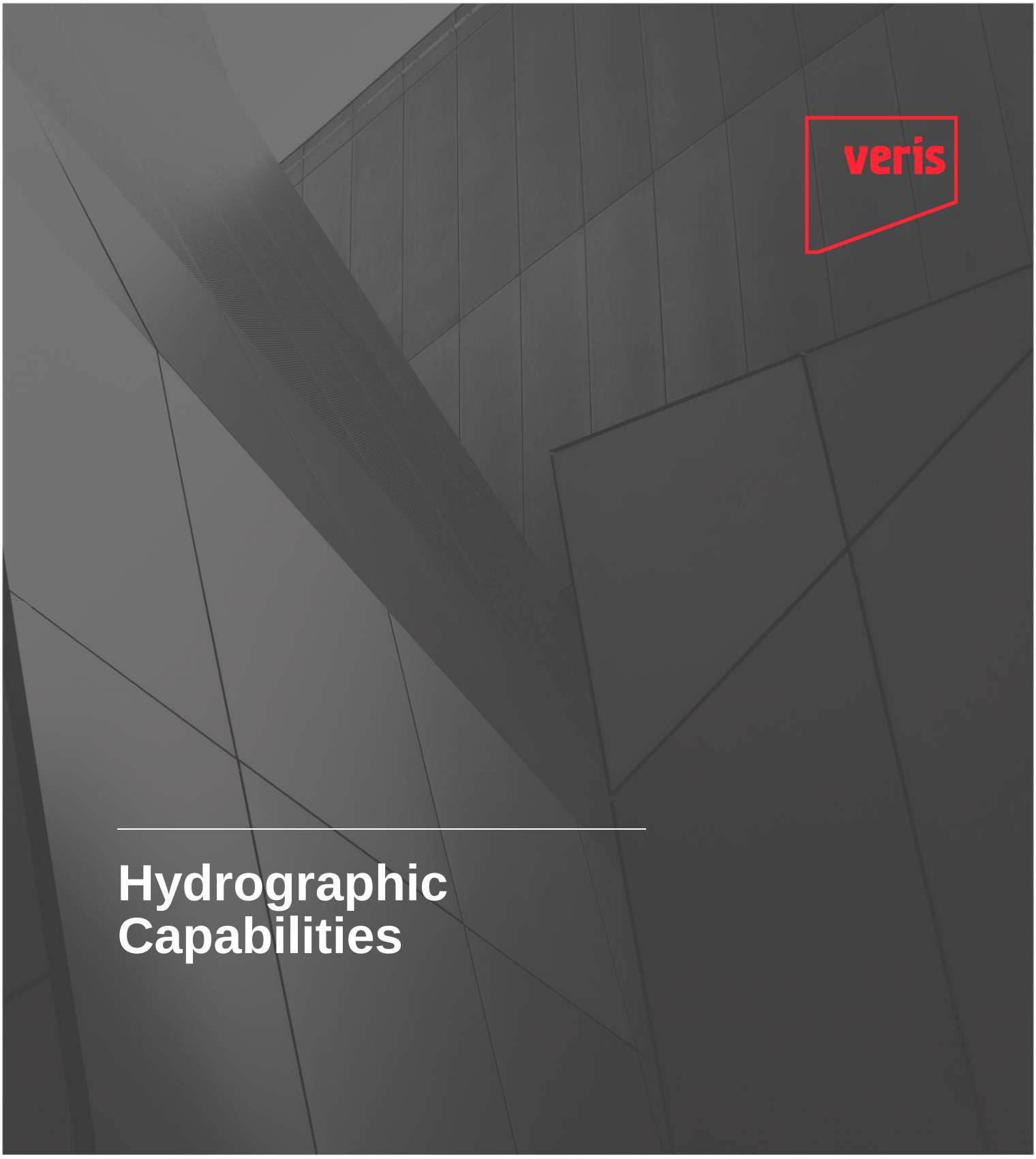

Hydrographic Capabilities

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Hydrographic Survey Manager

VRS-TMP-120_7

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1. Introduction

This document is intended to provide a brief overview of Veris's hydrographic surveying capabilities. It provides a summary of the types of hydrographic survey Veris can undertake, technical specifications of the equipment deployed, and a 'rule of thumb' pricing model.

