Patawalonga River and Basin

Sediment Monitoring Pilot Project

March 19, 2014

Authored by: Daniel Denison and Frank Mangeruca

Patawalonga River and Basin

Table of Contents

Introduction 3

Instrumentation Specifications 4

Accuracy and Specifications SonTek M9 6

Survey Bench Marks 7

Methodology 9

Calibration Spot checks 10

Results and Discussion 12

Technical Issues Experienced 13

Figure .1 *The Patawalonga survey area* 2

Figure.2 *YSI M9 with RTK rotor head* 3

Figure.3 *Specifications chart of the YSI M9* 4

Figure.4 *RTK Base Station setup at Benchmark 66287679* 5

Figure.5 *Bench Mark used is a third order BM number 62824390* 6

Figure.6 *Bench Mark used is a third order BM number* 66287679 7

Figure.7 *Bench Mark used is a third order BM number* 66287532 7

Figure.8 *R and D; pairing M9 and R8 GPS system with custom cable and settings.* 8

Figure.9 *Transecting the Basin A in Kayak due to depth and access limitations* 9

Figure.10 *Spot check between YSI M9 and manual survey staff to confirm accurate consistancy* 10

Figure.11 Initial plot of all survey data; level is plotted by color in AHD (m). 12

Patawalonga River and Basin - *Sediment Monitoring Pilot Project*

Introduction

SMK Resource Monitoring Unit was approached by Adelaide and Mount Lofty Ranges (AMLR) NRM Region's Metro Unit (led by Rajiv Mouveri) to potentially deliver a ***sediment accumulation/characterisation survey and information product*** by 30 June 2014. Initially the scope of RMU work was to conduct bathymetric surveys of Basin A of the Patawalonga, shortly after surveying began the scope increased to bathymetric surveying Basin B and the entirety of the Patawalonga from the Northern Gates to the Glenelg Gates.

Basin A is a very important part of the urban storm water management system for metro Adelaide. It has a very large catchment that stretches all the way to the top of the Mount Lofty Ranges and, together with the associated Barcoo Outlet, plays a critical role in water quality improvement and flood mitigation.

Technical discussions with RMU team's Frank Mangeruca, Daniel Denison and Tom Stewart showed that RMU could effectively deliver the Bathymetric survey section of the project.

Fig.1: The Patawalonga survey area

Instrumentation Specification

SonTek M9

The SonTek M9 is a highly sophisticated, multifunctional hydrographic tool. Its primary role is the measurement of surface water discharge, however it equally capable of bathymetry surveying. The unit uses either a 0.5 Mhz vertical beam, or the average of 4 x dual frequency beams at 25 degree slant (3 Mhz/ 1Mhz) to measure depth profiles. The high frequency of operation provides almost negligible penetration and very high resolution. The SonTek M9 system can be paired with RTK system to provide very accurate absolute positioning.

Fig.2 YSI M9 with RTK rotor head

Accuracy and Specification of the YSI M9

Transducer Configuration	Nine (9) Transducers Dual 4-beam 3.0 MHz/1.0 MHz Janus at 25° Slant Angle 0.5 MHz Vertical Beam
Range	0.20 to 80m
Accuracy	1%
Resolution	0.001 m
Range with Bottom-Track	0.3 to 40m
Range with RTK GPS	0.3 to 80 m
Computations	Internal

Fig.3 Specifications chart of the YSI M9

Trimble R8

The Trimble R8 (RTK) Real Time Kinematic system is a tool used to enhance the precision of position data derived from satellite-based positioning systems being usable in conjunction with (GPS) Global Positioning Systems. It uses measurements of the signals carrier wave, rather than the information content of the signal, and relies on a signal reference station to provide real-time corrections, providing high level accuracy.

The accuracy of RTK is approximately <1cm compared to the more commonly used DGPS <1m accuracy.

