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**EPBC Referral Report No. 2 - Boskalis Cambridge Gulf -
Annex 1 - *Sand Assessment***

Proposed action: Boskalis Cambridge Gulf Marine Sand Proposal, Western Australia.

Proponent: Boskalis Australia Pty Ltd.

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Reference

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TECHNICAL NOTE SOIL ENGINEERING



**PROJECT : Cambridge Gulf Sand Search -
Potential Sand volume**

LOCATION : WA, Australia

MIAS/BIMS :

DD : 23814

Revision Status					
Rev	Issue Date	Reason for Issue	Prepared	Checked SE	Checked PE
0.0	24/04/2024	Estimation of potential sand volume	STKX	GKOL	
1.0	29/04/2024	EIA	STKX	S. Raaymakers	
2.0	3 Aug 2024	EIA	STKX	S. Raaymakers	
List of Changes to previous versions					
Par	Change				
Fig. 1	Updated given issue of Exploration Tenement E80/6009 to BK.				
Text	Slight changes given issue of Exploration Tenement E80/6009 to BK. Changed 'possible proposal footprint' to 'proposed operational area' to be consistent with other reports.				

Introduction

This Technical Note provides an estimate of the potential volume of sand present in Boskalis' two sand exploration tenements in Cambridge Gulf - E80/5655 (Block 4) and E80/6009 (Block 4A) combined (**Error! Reference source not found.**). The estimate for E80/5655 is based on vibrocores, grab samples, sub-bottom profiler (SBP) and side-scan sonar (SSS) surveys undertaken within that tenement in February - March 2023, plus multibeam echosounder (MBES) survey undertaken for environmental impact assessment (EIA) purposes in February- March 2024 (Figure 2).

