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Dear Snyman,

Reference # 12979.406.M4.Rev0

TECHNICAL NOTE: Mardie Offshore Disposal Area - Dredge Plume Characteristics

Brief Project Background

Baird have been requested by BCI Minerals (BCIM) to provide additional detail regarding the characteristics of the dredge plumes generated at the offshore dredged material placement area (DMPA) offshore of the Mardie site.

Analysis of dredge plumes generated at the DMPA during the capital dredging phase are presented in Baird (2024). The dredging schedule, dredge method, geotechnical description of the seabed and sediment characteristics from field measurements were used to inform the dredge plume modelling scenarios. A calibrated hydrodynamic model was used to assess plume generation and dispersion around the DMPA for the planned dredge campaign.

This correspondence revisits the models and results from the work presented in Baird (2024) to provide understanding of the potential dredge plumes that would be generated at the DMPA location as part of the future maintenance dredging for the Mardie Project.

There are two key processes outlined in more detail herein.:

1. Key considerations that will inform the frequency of maintenance dredging and the mitigation approaches to ensure that plume generation at the DMPA is within the agreed impacts from capital dredging at the site.
2. The duration over which plumes that are generated at the DMPA remain at a significant level above background in the water column.

These investigations focus on the disposal of maintenance dredge spoil following the initial dredge campaign of the berth pocket and navigation channel. The analysis is intended to support BCIM's application for a sea dumping permit for the Mardie Salt Project for the designated disposal area, DMPA4, as depicted in Figure 1.

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Baird's Quality Management System has been certified by Bureau Veritas against the requirements of ISO 9001.