Fig.4 RTK Base Station setup at Benchmark 66287679

Survey Benchmarks

The survey marks used were obtained from the Property Location Browser (PLB), which is a map based application in the Survey Database folder. This folder has the survey mark information including. Three survey Markers were used in this project BM 62824390, 66287679 and 66287532.

- coordinate and elevation values
- accuracy statements
- descriptive information
- references to connecting plans of survey and other documents

The survey database is updated principally from plans of survey lodged with Land Services Group. Information is also provided

- other government agencies
- local government
- the surveying community

Fig.5 Bench Mark used is a third order marker, BM number 62824390

Fig.6 Bench Mark used is a third order marker, BM number 66287679

Fig.7 Bench Mark used is a third order maker, BM number 66287532

Methodology

The primary instruments used for the Bathymetry data collection were the Sontek M9 using Hydroboard mount (essentially a custom boogie board) and Trimble R8 RTK GPS system. This would be towed by kayak in Basin A and other areas where the water was shallow and with protruding debris. Where possible in the lower reaches of the Patawalonga, a small powered punt would be used to save time.

The Sontek M9 system was used to profile the floor of the water body by collecting depth measurements with a multi beam acoustic sounder; this recorded a depth measurement approximately every second with associated GPS co-ordinates to give the XYZ data required for later processing and mapping.

After significant technical set up involving having a custom cable manufactured; the M9 system was paired to the Trimble R8 system, this allowed streaming RTK GPS data to the M9 system, improving accuracy to about <3cm horizontal. The standard DGPS system with the M9 has <1m accuracy so this was a vast improvement in data quality. The Trimble R8 RTK base station was set up on a known PSM.

Transects were run latitudinal and longitudinal with 1-2m spacing in the Basins, and 2-4m spacing in the lower Patawalonga. AHD water level data was collected using the RTK GPS approximately every 30 minutes so that AHD level of the water body floor could be accurately deduced in post processing.

Fig.8: Research and development; pairing M9 and R8 GPS system with custom cable and settings

Fig.9: Transecting the Basin A in Kayak due to depth and access limitations

Processing data

- Raw data from M9 system was exported to text file
- Raw WL data offset to AHD level
- Removed zero values
- Paired with lattitude and longitude
- Plotted with web app and google earth to give feedback on transect progress.

Calibration spot checks

Throughout the bathymetric surveying phase spot checks were carried out to confirm that the M9 depth measurement was correct. We achieved this by taking a manual reading using a survey staff and checking the results obtained by the M9. The manual readings were taken on firm concrete bottoms and also in suspended sediment and all cases the M9 provided to be reading correctly

Fig.10 Spot check between YSI M9 and manual survey staff to confirm accurate consistancy

Results / discussion

Surveying time was approximately 1 day per Basin and 3-4 days for the lower Patawalonga. All data collaborated and plotted on Google Earth shows extent of survey (fig.4). The processed data has been forwarded to Matt Royal for GIS manipulation such as contouring and producing a 2D and 3D map.

Technical Issues experienced

- The YSI M9 at times would drop out hence would not communicate with the RTK, this was frustrating in the initial stage of the project as it absorbed a considerable amount of time to reprogram the instrument. We have now resolved this issue by connecting an enhanced radio repeater which will have a broadcast strength of up to 20km.

- Due to shallow waters it was time consuming swapping between flat bottom boat to kayak to obtain depths less than 0.300m

- Setting up the RTK base station each time took over 1hour. It was also a risk leaving the equipment unattended as it could potentially be stolen.

- Boat accessibility was difficulty in parts of Basin A especially near gates.

- Water level measurements had to be taken regularly throughout the bathymetric surveys as the levels were highly variable to change.
- Bluetooth connection between the hand controller and the RTK rover unit must be in within close range to work; initially we had some issues with this connection. This was rectified by making sure that the controller was always in close proximity to the rover unit.