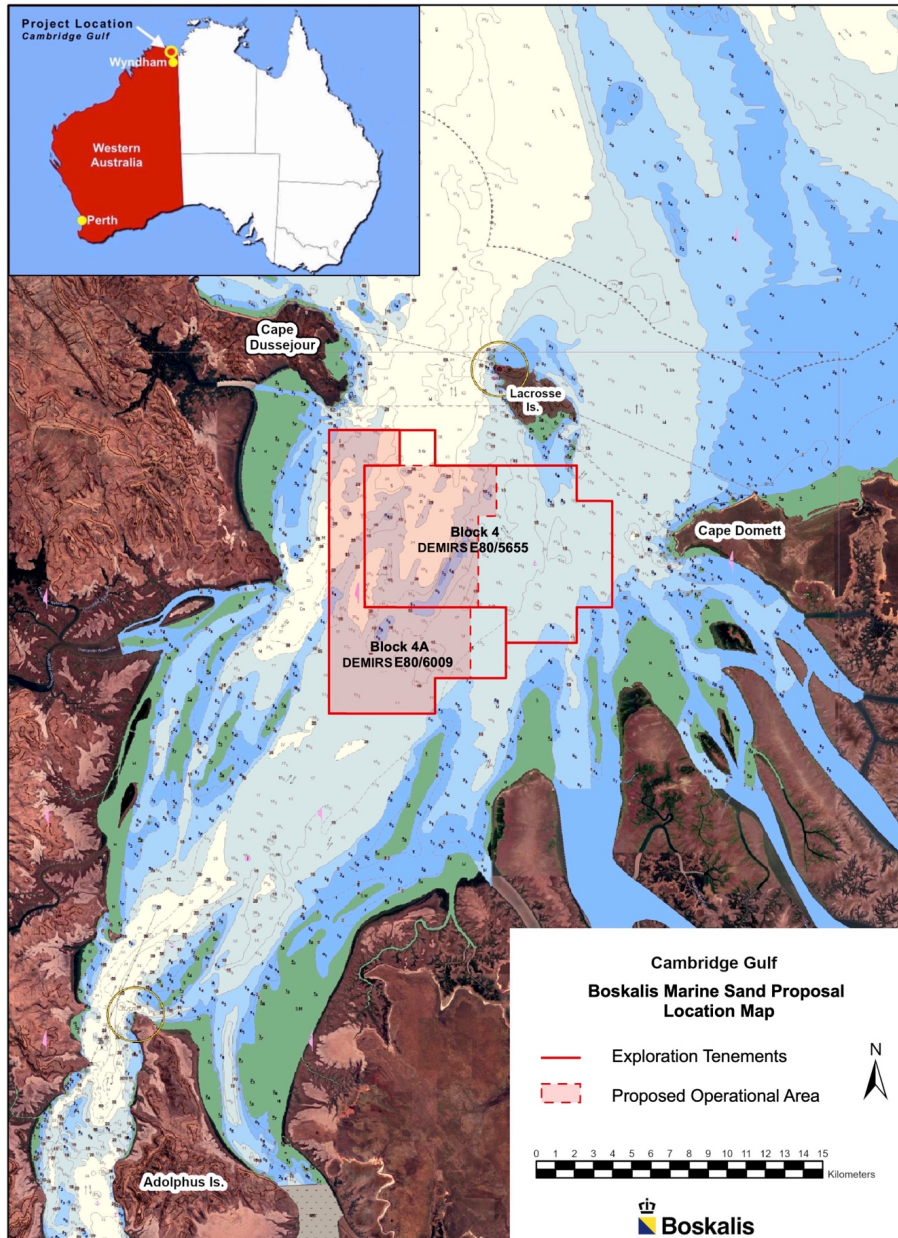


Figure 1: Exploration tenements E80/5655 and E80/6009. Also shown is the proposed operational area (subject to regulatory approval), based on the area where the sand resource is present. Note that no sand was found in the east of E80/5655, hence it is excluded from the proposed operational area.

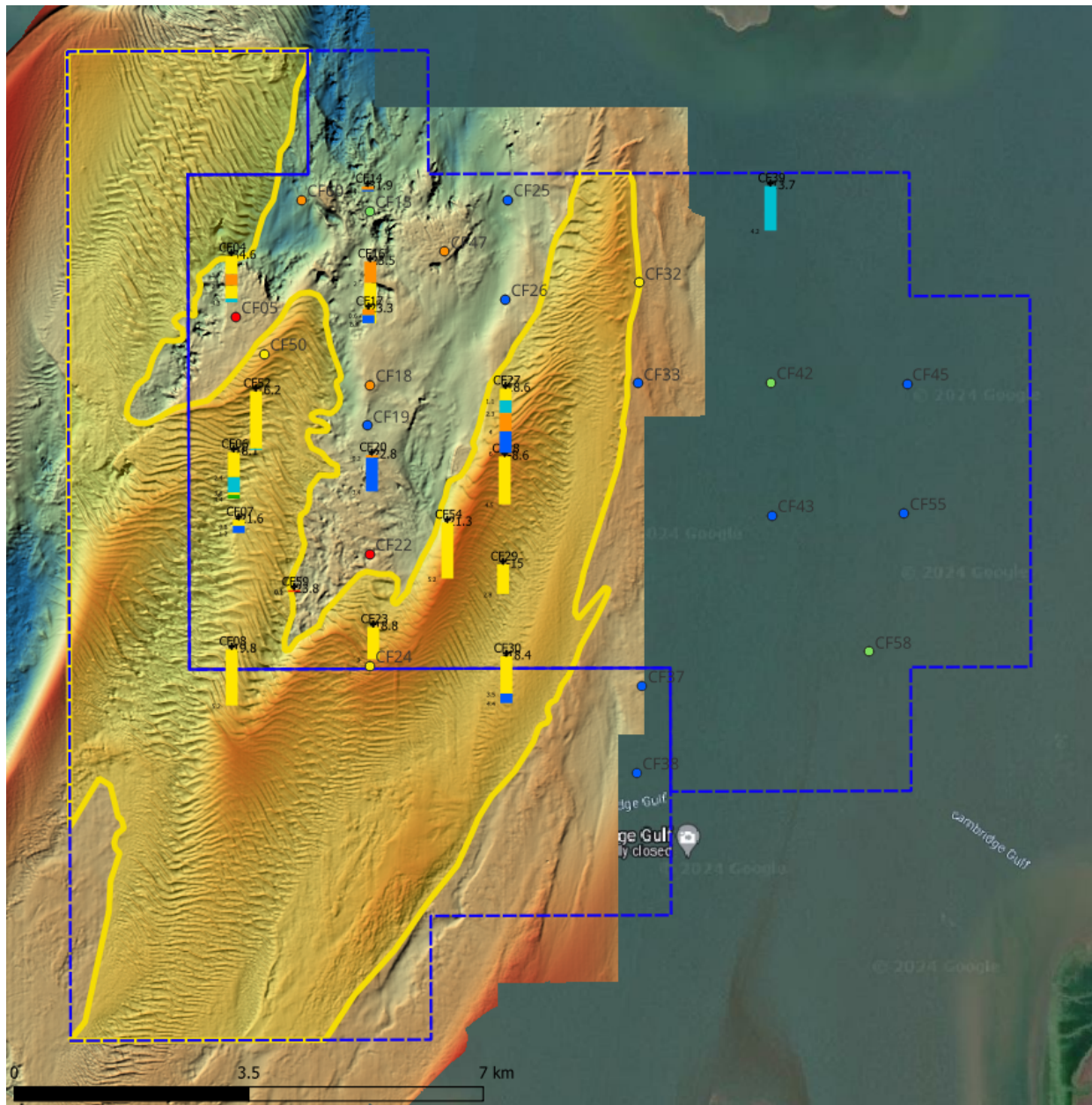


Figure 2: MBES survey undertaken for EIA purposes in Feb-Mar 2024. Area where sand is present is within the yellow boundary. Vibrocores and grab samples (dots) undertaken for sand exploration purposes in Mar 2023: sand=yellow; gravel=orange; rock=red; clay=blue; silt=green

