ASTUTE SURVEYING
HYDROGRAPHIC AND GPS SURVEYING

HYDROGRAPHIC & AERIAL SURVEY REPORT

Darwin, NT

MANDORAH

For

STANTEC

Surveyed on 10-11 oCTOBER 2022

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1. INTRODUCTION

Astute Surveying has been retained by Stantec to undertake investigation surveys for the planned upgrade to Mandorah Wharf, NT

Surveys were undertaken with Multibeam Echo Sounder and Drone, with processed 3d point data output.

The following Report details the survey equipment, methodology, processing, and results of the surveys.

2. ACRONYMS AND ABBREVIATIONS

AHD	Australian Height Datum
AS	Australian Standard
BM	Benchmark
CD	Chart datum
DGPS	Differential Global Positioning System
DTM	Digital Terrain Model
HAT	Highest Astronomical Tide
HSE	Health Safety Environment
HSSE	Health, Safety, Security and Environment
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
MSQ	Marine Safety Queensland
RTK	Real Time Kinematic
SIC	Surveyor In Charge
SVP	Sound Velocity Probe
VRF	Vessel Reference Frame
WGS94	World Geodetic System 1994

3. SURVEY OBJECTIVES

The survey objectives of the project were to accurately measure the seabed for depth using a multibeam echo sounder and accurately define the shoreline via aerial survey. This data will be used to aid in planning for the refurbishment of the Mandorah Wharf

4. CODES AND STANDARDS

Astute Surveying complied with the following standards:

- Principles for Gathering and Processing Hydrographic Information in Australia Ports – Ports Australia

5. SURVEY DATE

The survey was conducted on the 10-11th of October 2022.

6. PERSONNEL

The following personnel were used for this project

Surveyor in Charge (SIC) - Ben Gray BSpScTech H1
Greg Edwards (Survey Technician / Coxswain)

7. PROJECT HORIZONTAL AND VERTICAL DATUMS

The real-time corrections were transmitted from Smartnetaus via 4G modem. The basestation used was located at Mandorah (Smartnetaus - MDRH)

7.1 Horizontal Datum

The project horizontal datum was the Geocentric Datum of Australia 94 (GDA94) with grid coordinates projected onto the Map Grid of Australia 94 (MGA94) Zone 52

- Datum: Geocentric Datum of Australia 94 (GDA94)
- Reference Frame: International Terrestrial Reference Frame 1992 (ITRF92)
- Ellipsoid: GRS80
- Semi-major axis (a): 6,378,137.0 metres
- Inverse flattening (1/f): 298.257222101
- Projection: Map Grid of Australia 2020 (MGA2020)
- Projection Method: Universal Transverse Mercator (UTM),
- Zone: 52
- Latitude of Origin: 0° S
- Longitude of Origin: 129° E
- Scale factor at Origin: 0.9996
- False Easting: 500000m
- False Northing: 10000000m

7.2 Vertical Datum

The project levels are based on Lowest Astronomical Tide (LAT)

LAT is 4.105m below AHD

The geoid for this project is based on AusGeoid09

8. SURVEY EQUIPMENT

8.1. Hydrographic & Aerial System

The hydrographic survey was carried out on the survey vessel “Hugh Vaughn” with the following equipment installed:

- Norbit Winghead i77h
- Trimble POSMV Oceanmaster
- Hypack Acquisition and Processing Software (2022)
- AML Sound Velocity Probe (SVP)
- 2 × Panasonic Toughbook's

The aerial survey was undertaken with a Phantom 4 RTK and post processed using Rec Catch

8. CALIBRATIONS AND FEILD CHECKS

Manual measurements were undertaken after the equipment had been installed. Following this a GAMS calibration was undertaken to determine the antenna offsets and heading accuracy of the system.

A patch test was undertaken prior to the start of survey with the angular corrections calculated

Our RTK GPS was placed over a local survey mark at Mandorah and checked for position and height accuracy. Once satisfied check points were collected along the shoreline and compared to the aerial and multibeam survey data.

Surveys data from the aerial survey and the multibeam survey were compared and found to be within survey tolerances (better than 10cm in height and position)

9. SURVEY PROCEDURES

Once the bracket has been lowered into place testing of all equipment can commence. The sound velocity probe is lowered to the sea floor and retrieved from the water and downloaded.

The survey software is setup with the instrument offsets and geodetic parameters with run lines setup.

The Multibeam Beam settings are changed for depth and ensonification of the sea floor, pulse per second timing checked.

The aerial survey was undertaken in the middle of the day to reduce shadowing and was flown at a height of 100m. 80% forward and 80% Side overlap

Approximately 1000 photos were captured

9.1 Accuracy of survey

Horizontal ±1.0m
Vertical ± 0.15m

Note: Although these are the stated accuracy for the Australian standards, our surveys are far more accurate as demonstrated from the position check and the beam angles for working depth of the project.

Estimated Accuracy:

Horizontal ±0.1m
Vertical ± 0.1m

9.2 Sounding Lines

The run lines were displayed in Hypack survey software enabling the helmsmen to navigate along the predefined line. The survey was conducted at 3-4 knots.

The survey was conducted 100% swath overlap perpendicular to the shoreline with backscatter data collected simultaneously.

9.3 Tidal Data

The Hypack software package logged tidal height data relative to LAT. This data was calculated using real time kinematic corrections transmitted from the GPS basestation to the survey vessel GPS. The offset from antenna to water level gave a relative tide height (RL of water level). This data formed a tidal data base which was used in the processing of the raw data to reduce all soundings relative to LAT.

9.4 Sound Velocity

The sound velocity in the water column at the survey site was very uniform with an average sound velocity of 1547.13m/s

9.5 Data Logger & Processing

The navigation processor and data logger consisted of a laptop computer system. All digital navigation and bathymetry data was logged to hard disc, time tagged and uniquely annotated. The system provided a left/right indicator display for the vessel helmsman to assist in tracking the vessel along the run lines.

9.6 Records

All digital bathymetric and navigation data is retained by Astute Surveying on back up media.

10. WEATHER AND SEA CONDITIONS

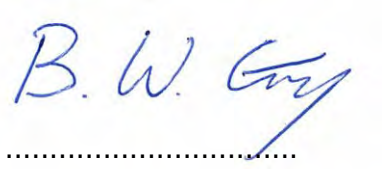
The weather conditions for the surveys were calm with clear skies. Hydrographic survey was conducted at high tide, aerial survey was conducted at low tide.

13. DATA SETS DELIVERED

1. 20221011 - Mandorah Aerial Survey Decimated MGA94_CD - Croped.laz
2. 20221011 - Mandorah Aerial Survey MGA94.tfw
3. 20221011 - Mandorah Aerial Survey MGA94.tif
4. 20221011 - Mandorah Backscatter.tfw
5. 20221011 - Mandorah Backscatter.tif
6. 20221011 - Mandorah Colour Gradient Model - Hydro and Aerial.tfw
7. 20221011 - Mandorah Colour Gradient Model - Hydro and Aerial.tif
8. 20221011 - Mandorah Hydro Survey 0.25m grid MGA94.tfw
9. 20221011 - Mandorah Hydro Survey 0.25m grid MGA94.tif
10. 20221011 - Mandorah Raw Hydro Survey 0.25m grid - MGA94_CD.xyz
11. Mandorah 1m Contours.DXF
12. Mandorah Prelim Data.pdf
13. Mandorah Survey Areas.dxf
14. 20221011 - Mandorah Backscatter 001.pdf
15. 20221011 - Mandorah Hydrographic & Aerial 001.pdf

14. SIGN OFF

Astute Surveying Pty Ltd
11 November 2022.



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