Shark Bay Resources

Annual Compliance Report

EPBC 2020-8717

2024/25

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Shark Bay Resources Pty Ltd

ABN: 88 079 088 636

2024/25 Annual Compliance Report EPBC 2020-8717

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1 INTRODUCTION

Shark Bay Resources (SBR) is a solar salt project, operating in Useless Loop and Useless Inlet in Shark Bay, Western Australia. The operation is approximately 900 km north of Perth. Salt is produced with an extensive system of brine concentration and salt crystallisation ponds which convert sea water into high grade sodium chloride (NaCl) crystals. Salt is harvested from the crystallisation ponds and trucked to a wash plant to improve salt quality. Once washed the salt runs along a conveyor to a stockpile on Slope Island where it is air dried and shipped to local and overseas customers via the SBR Port.

Shipping access to the berth pocket adjacent to the Slope Island Jetty at the SBR Port is via Denham Channel, a natural feature that extends through the northern entrance of Denham Sound at Bar Flats. An entrance channel was created at Bar Flats to allow shipping access to the SBR Port. Both the Entrance Channel and the Berth Pocket require maintenance dredging on an as-needs basis.

In 2018, hydrographic surveys indicated that the accretion of material in the berth pocket and the entrance channel would begin to impede on optimal vessel loading in the near-term and was required to be removed.

A dredging and seabed levelling campaign (hereafter, the Campaign) was undertaken over four weeks from 15 August 2022 to 12 September 2022. During the Campaign, approximately 1,403 m3 of material was levelled at the Berth Pocket using a levelling bar hauled behind a tugboat. At the Entrance Channel approximately 63,150 m3 of material was removed using a trailing suction hopper dredge (TSHD) and disposed at an approved Disposal Area (hereafter, the Disposal Area) located approximately 3 km north-east of the Entrance Channel, outside the SBMP (Figure 1.2). The Campaign was completed in accordance with the following regulatory instruments:

- SBR's Dredging Environmental Management Plan (DEMP; BMT 2021a)
- Ministerial Statement (MS) No. MS 1173 issued by the Western Australian Government's Department of Water and Environmental Regulation (DWER)
- Approval under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) EPBC 2020/8717 issued by the Australian Government's Department of Agriculture, Water and the Environment (DAWE1)
- Sea Dumping Permit (SDP) No. SD 2020-3993 issued by DAWE1.

The DEMP (BMT 2021a) is the primary document outlining the environmental monitoring and management requirements for the Campaign and was prepared to align with the conditions of MS 1173 issued by DWER. Additional environmental monitoring and management requirements relating to the protection of the values of the SBWHA were required by EPBC 2020/8717, which largely pertain to the seagrass communities and marine fauna of the SBWHA. The SDP predominantly refers to the environmental monitoring and management requirements detailed in the DEMP.

2 ACTIVITY TIMELINE

Activity	Date	Status
2024/25 Compliance Report	1 November 2024	Compliant with all conditions
2023/24 Compliance Report	22 November 2024	Compliant with all conditions except Condition 14
2022/23 Compliance Report	19 September 2023	Compliant with all conditions
Environmental Close out Report	05 December 2022	Final Report
Project Close out Report	29 November 2022	Final Report
Maintenance Dredging Survey Report	31 October 2022	Final Report
Dredging Completed	15 September 2022	Dredging Completed
Dredging Commenced	15 August 2022	Dredging Commenced
Ground Truth Survey Report	18 July 2022	Final Report
Dredging Approval EPBC 2020/8717	Date of Decision 6 October 2021	Approval has effect until 1 September 2036