The objective is that Regional Managers, Principals and Job Managers have sufficient knowledge to identify and refer opportunities to the hydro team.

Veris's hydro capability is based in Tasmania but has worked across Australia. It is a national business line so revenue from hydro work is recognised in the location in which the work is undertaken.

Veris operates under a Commercial Marine Operations Licence issued by AMSA, the Australian Marine Safety Authority. This means all our marine activities must be recorded, as AMSA regularly does paperwork audits. The paperwork is basic and includes a logbook entry detailing activity on the water and signed by people on board showing they received an induction onto the boat. This induction explains where safety equipment is on board and what to do in an emergency.

2. Key Contact

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3. Types of Surveys

- Special Order Surveys – to certify available depth in commercial ports
- Dredging – before, during and after surveys, to calculate volumes and check compliance
- Hazard location – to locate and chart underwater hazards such as wrecks, submerged objects, abandoned wharf piles, trees flooded in man-made lakes, and even an aerator lost in a sewerage treatment plant.
- Condition assessment – high resolution scanning of underwater structures to measure and record deterioration through biomass accretion, corrosion, erosion, impact damage, seismic activity or age.
- Tide Analysis – installation and levelling of tide gauges, and determination of Lowest Astronomical Tide
- Acoustic Doppler Current Profiling – measurement of flow speed and direction in the water column

4. Vessels

On water activities require a vessel that is in survey and commercially certified. Boats that are available for rental from a commercial hire company will usually meet this requirement. Veris has two boats in survey: a 4m dingy and a larger 7m full cabin boat. Both boats are based in Tasmania, but can be economically deployed to Victoria or New South Wales. Beyond that, it will usually be more cost efficient to hire a boat in the local area. We are looking at partnering with a boat hire company on the east coast to simply deployments through-out NSW and QLD, we have access to a good boat hire company in WA

Figure 1: Veris's 7m Survey boat

The vessel must be operated by a licensed coxswain (commercial boat licence), unless within 100m for the shoreline or are working in a man-made water body, in which case the operator need only hold a recreational boat licence.

5. Equipment

5.1. Sonar systems

SBES: Single beam dual frequency echo sounder system

This system sends a single sonar beam to the sea floor and calculates depth from the time taken for the signal to return. The two different frequencies it uses penetrate the sea floor to different extents depending on its characteristics, so allowing measurement of silt depth and hardness. This is particularly useful for dredging surveys.

Point accuracy is approximately 200mm on the Z Axis. As this system does not have any in-built horizontal positioning capability, it relies on a separate GPS with NMEA output. This can be supplied by the hydro team our sourced from a local Veris office.

This system is very portable, easy to setup and operate. It can be mounted on a range of platforms and runs off 12-volt batteries

The single beam system does not provide 100% bottom coverage but generally produces a 5m x 5m grid. Area coverage is approximately 40 ha per day. It can survey a maximum depth of 100m.

The simplicity of this system means that local resources can be trained in its operation.