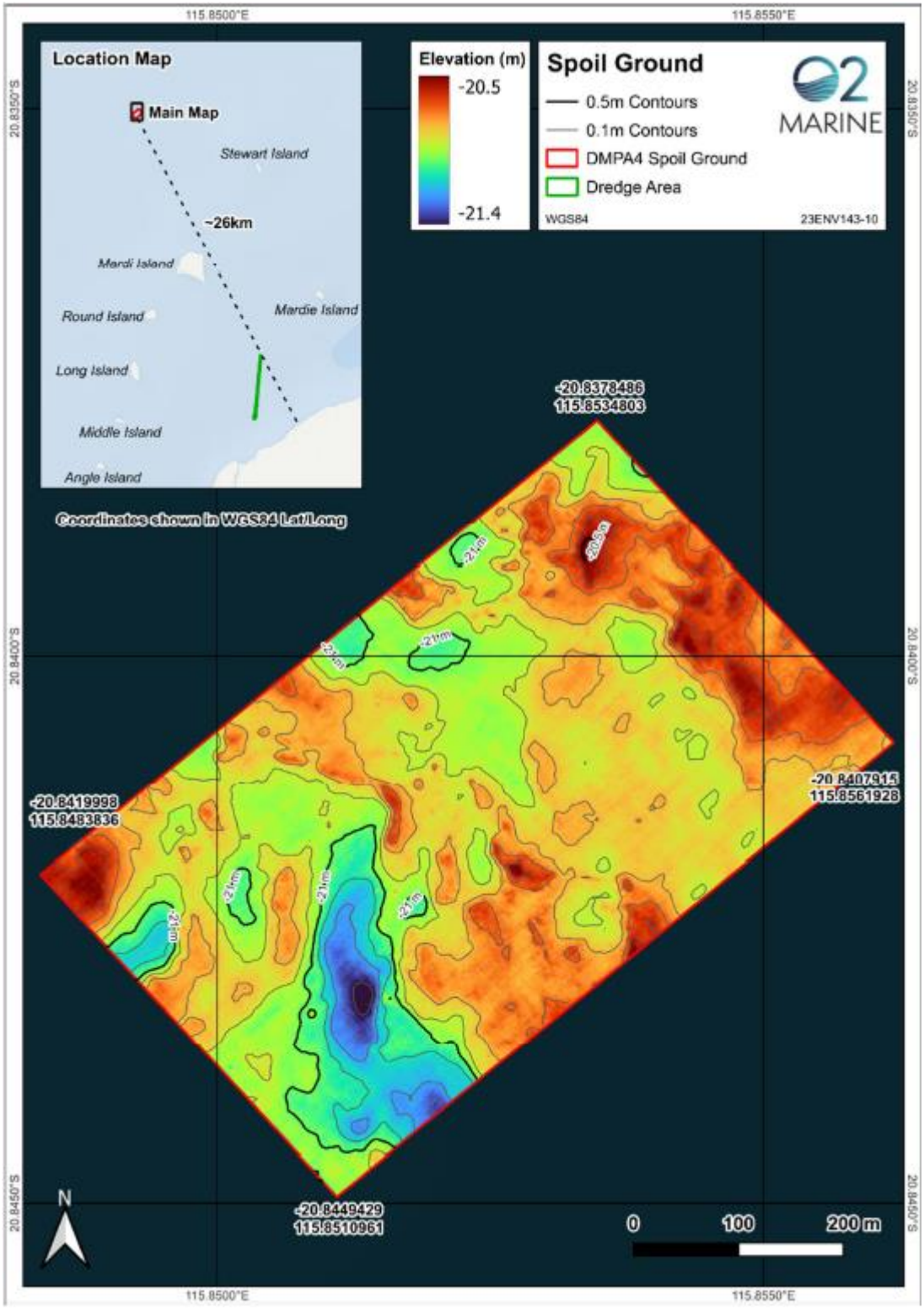

Figure 1: Seabed description of the DMPA4 location offshore of Mardie.

Maintenance Dredging – Key Drivers

When Baird completed the numerical modelling for the capital dredging to determine sediment plume impacts at the dredging footprint area and the DMPA, there were a number of datasets and assumptions to inform the process. Key amongst these were:

- Dredging schedule of the contractor (RN Dredging) providing complete detail of dredging activity through the capital dredging including dates and locations of plant in the footprint.
- high resolution description of the seabed to inform volume calculation of dredge material.
- geotechnical borehole information below the seabed and seabed grabs of PSD to inform sediment classification of dredge spoil material in the model.
- defined dredge plant (2 x TSHD and 1 BHD) with assumptions for daily dredge rates, source terms and losses through the water column associated with the dredge method based on WAMSI guidance and specialist dredge contractor In2Dredging.

Over the 183-day dredging program there was 523,000m3 of dredge material removed and placed at the DMPA at rate of 3,200m^3/day. The size of the ZoMI and ZoHI around the project footprint and the DMPA were calculated with a reasonable degree of understanding of the key variables affecting the plume generation. Of particular importance was the description of the sediment – this varied through the dredge program according to location (inshore/ offshore) and depth of dredge. In general, there was a high level of fine material (silt and clay) with the fraction higher than 50% in certain areas.

To predict the maintenance dredging requirements at the site presents a challenge due to the considerable uncertainties in many of the key variables. There is high degree of uncertainty regarding the key information that was available to inform the plume modelling of the capital dredging. The unknowns are as follows:

1. There is no information regarding the rate / volume of sedimentation or the sediment classification (ie the breakdown of silt, clay and sand) that will be deposited at the seabed following the completion of capital dredging. Baird have attempted to quantify the sedimentation rate and type of material based on analysis of seabed grabs of the existing seabed, however the characteristics of the sedimentation post-dredging when the berth pocket and surrounding Marine areas are dredged more than 5m below the existing seabed is a large unknown.
2. The dredging plant to be adopted in the maintenance dredging is not defined. The type of dredge will likely be informed by volume and type of material to be removed (item 1). The production rate of the maintenance dredging and disposal rate at the DMPA will be determined by the selection of plant.
3. The time of year when dredging will occur is unknown. The wind and tides have a bearing on the way in which the plume moves around the DMPA.

Due to the large degree of uncertainty, modelling of projected maintenance dredging scenarios and the dredge plume impacts is not considered warranted. Instead, Baird recommend that BCIM commit to undertaking post-dredge survey at the completion of the capital dredging program and then commit to survey at a minimum of 6-monthly intervals in the first year to determine the rate of sedimentation that is occurring. Sedimentation rates in the wet season are forecast to be higher than the dry season so capturing at two distinct times of the year will be strongly recommended. In addition, field data to ensure the collection of sediment grabs from the seabed at the time of survey capture, suitable for PSD analysis (including fines) will be required.