3 2024/25 COMPLIANCE SUMMARY

Condition Number	Condition Details	Status	Evidence / Comments
1	To minimise direct impacts to the World Heritage value/s of the Shark Bay World Heritage property and the National Heritage value/s of the Shark Bay National Heritage place, including but not limited to protected matter/s Loggerhead Turtles, Humpback Whales, and Dugong the approval holder must: a) Not conduct seabed levelling operations outside the berth pocket levelling area Zone of High Impact (ZoHI). b) Not conduct dredging operations outside of the entrance channel dredge area ZoHI. c) Not dispose of more than 80,000 cubic metres (m^3) of dredge material at the dredge disposal site. d) Not dispose of dredge material outside of the dredge disposal site.	Compliant	During seabed levelling, the vessel position was tracked with data presented as waypoints. Waypoints were taken from a handheld geographical positioning system (GPS) that recorded the track log at 1 min intervals for the daily works duration. Edi's levelling areas were digitised and plotted in a geographical information system (GIS) to compare with spatial boundaries associated with the project. Seabed levelling was inferred to be the areas densely populated with waypoints, as the vessel typically required multiple passes to redistribute material. In addition, position data from the navigation system aboard the dredge vessel was exported daily and reviewed each subsequent day. The position of the vessel while operational (i.e. either actively dredging or disposing of material) was corroborated with vessel logs to confirm timing of operational activities, digitised and plotted in a GIS to compare with spatial boundaries associated with the project. Evidence of seabed levelling vessel position monitoring at the Berth Pocket is provided in Section 2.1 of the Useless Loop Maintenance Dredging: Environmental Close Out Report (Attachment B). Seabed levelling operations concluded on 12 September 2022, with no further maintenance dredging works conducted during the reporting period. During the Campaign, 63,150 m3 of material was dredged from the Entrance Channel and disposed at the Disposal Area, below the permitted volume of 80 000 m3. Evidence of dredging and disposal volumes is provided in the Section 1.1 of the Useless Loop Maintenance Dredging: Environment Close out Report (Annex B). Seabed levelling operations concluded on 12

			September 2022, with no further maintenance dredging works conducted during the reporting period. During disposal operations, position data from the navigation system aboard the dredge vessel was exported daily and reviewed each subsequent day. The position of the vessel while operational (i.e. either actively dredging or disposing of material) was corroborated with vessel logs to confirm timing of operational activities, digitised and plotted in a GIS to compare with spatial boundaries associated with the project. Evidence of disposal operations position monitoring at the Disposal Area is provided in the Useless Loop Maintenance Dredging: Environmental Close Out Report (Annex B). Seabed levelling operations concluded on 12 September 2022, with no further maintenance dredging works conducted during the reporting period.
2	To mitigate impacts to marine fauna, as a World Heritage value/s of the Shark Bay World Heritage Area and as a National Heritage value/s of the Shark Bay National Heritage place including but not limited to protected matter/s, the approval holder must: a) Ensure that a Marine Fauna Observer is present and able to monitor marine fauna at all times during operations as well as during transit to/from the BPLAZoHI, ECDAZoHI, and/or the dredge disposal site. The Marine Fauna Observer must have access to equipment suitable to detect, monitor, and record marine fauna at all times during operations and transit to/from the BPLAZoHI, ECDAZoHI, and/or the dredge disposal site. b) Ensure that if marine fauna, including, but not limited to, protected matter/s is sighted within the observation zone, an MFO must continuously monitor the marine fauna and record the required data in the Marine Fauna Observation Log.	Compliant	Prior to the commencement of seabed levelling, dredging, or disposal operations, eight persons (five vessel operators and/or crewmembers, two traditional owners, and one JNCC certified marine mammal observer) underwent project-specific marine fauna observer (MFO) training from BMT to minimise the risk of marine fauna interactions during mobilisation and construction activities. The training included marine fauna behaviour and actions, and reporting requirements in the event of marine fauna injury or mortality. EPBC Regulations 2000 – Part 8 Division 8.1, Interacting with cetaceans were included in the training and adhered to, as required. All operational activities were completed with multiple BMT-trained MFOs on location where continuous observations were maintained for the duration of all operational works. Marine fauna observation field logs were completed daily by trained personnel and were reviewed by and reported by BMT daily during the Campaign. During seabed levelling operations at the Berth Pocket (15 August 2022 to 26 August 2022), two MFOs were stationed on the Ship Loader Platform where a 360-degree view of the observational and shutdown zones was achieved, and one MFO was onboard the operational tug vessel (Edi). Across the 12 operational days at the