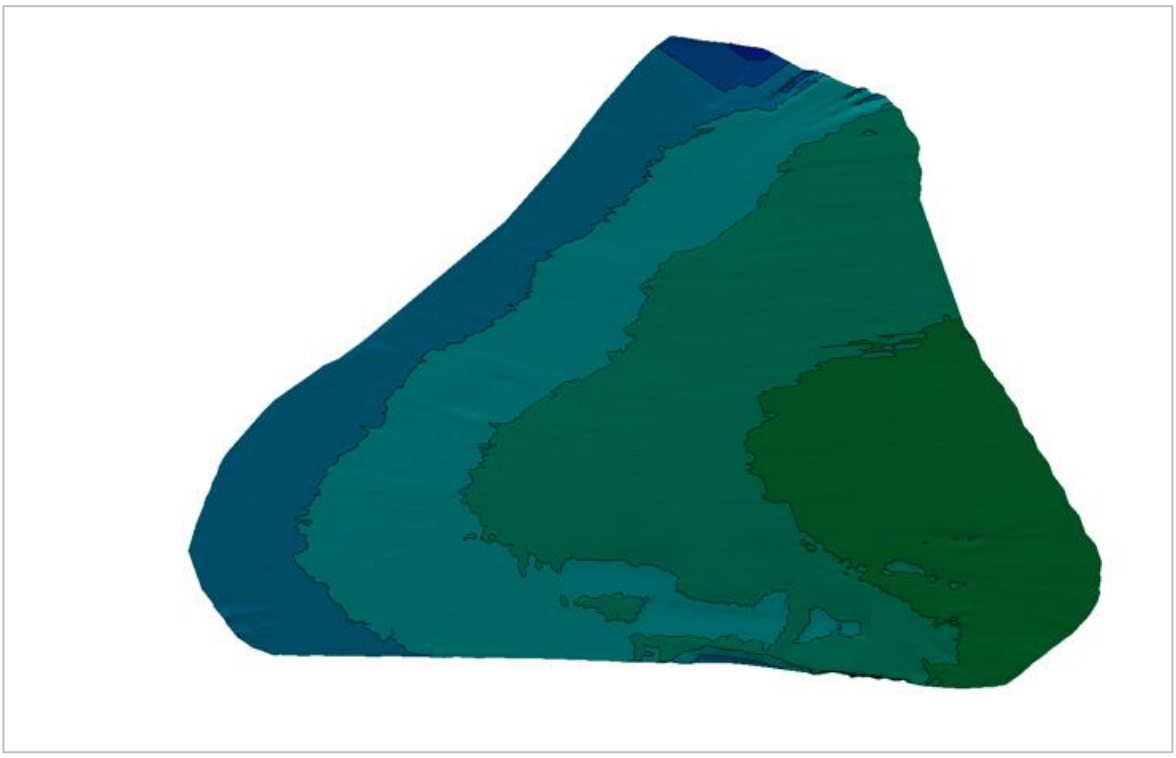

Figure 2: Example SBES DTM surface

5.2. MBES: Multi Beam Echo Sounder system.

This system sends 500 beams to sea floor simultaneously through a 120°swath. The output is a dense point-cloud of the sea-floor in a 0.25x0.25m grid file. At 10m depth, area coverage is similar to single beam (SBES) at 40ha per day but coverage is 100% at much higher point density. The 40ha coverage is based on an average 10m water depth.

Point accuracy is approximately 150mm on the Z axis. As with SBES, this system relies on an external GPS to provide position via an NMEA output.

MBES is best suited to broad acre projects. Data can be processed at a rate of one day's office work for each two days in the field.

Local resources can be of assistance.

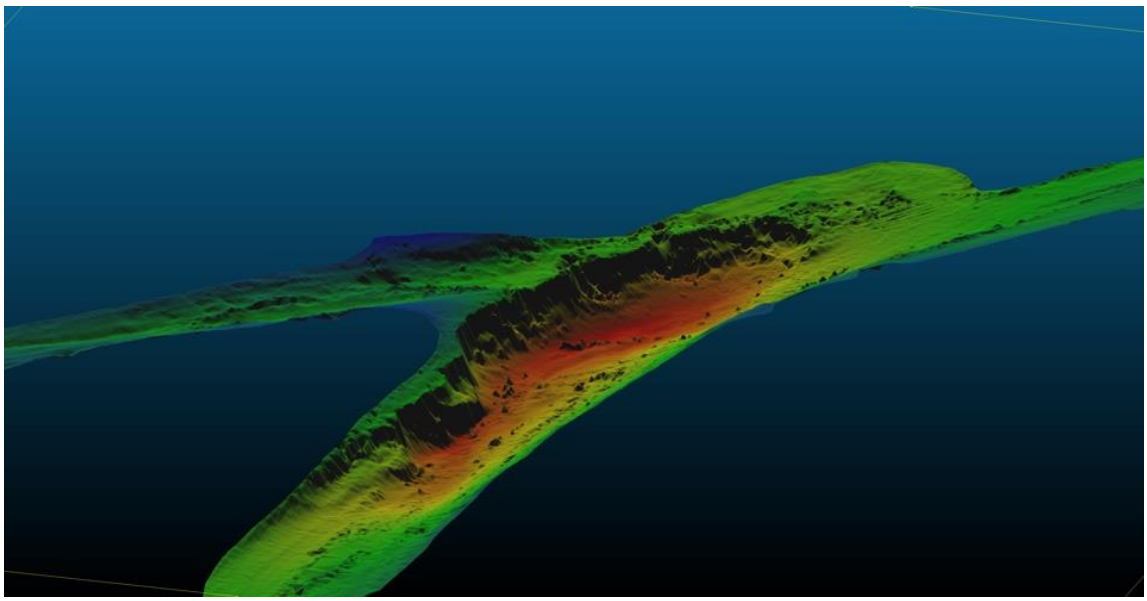

Figure 3: Example MBES DTM Surface

5.3. Scanning Sonar:

Similar to a terrestrial laser scanner, this is a stationary sonar system that has two operating modes:

3D mode for collecting high resolution point clouds to around 50mm XYZ accuracy. This can scan two to three bridge piers or similar per day. It is well suited to capturing condition of wharf or bridge structures after flood events. It can be deployed on a tripod from a wharf or small boat.

Because the system is on sea-floor, surface movement does not degrade overall point quality.

3D hardware requires significant mobilisation outside of NSW, VIC and TAS due to the weight of the equipment.

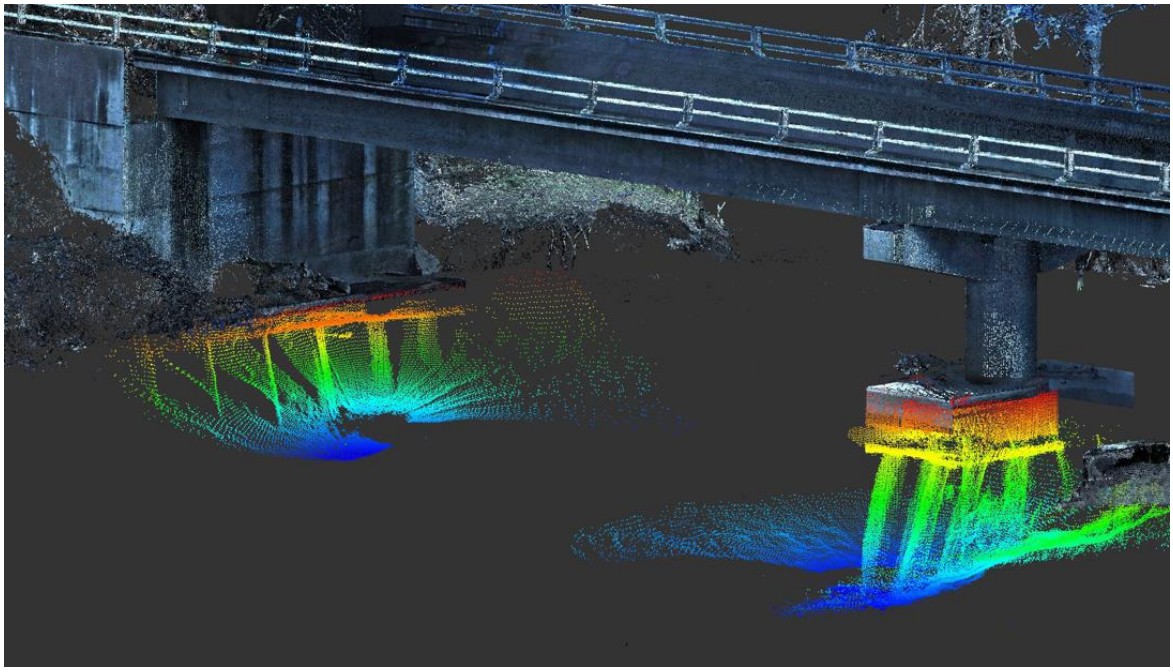

Figure 4: Example Scanning Sonar point cloud

2D mode is boat based and relatively fast. The product is a 2D image similar to an ultrasound. This method can cover up to 300 linear metres per day, such as along a dam wall or wharf. It provides rapid indication of damage or under-mining.

Mobilisation for a 2D operation is significantly less than for a 3D survey.