Volume Estimation

The extent of the sand is clearly visible on the MBES data by the presence of sand waves and sand ripples. The information on the seabed morphology from the MBES was combined with the information from the SBP- and SSS survey and the vibrocores in E80/5655. Using all of these data sources the area where sand is present is mapped (Figure 2). The areal extent seabed that is covered by sand in the proposed operational area is approximately 75.3 km².

The thickness of the sand is estimated using the vibrocores and SBP data from E80/5655. However, the maximum penetration of the vibrocores is 5.7 m and the SBP data does not penetrate sand beyond approx. 5.5 m. This means that in places where the thickness of the sand layer is more than 5.5-5.7 m, the base is not visible in the geophysical data and could not be reached by a vibrocore.

Most sand is present in a few large sand dunes, which run parallel to the current direction from SSW to NNE. No sand was found in the eastern part of E80/5655. The greatest thickness of sand is found on top of the dunes, where the base of the sand is beyond the limits of detection by SBP or vibrocores (Figure 3 and Figure 4). In the troughs of the dunes, the base of the sand is recovered in the vibrocores and could sometimes be detected on the SBP data.

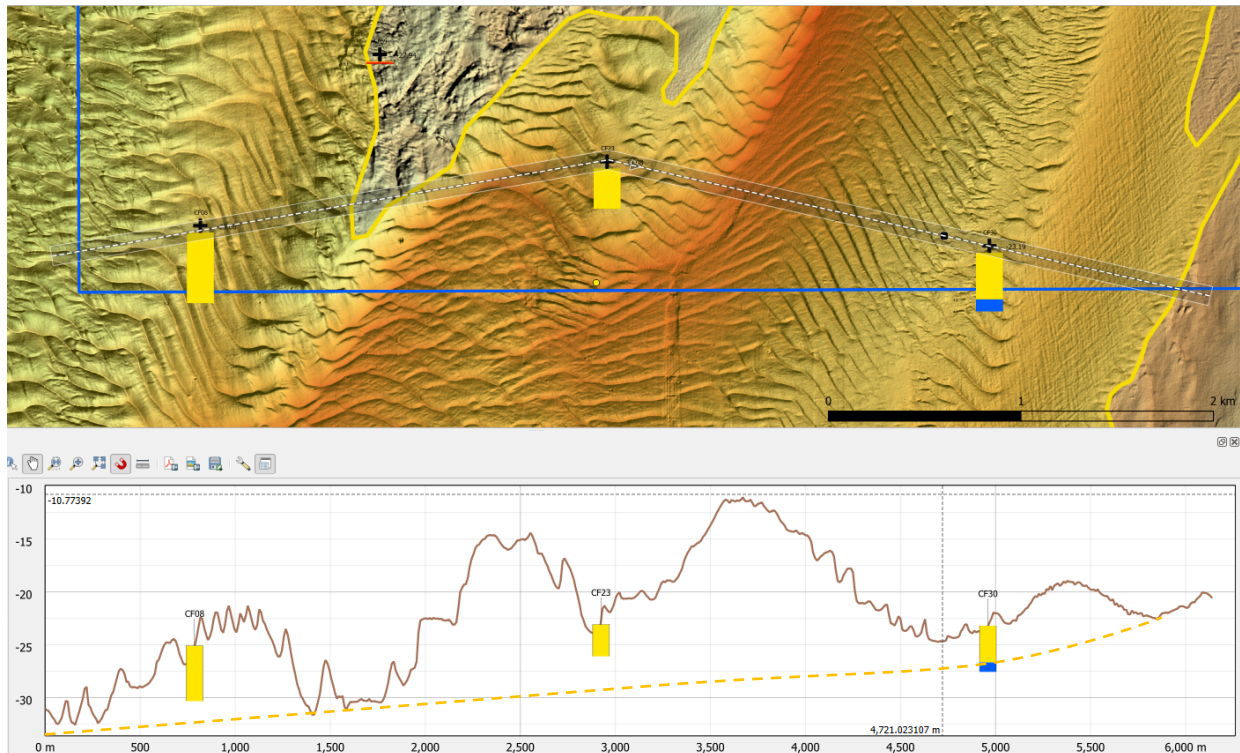


Figure 3: W-E cross section, showing vibrocores CF08, CF23 and CF30 and the estimated base of sand (yellow dashed line)