c) Cease dredging operations and/or dredge disposal operations if one or more whales, other marine mammals, or marine turtles are sighted within the shut down zone applicable for the particular marine fauna type at any time during dredging operations or dredge disposal operations.	Berth Pocket, visual observation time totalled ~109 hours, resulting in the observation of 32 mitigation species within the operation area and mitigation actions (operational shut down) being required on 21 occasions.
d) Ensure that, if dredging operations and/or dredge disposal operations have ceased in accordance with condition EPBC 2020/8717 #2c, dredging and/or disposal operations do not recommence until the MFO confirms that all whales, marine mammals, and turtles have moved out of the shut down zone or the sighted marine turtle has not been seen within 300m, or for other marine fauna within 500m, of the dredge vessel for a period of at least 30 minutes.	During dredging and disposal operations at the Entrance Channel and Disposal Area (01 September 2022 to 07 September 2022), two MFOs were stationed onboard the dredge vessel (Modi R) and two MFOs were onboard the pilot vessel (Pelagic) where a 360-degree view of the observational and shutdown zones were achieved. In addition to dredging and disposal operations, seabed levelling of the Entrance Channel was undertaken by the tug vessel (Edi) with one MFO onboard during this time (02 September 2022 to 12 September 2022).
e) Ensure the MFO undertakes a pre-start-up visual observation for at least 20 minutes before each commencement of a soft start procedure and records the required data in the Marine Fauna Observation Log.	Across the 11 operational days at the Entrance Channel and 7 operation days at the Disposal Area, visual observation time totalled ~96 hours, resulting in the observation of 23 mitigation species within the operation area and mitigation actions (operational shut down and/or delayed start of operations) being required on 10 occasions.
f) If no protected matter/s have been observed during the pre-start-up visual observation, a soft start procedure is implemented in the 20 minutes prior to commencement of dredging operations and/or dredge disposal operations. Visual observation by a MFO must continue to be undertaken during each soft start procedure to enable the MFO to determine if any marine fauna are within the observation zone.	To address the management measures associated with marine turtles, BMT confirmed the installation of a turtle exclusion device to the suction head prior to commencement of dredging (Figure 5 of the MFO report; Attachment C). As part of their operational work pack the dredging contractor developed their own DEMP, which outlined the environmental management measures undertaken including soft-start procedures, noise mitigation actions and additional measures to mitigate the risk of vessel strike in low light conditions (RND 2022).
g) Ensure that during night-time and times of low visibility, soft start procedures are undertaken, and operations may commence only if: a. There have not been 3 or more protected matter/s instigated power-down or shut-down situations during the	The MFO report incorporating the daily logs as specified in the DEMP (BMT 2021a) is provided below (Attachment C). Seabed levelling operations concluded on 12 September 2022, with no further maintenance dredging works conducted during the reporting period.