With this key information on sedimentation depth, rate and volume (2 seasons) and classification of the sediment (sand, silt, clay fractions), BCIM would then be able to plan the maintenance dredging requirements. Planning of future maintenance regime can then determine the optimum program in terms of frequency (eg 1-yr, 2-yr, 5-yr etc) and dredging method.

Planning of the maintenance dredging program would be informed by learnings during the capital dredging phase. To stay within the agreed ZoMI and ZoHI limits at the DMPA offshore, maintenance dredging would

need to ensure production rates and dumping rates of the fines (silts, clays) is lower than the rates adopted for the capital dredging campaign. This could be planned once an informed understanding of the sediment classification of the dredge spoil is defined from the seabed grabs post-dredging. In addition, the sand content in the dredge spoil removed during maintenance dredging will be important to quantify as this will be the portion that falls directly to the seabed at the DMPA and determine the ultimate capacity of the DMPA to accommodate future dredge maintenance programs.

Analysis of Dredge Plume Characteristics

The extent of the dredge plume impacts (ZoHI and ZoMI) is show in Figure 2. This shows the ZoHi area extends to a maximum of approximately 2.5km from the DMPA along its West to Northeast arc.

Time series data from the model results was undertaken to examine how quickly the plumes develop once dumping commences and how long the suspended sediment concentration (SSC) level stays elevated in the water column once dumping concludes.

For this analysis, the model was run with reporting locations at approximately 2.5km around the DMPA at the boundary of the ZoHI and ZoMI.

The model results indicate the magnitude of the SSC is influenced both by the time of the dumping (three times a day) and by the movement of the plume in the tidal currents. In general, the following is noted:

- Sediment plumes are generated immediately at and around the DMPA following the dumping program with elevated SSC spikes for short periods of time noted.
- Once dumping stops there is a gradual settling of the level of SSC in the water column over a series of tides. The model indicates that within 4-days of the last disposal into the DMPA, the SSC level has dropped to background level at the ZoHI / ZoMI interface location (approximately 2.5km West) as noted in Figure 3.