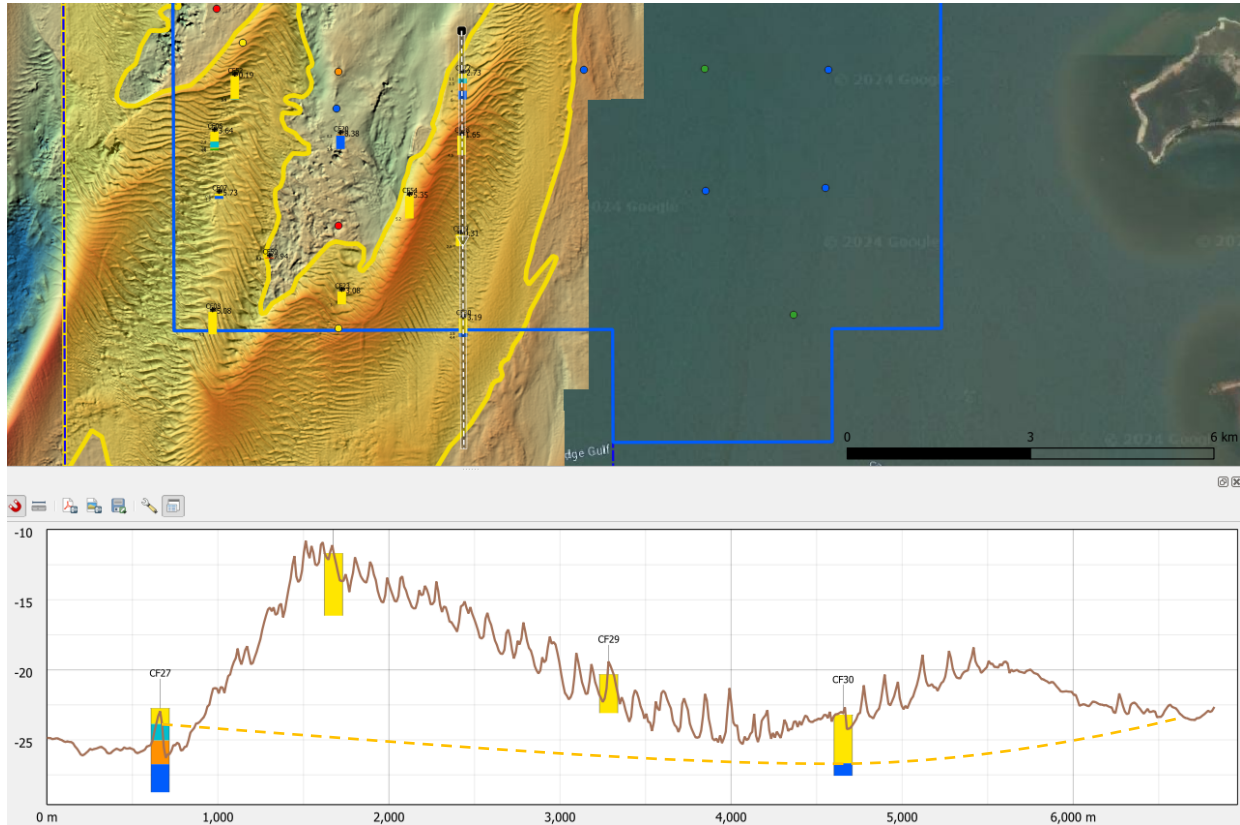


Figure 4: N-S cross section showing vibrocores CF27, CF28, CF29 and CF30 and the estimated base of sand (yellow dashed line)

The cross sections above show that the maximum thickness of the sand in E80/5655 may be up to approximately 15 m on top of the dunes. Towards the troughs the thickness reduces rapidly. However, the maximum thickness is a very rough estimate because the base of the sand cannot be determined on the available data. For the volume calculations, the average thickness of sand recovered in the vibrocores, was used.

The average thickness of sand in all vibrocores taken in the area where sand is present, in E80/5655, is approximately 4 m, where a maximum of 6 m thickness was taken for the cores in which the base of sand was not recovered. Based on the cross sections, this is likely a conservative estimate. A similar average thickness was assumed in E80/6009 – where exploration sampling has not yet been undertaken, but where the MBES survey undertaken for EIA purposes indicates a similar pattern.

Volume of sand = area of sand x average thickness sand = $75.3 \text{ km}^2 \times 4 \text{ m} = 301,200,000 \text{ m}^3$

- The surface area of sand is calculated in QGIS.
- The average thickness is based on sand recovered in the vibrocores from E80/5655.

Based on the above, a minimum volume of 300M m³ sand is likely to be present in exploration tenements E80/5655 and E80/6009 combined.