	preceding 24 hours period, or b. If operations were not previously underway during the preceding 24 hours, the vessel has been in the vicinity (~10km) of the proposed start up position for at least 2 hours (under good visibility conditions) within the preceding 24 hour period and no protected matter/s has been sighted.		
3	To minimise indirect impacts of poor water quality on the World Heritage value/s of the Shark Bay World Heritage Area and the National Heritage value/s of the Shark Bay National Heritage place, and habitat for protected matter/s including Loggerhead Turtles and Dugong, the approval holder must: a) Implement the monitoring and management actions to protect Benthic Communities and Habitat as specified in the DEMP. b) Ensure that PAR levels do not exceed the threshold values specified in the DEMP. c) Undertake dredge plume visual observations as specified in the DEMP.	Compliant	Details of the monitoring and management actions and outcomes undertaken as specified in the DEMP (BMT 2021a) are provided in Section 3 of the Useless Loop Maintenance Dredging: Environmental Close Out Report (Attachment B). Seabed levelling operations concluded on 12 September 2022, with no further maintenance dredging works conducted during the reporting period. Trigger and threshold criterion were not exceeded during seabed levelling, dredging and disposal operations at any location, in accordance with the DEMP (BMT 2021a). Methods and outcomes of PAR monitoring in accordance with threshold values specified in the DEMP (BMT 2021a) are outlined in Section 2.3 of the Useless Loop Maintenance Dredging: Environmental Close Out Report (Attachment B). Seabed levelling operations concluded on 12 September 2022, with no further maintenance dredging works conducted during the reporting period. Turbid plumes were visually monitored throughout the Campaign to assess the risk of potential environmental impacts associated with increased water column turbidity, as described in the DEMP (BMT 2021a). The methods of visual plume observation monitoring included plume sketches, site photographs and remote imagery. The outcomes of visual plume observation monitoring are provided in Section 2.2 of the Useless Loop Maintenance Dredging: Environmental Close Out Report (Attachment B). Seabed levelling operations concluded on 12 September 2022, with no further maintenance dredging works conducted during the reporting period.

4	To minimise indirect impacts on seagrass which supports the World Heritage value/s of the Shark Bay World Heritage Area and the National Heritage value/s of the Shark Bay National Heritage place, and habitat for protected matter/s, the approval holder must: a) Conduct surveys of the location, benthic habitat type/quality, species/description, area of recoverable loss, and proportion of recoverable loss of all seagrass in potentially affected areas within 3 months prior to the commencement of any seabed levelling operations, dredging operations or dredge disposal operations. Should the location, benthic habitat type/quality, species / description, area of recoverable loss, or proportion of recoverable loss of seagrass differ from that specified in the DEMP, the approval holder must submit for the Minister's approval a revised version of the DEMP in which description of the project area has been revised to reflect the up-to-date location, mapping, benthic habitat type/quality, species/description, area of recoverable loss, and proportion of recoverable loss within the potentially affected areas. b) Not commence dredging or disposal operations until the Minister has approved in writing a revised version of the DEMP, if a revised version is required under condition 4(a). c) Undertake a survey of the location, benthic habitat type/quality, species/description, area of recoverable loss, and proportion of recoverable loss of all seagrass in the potentially affected areas within 60 business days of the cessation of seabed levelling operations, dredging operations, and dredge disposal operations, as specified in the DEMP.	Compliant	Surveys were conducted at each location within three (3) months prior to the commencement of any seabed levelling operations, dredging operations, or dredge disposal operations. The additional ground truthing survey was implemented in June 2022 and provided further confidence in the habitat map used to inform the environmental impact assessment (EIA; BMT 2021b) and develop the DEMP (BMT 2021a). The majority of the classified habitat point data from the June 2022 survey was well aligned with the existing habitat map, which is considered characteristic of the Shark Bay marine environment. However, variability between the 2019/20 and 2022 habitat data was observed in two areas: 1) north of the berth pocket ZoHI and, 2) south-east of the entrance channel ZoHI. The differences in the observed data were reduced seagrass cover (i.e. increased bare substrate) at these two areas and is considered to be representative of natural temporal and spatial variability of seagrasses present among survey years and areas. It was concluded that there was no new or increased risk of impact to BCH, or World Heritage values of the Shark Bay World Heritage Area. Details of benthic communities and habitat survey assessment outcomes is provided below in the Ground Truth Survey Report (Attachment D). Seabed levelling operations concluded on 12 September 2022, with no further maintenance dredging works conducted during the reporting period. No revision was made to the DEMP following the additional ground truthing. See Ground Truth Survey Report (Attachment D). Seabed levelling operations concluded on 12 September 2022, with no further maintenance dredging works conducted during the reporting period. Surveys were conducted at each location within 60 business days following the cessation of seabed levelling operations, dredging operations, or dredge disposal operations. No further maintenance dredging works were conducted during the reporting period Outcome of benthic communities and habitat survey assessment is provided in Section 2.6 of the Useless Loop Maintenance Dredging: Environmental Close Out Report (Attachment B).