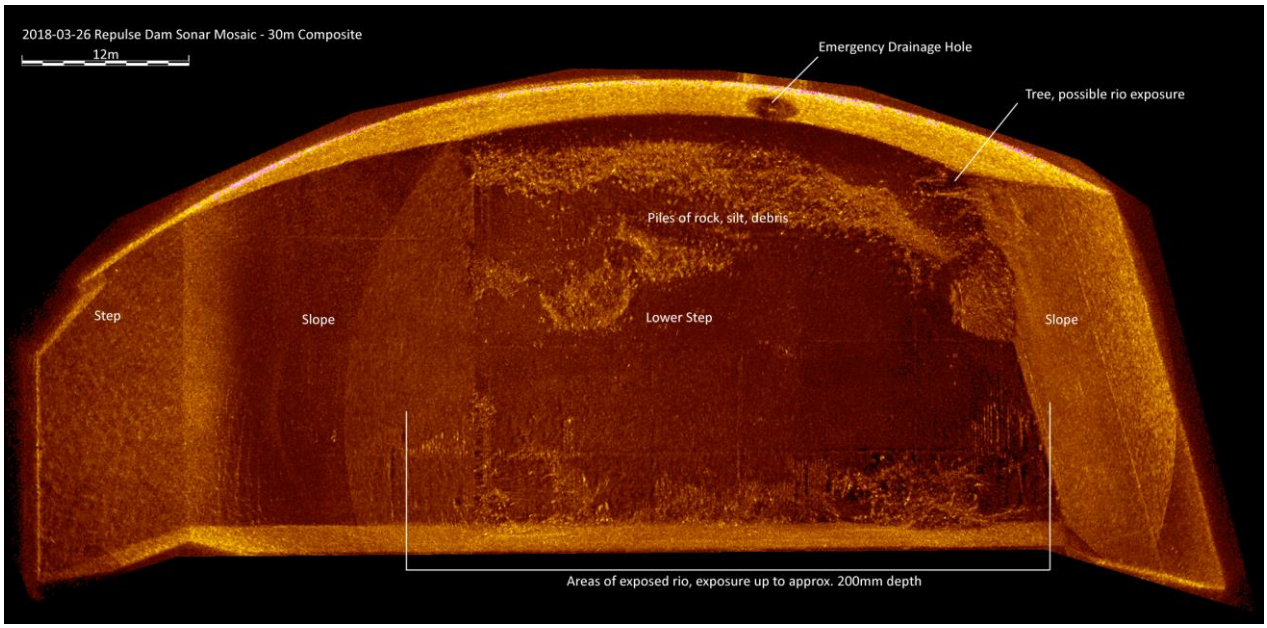

Figure 5: Example 2D mosaic image

5.4. Tide Analysis

We can install and calibrate tide gauges for harbours and ports to determine the tidal range in an area. Gauges are then levelled into the local geodetic network.