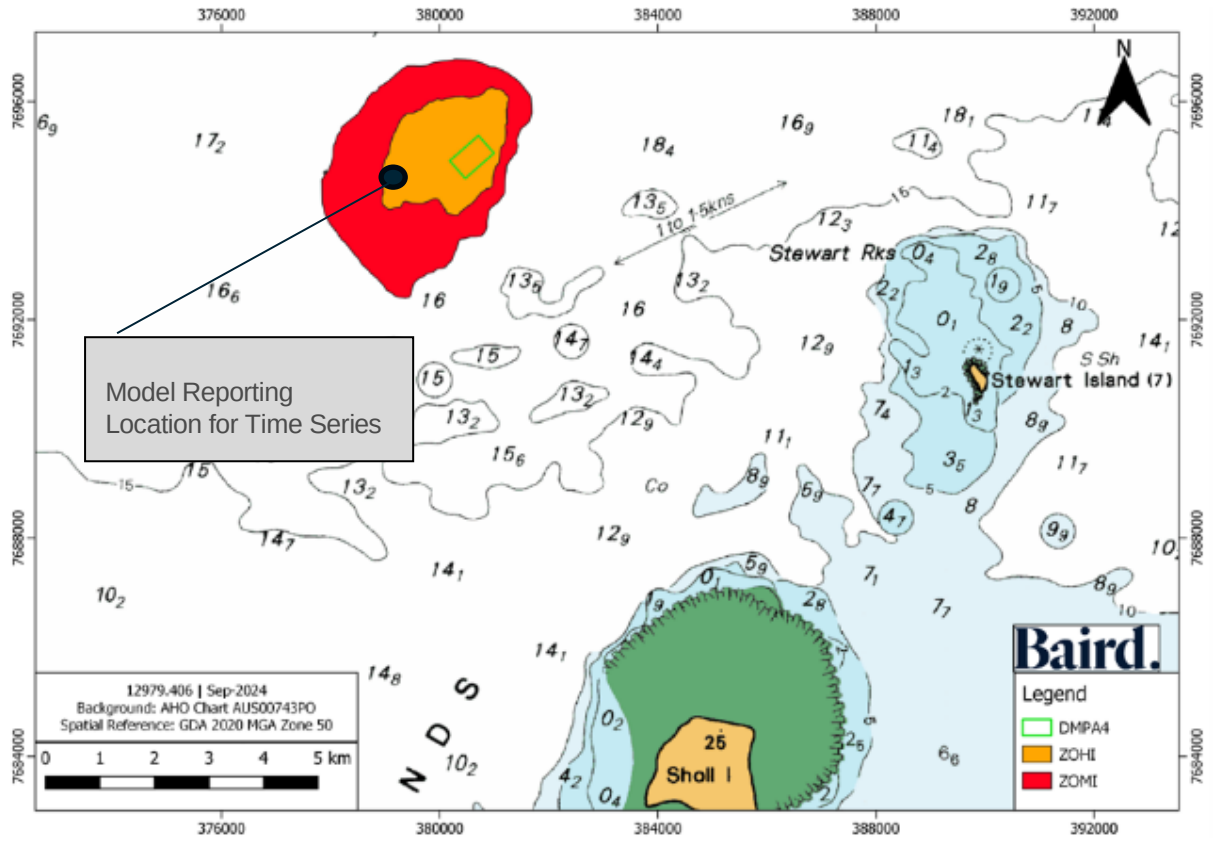

Figure 2: Calculated areas for the ZoHI and ZoMI around DMAP4.

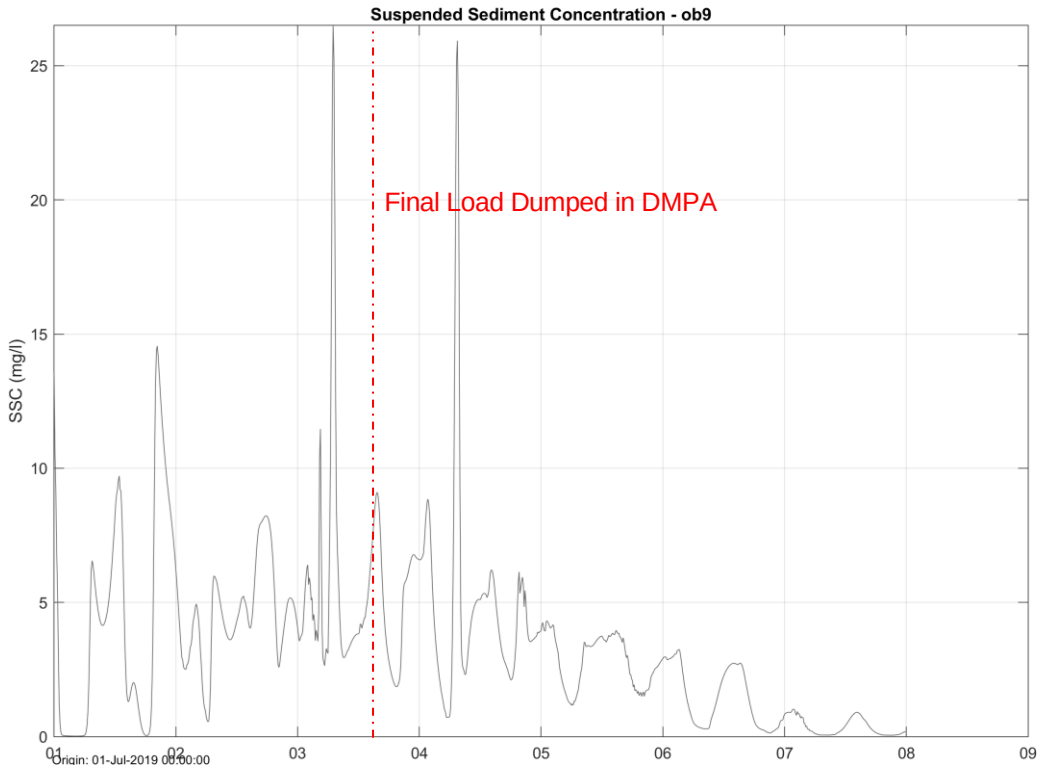

Figure 3: Model SSC at location on the ZoHI / ZoMI boundary to the West of the DMPA

With thanks,

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