5	The approval holder must submit a copy of a Compliance Assessment Report to the DAWE within 60 business days following the cessation of seabed levelling operations, dredging operations, and dredge disposal operations. The Compliance Assessment Report must include: a) Details of the monitoring that was undertaken before and during the implementation of the proposal. b) Results of the monitoring undertaken to demonstrate that the environmental protection objectives specified in table 2.1 of the DEMP related to BCH, marine environmental quality, and marine fauna. c) Details of any management actions undertaken during the implementation of the proposal to meet the environments protection objectives indicated in condition 5(b). d) The completed Marine Fauna Observation Log and Marine Fauna Interaction Log as required under Conditions 2, 3, and 4, and as specified in the DEMP.	Compliant	The Compliance Assessment Report (CAR) was submitted on 7 December 2022 within 60 business days of the date of cessation of seabed levelling operations, dredging operations, and dredge disposal operations (6 October 2022), in compliance with this condition. The CAR is publically available on the Shark Bay Salt website: https://www.salt.com.au/environment.php Additional details of the monitoring that was undertaken throughout the duration of the Campaign is provided in Attachment B. No further maintenance dredging works were conducted during the reporting period. Details of the monitoring undertaken to demonstrate that the environmental protection objectives specified in table 2.1 of the DEMP related to BCH, marine environmental quality, and marine fauna were met are summarised in Section 4 of the Useless Loop Maintenance Dredging: Environmental Close Out Report (Attachment B). Details of the management actions undertaken during the Campaign are provided in the Section 3.1 of the Useless Loop Maintenance Dredging: Environmental Close Out Report (Attachment B). The completed Marine Fauna Observation and Interaction report incorporating the completed daily logs as specified in the DEMP (BMT 2021a) is provided in Attachment C.
6	Unless otherwise demonstrated in the Compliance Assessment Report required by condition 5, within eighteen (18) months following the cessation of seabed levelling operations, dredging operations, and dredge disposal operations, The approval holder must submit a copy of a Seagrass Report to DAWE that reports on whether post-operation seagrass validation monitoring indicated any change of location, benthic habitat type/quality, species/description, area of recoverable loss, or proportion of recoverable loss of seagrass outside the dredge / seabed levelling areas and disposal site in	Compliant	Multiple lines of evidence demonstrate that any observed impacts to seagrass habitat and communities have been managed in line with the DEMP (BMT 2021a) and the EPOs as defined within the approval conditions specified by both state and federal regulators have been met for continued BCH health. Permanent loss of seagrass beyond the ZoHI has not been demonstrated. The small-scale recoverable loss of seagrass within the ZoMI is below the acceptable level as defined in the DEIA (BMT 2021b) and is not anticipated to result in a significant impact to the ecological values of the SBWHA or the SBMP or reflect the loss of habitat critical for survival of threatened and migratory marine fauna in the region. The risks posed by the project to key

