profile measurements and water samples analysed in the laboratory to determine the spatial and temporal variation in plume concentration. These measurements are very useful for characterising the particle size distribution of plume sediment and to assist in the calibration and validation of plume release source rates in the model.

3 Data Processing

3.1 Continuous Turbidity Measurements

Each of the continuous turbidity measurement data sets have been through a quality control process where obvious errors (due to fouling or sensor problems) have been removed. Each data set has been converted into a consistent CSV file format with column headers indicating the content of each data column, so that the data can easily be imported into visualisation software, plotted in comparisons with model output or archived for later use.

The column headers that have been adopted for the purposes of this study are:

Site, Lat, Long, Date, Data_Type, Variable, Value, Units

Site: the name of the deployment location

Lat: latitude of deployment location

Long: longitude of deployment location

Date: date and time of measurement

Data_Type: for these measurements, this field contains information on the vertical position of the measurement (e.g. Surface or Benthic)

Variable: the variable being measured – i.e. turbidity

Value: measured value of the variable

Units: NTU in the case of these data sets

3.2 Data Viewers

Two different interactive online presentations of the collated turbidity data have been developed to show potential methods for storing and presenting the turbidity data.

3.2.1 DEEP

This BMT-developed system is particularly well suited for the presentation, manipulation and automated quality control of large datasets. The continuous datasets collected by Vision Environments during 2014-15 have been uploaded into the system, and the user can view the data in a number of ways and undertake simple statistical analysis of the data.

http://52.42.252.156:8080/appshomepage/#/home (password protected)

3.2.2 Tableau

Another simpler demonstration website has been set up to show a small subset of the turbidity data for a one-month period (January 2015). This simple web display shows a map of the data collection locations, simple statistical analysis of the data collected at each point, and the time series of each dataset allowing direct comparison between the data collected at each site.

https://public.tableau.com/profile/aditya.singh2484#!/vizhome/shared/W6GRC6YX5

4 References

GHD, 2009. Western Basin Dredging and Disposal Project Environmental Impact Statement. https://www.statedevelopment.qld.gov.au/assessments-and-approvals/port-of-gladstone-western-dredging-project-eis-documents.html

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