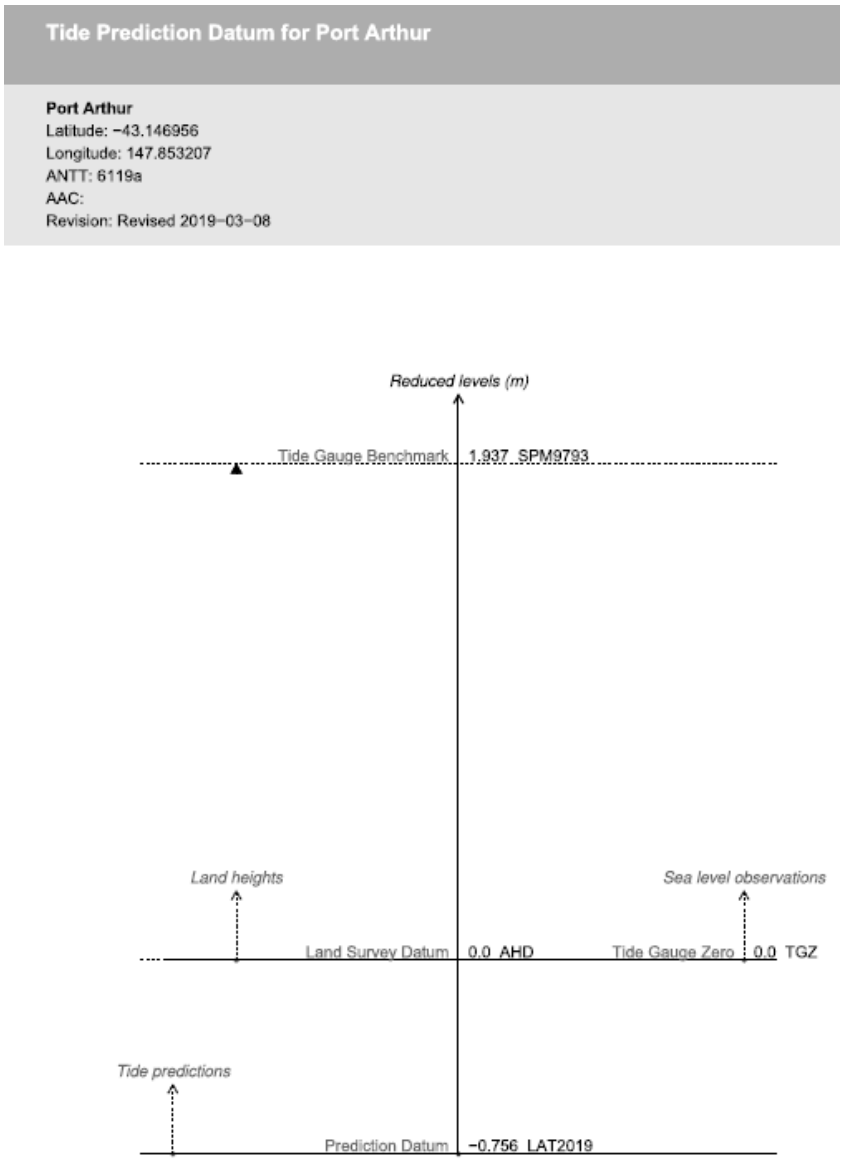

FIGURE 6: TIDE ANALYSIS

5.5. ADCP Current Profiling

This system sends out five sperate beams to accurately map the speed and direction of water flow from the surface to the sea floor, this is a very important tool for pre-construction to understand water movement or better understand sediment build up issues.

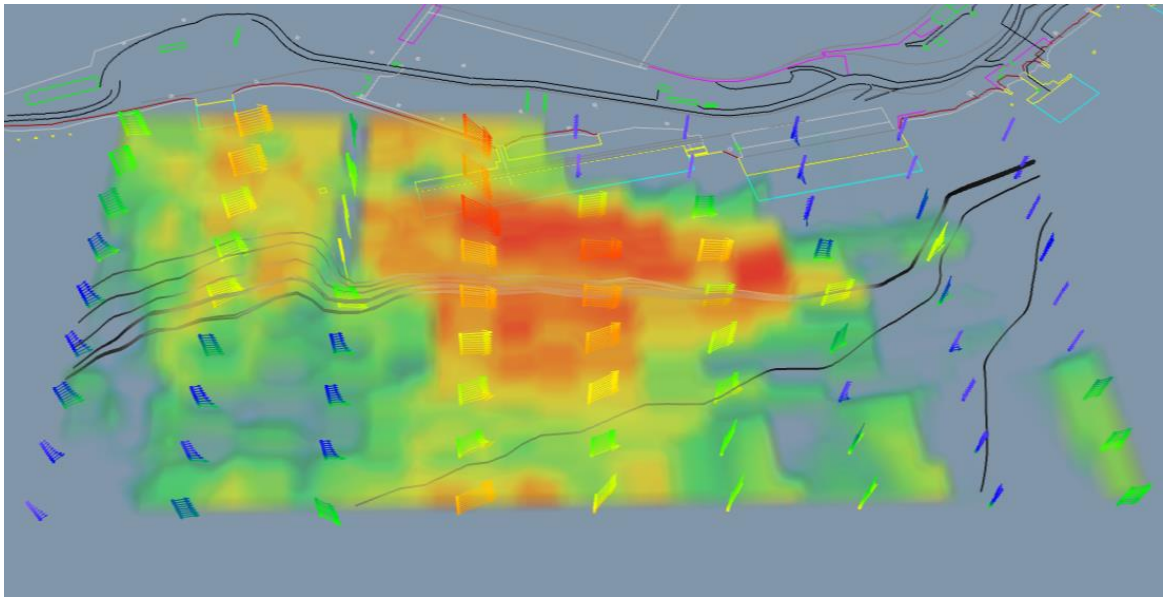

FIGURE 7:3D MODEL OF CURRENT FLOWING PAST A WHARF

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