	ZoHI. If changes in any of these categories has been observed, the Report must include a discussion of the likely cause(s) of the change with sufficient evidence, as confirmed in writing by DAWE, to rule out the possibility of the approved action being the cause.		sensitive receptors and the SBWHA values have been shown to be low and acceptable. Statistical outcomes (Sections 2.6.3) and a discussion of the results (Sections 2.6.4) are provided in the Useless Loop Maintenance Dredging: Environmental Close Out Report (Attachment B). This evidence was previously provided in the CAR (BMT 2022) and reiterated in this report. Seabed levelling operations concluded on 12 September 2022, with no further maintenance dredging works conducted during the reporting period.
7	If the approval holder cannot demonstrate that the impact to seagrass was due to natural processes, the approval holder must submit a seagrass offset proposal for approval by the Minister within 6 months of the submission of the Seagrass Report required by condition 6. The seagrass offset proposal must be within the Shark Bay World Heritage Property and be consistent with the Department's Environmental offset policy, and must include: a) A discussion of how the offset meets relevant environmental objects as outlined by the Department's Environmental offset policy, how it will offset the residual significant impacts of relevant EPBC Act protected matter/s, and a reference to EPBC Act approval conditions to which the seagrass offset proposal refers. b) Endorsement from a suitably qualified seagrass ecologist from a tertiary institution or government department with experience in seagrass rehabilitation undertaking. c) A table of commitments made in the seagrass offset proposal to achieve the objectives, and a reference to where the commitments are detailed in the seagrass offset proposal. d) Reporting and review mechanisms, and documentation standards to demonstrate	Not Applicable	Permanent loss of seagrass beyond the ZoHI has not been demonstrated. The decline of seagrass observed within the ZoMI is below the acceptable level of recoverable loss as defined in the DEIA (BMT 2021b) and is expected to recover within a period of 5 years following completion of the campaign. Seabed levelling operations concluded on 12 September 2022, with no further maintenance dredging works conducted during the reporting period. See Condition 6 above and the Useless Loop Maintenance Dredging: Environmental Close Out Report (Attachment B).

	compliance with the seagrass offset proposal. e) An assessment of risks to achieving seagrass offset proposal environmental objectives and risk management strategies that will be applied. f) A monitoring program, which must include: i. measures of success that are linked to the purpose of the offsets and provide clear benchmarks about their success or failure; ii. the timing and frequency of monitoring to indicate whether benchmarks are being met; iii. trigger values for corrective actions; and iv. proposed corrective actions if trigger values are reached. When the Minister approves the seagrass offset proposal, then the seagrass offset proposal must be implemented within 6 months of approval of the offset proposal or as required to align with the monitoring commitments of the seagrass offset proposal		
8	The approval holder must notify the Department in writing of the date of commencement of the action within 10 business days after the date of commencement of the action.	Compliant	A notification letter stating the date of commencement (15 August 2022) was provided to the CEO of the Department of Climate Change, Energy, the Environment and Water (DCCEEW) on 18 August 2022 in accordance with the EPBC 2020/8717 Condition 8.
9	If the commencement of the action does not occur within 5 years from the date of this approval, then the approval holder must not commence the action without the prior written agreement of the Minister.	Not Applicable	Commencement of the action occurred within 5 years from the date of approval (6 October 2021).

10	The approval holder must maintain accurate and complete compliance records	Compliant	BMT maintains a robust document management system (DMS) that provides a controlled and secure repository for all Project documentation. Evidence provided in this Compliance Assessment Report is supported by document reference numbers from this DMS to substantiate activities associated with, or relevant to, the conditions of approval for EPBC 2020/8717.
11	If the Department makes a request in writing, the approval holder must provide electronic copies of compliance records to the Department within the timeframe specified in the request	Compliant	No requests were made by the Department during the compliance reporting period for records substantiating activities associated with, or relevant to, the conditions of approval.
12	Unless otherwise agreed to in writing by the Minister, the approval holder must: a) Publish the DEMP on the website within 20 business days of any of the following: i. commencement of the action, ii. a revised version of the DEMP being approved by the Minister in writing; iii. a revised version on the DEMP having been submitted to the Department under condition 21; and iv. keep all versions of the DEMP published on the website from the date that they are first published until the end date.	Compliant	The DEMP was published on the website (https://www.salt.com.au/environment.php) on 18 June 2021 and did not undergo any further revisions in accordance with the EPBC 2020/8717 Condition 12.
13	The approval holder must ensure that any monitoring environmental data (including sensitive ecological data), surveys, maps, and other spatial and metadata required under the DEMP is prepared in accordance with the Department's Guidelines for biological survey and mapped data (2018) and submitted electronically to the Department in accordance with the requirements of the DEMP and within the requirements of condition 2, 3, 4, 5, and 6	Compliant	Monitoring environmental data (including sensitive ecological data), surveys, maps, and other spatial and metadata required under the DEMP (BMT 2021a) was prepared in accordance with the Department's Guidelines for biological survey and mapped data (2018) and presented in the closeout report (Attachment B). No further works or associated monitoring were conducted during the reporting period after the submission of the CAR. If the need for additional environmental monitoring occurs during the lifetime of the approval, then associated monitoring data will be prepared and submitted in accordance with the requirements of the DEMP (BMT 2021a) and the relevant conditions.