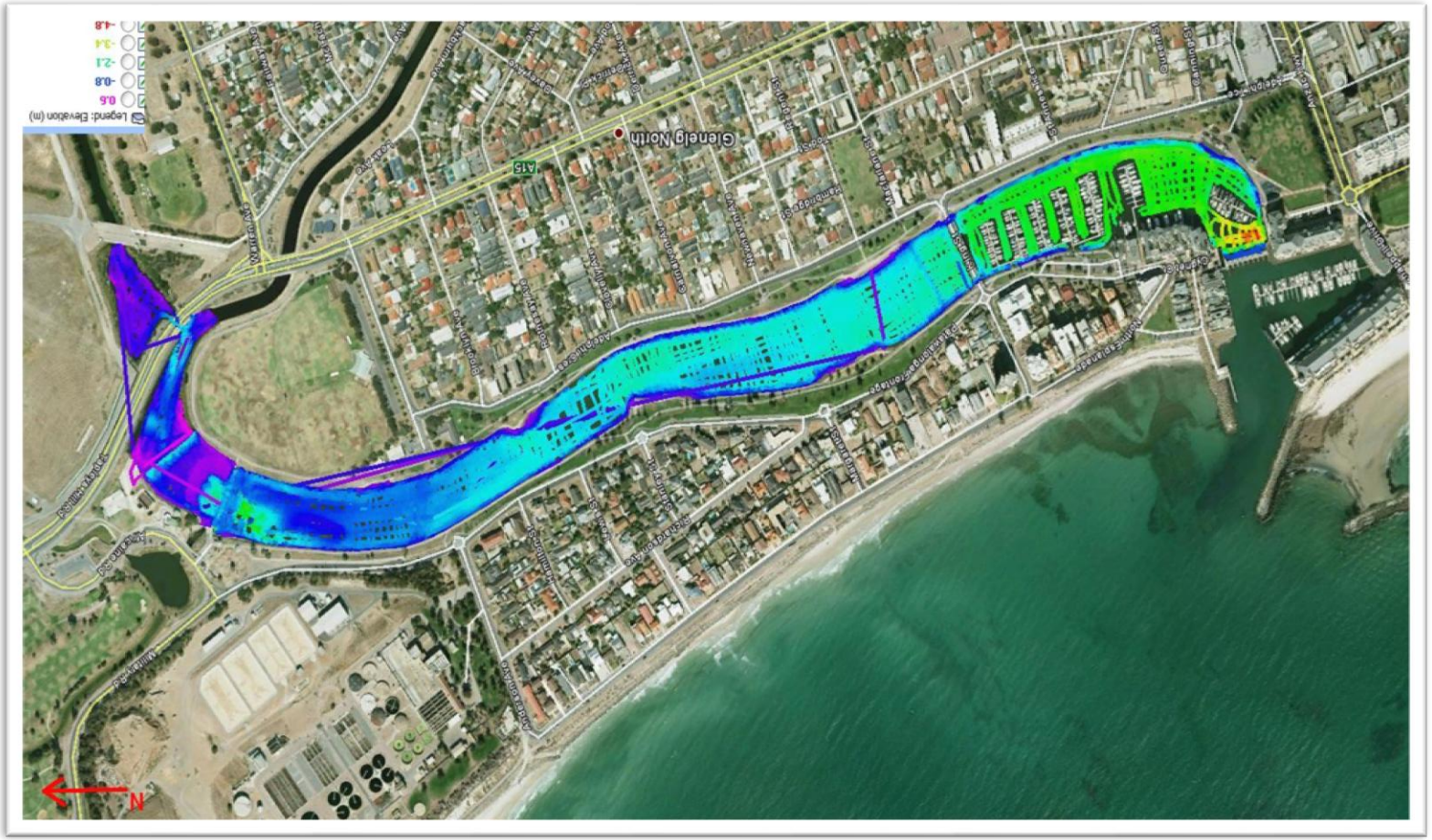
Legend: Elevation (m)
0.6
-0.8
-2.1
-3.4
-4.8
Glenelg North
A15
N

Fig.11: Initial plot of all survey data; level is plotted by color in AHD (m). Matt Royal will be producing a 2D and 3D contoured map as a finished product.