14	The approval holder must prepare a compliance report for each 12 month period following the date of commencement of the action, or as otherwise agreed in writing by the Minister. The approval holder must: a) publish each compliance report on the website within 60 business days following the relevant 12 month period; b) notify the Department by email that a compliance report has been published on the website and provide the weblink for the compliance report within 5 business days of the date of publication; c) keep all compliance reports publicly available on the website until this approval expires; d) exclude or redact sensitive ecological data from compliance reports published on the website; and e) where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within 5 business days of publication	Compliant	This document incorporates all field operations associated with the Useless Loop Maintenance Dredging campaign previously included in the CAR (BMT 2022), with no further works conducted during the reporting period, and is structured to adhere to this condition. This report is required to be published on the website by 6 November 2025. This report was published on the website as required within 60 business days following the current reporting period. This report is publicly available as of week beginning 3 November 2025 on the Shark Bay Salt website: https://www.salt.com.au/environment.php
15	The approval holder must notify the Department in writing of any: incident; non-compliance with the conditions; or non-compliance with the commitments made in plans. The notification must be given as soon as practicable, and no later than 2 business days after becoming aware of the incident or non-compliance. The notification must specify: a) any condition which is or may be in breach; b) a short description of the incident and/or non-compliance; and c) the location (including co-ordinates), date, and time of the incident and/or non-compliance. In the event the exact information cannot be provided, provide the best information available	Compliant	A notification letter of non-conformance (associated with MS 1173 issued by the Western Australian Government's DWER) was provided to the CEO of the Department of Climate Change, Energy, the Environment and Water (DCCEEW) on 6 October 2022 in accordance with the EPBC 2020/8717 implementation conditions 15 and 16. Additional examination of the non-conformance is provided in Section 2.1 of the Useless Loop Maintenance Dredging: Environmental Close Out Report (Attachment B). Seabed levelling operations concluded on 12 September 2022, with no further works conducted during the reporting period.
16	The approval holder must provide to the Department the details of any incident or non-compliance with the conditions or commitments made in plans as soon as practicable and no later than 10 business days after becoming aware of the incident or non-compliance, specifying: a) any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future;	Compliant	A notification letter of non-conformance was provided to the CEO of the Department of Climate Change, Energy, the Environment and Water (DCCEEW) on 6 October 2022 in accordance with the EPBC 2020/8717 implementation conditions 15 and 16. Additional information regarding the implementation outcomes of corrective action and the potential impact(s) of the non-compliance event is provided in Section 3.1 of the Useless Loop Maintenance

	b) the potential impacts of the incident or non-compliance; and c) the method and timing of any remedial action that will be undertaken by the approval holder		Dredging: Environmental Close Out Report (Attachment B). Seabed levelling operations concluded on 12 September 2022, with no further works conducted during the reporting period.
17	The approval holder must ensure that independent audits of compliance with the conditions are conducted as requested in writing by the Minister.	Compliant	No independent audits were requested by the minister during the reporting period.
18	For each independent audit, The approval holder must: a) provide the name and qualifications of the independent auditor and the draft audit criteria to the Department; b) only commence the independent audit once the audit criteria have been approved in writing by the Department; and c) submit an audit report to the Department within the timeframe specified in the approved audit criteria.	Compliant	No independent audits were requested by the minister during the reporting period.
19	The approval holder must publish the audit report on the website within 10 business days of receiving the Department's approval of the audit report and keep the audit report published on the website until the end date of this approval	Compliant	No independent audits were requested by the minister during the reporting period.
20	The approval holder may, at any time, apply to the Minister for a variation to the DEMP, by submitting an application in accordance with the requirements of section 143A of the EPBC Act. If the Minister approves a revised DEMP then, from the date specified, the approval holder must implement the revised DEMP in place of the previous DEMP.	Not Applicable	No variations or revisions were made to the DEMP (BMT 2021a).
21	The approval holder may choose to revise the DEMP without submitting it for approval under section 143A of the EPBC Act, if the taking of the action in accordance with the revised DEMP would not be likely to have a new or increased impact.	Not Applicable	No variations or revisions were made to the DEMP (BMT 2021a).
22	If condition 21 is chosen, then the approval holder must: a) notify the Department in writing that the DEMP has been revised and provide the Department with: v. an electronic copy of the revised DEMP; vi. an electronic copy of the revised DEMP marked up with track changes to show the differences between the DEMP and the	Not Applicable	No variations or revisions were made to the DEMP (BMT 2021a).

	revised DEMP; vii. an explanation of the differences between the DEMP and the revised DEMP; viii. the reasons the approval holder considers that taking the action in accordance with the revised DEMP would not be likely to have a new or increased impact; and ix. written notice of the date on which the approval holder will implement the revised DEMP (implementation date), being at least 20 business days after the date of providing notice of the revision of the action management plan, or a date agreed to in writing by the Department. b) Subject to condition 24 implement the revised DEMP from the implementation date.		
23	The approval holder may revoke its choice to implement the revised DEMP under condition 21 at any time by giving written notice to the Department. If the approval holder revokes the choice under condition 21, the approval holder must implement the DEMP in force immediately prior to the revision undertaken under condition 21.	Not Applicable	No variations or revisions were made to the DEMP (BMT 2021a).
24	If the Minister gives a notice to the approval holder that the Minister is satisfied that the taking of the action in accordance with the revised DEMP would be likely to have a new or increased impact, then: a) condition 21 does not apply, or ceases to apply, in relation to the revised DEMP; and b) the approval holder must implement the version of the DEMP specified by the Minister in the notice.	Compliant	No variations or revisions were made to the DEMP (BMT 2021a).
25	At the time of giving the notice under condition 24 the Minister may also notify that for a specified period of time, condition 21 does not apply for the DEMP.	Compliant	No variations or revisions were made to the DEMP (BMT 2021a).
26	Within 30 days after the completion of the action, the approval holder must notify the Department in writing and provide completion data.	Compliant	A notification letter stating the date of completion was provided to the CEO of the Department of Climate Change, Energy, the Environment and Water (DCCEEW) on 6 October 2022 in accordance with EPBC 2020/8717 Condition 26. Completion data is provided below in the Useless Loop Maintenance Dredging: Environmental Close Out Report (Attachment B). No further works were conducted during the reporting period.

ATTACHMENT A APPROVAL NOTICE AND CONDITIONS

ATTACHMENT B ENVIRONMENTAL CLOSE OUT REPORT

ATTACHMENT C MARINE FAUNA OBSERVATION REPORT

ATTACHMENT D GROUND TRUTH SURVEY REPORT

Australian Government
Department of Agriculture, Water and the Environment

APPROVAL

Shark Bay Resources Dredging, near Useless Loop, Shark Bay, Western Australia (EPBC 2020/8717)

This decision is made under sections 130(1) and 133(1) of the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (the EPBC Act). Note that section 134(1A) of the EPBC Act applies to this approval, which provides in general terms that if the approval holder authorises another person to undertake any part of the action, the approval holder must take all reasonable steps to ensure that the other person is informed of any conditions attached to this approval, and that the other person complies with any such condition.

Details

Person to whom the approval is granted (approval holder)	Shark Bay Resources Pty Ltd
ACN or ABN of approval holder	ACN: 079 088 636
Action	To undertake seabed levelling of an existing berth pocket, maintenance dredging of an existing shipping channel, and to dispose of the resulting dredge material (up to 80,000 m^3 of material) near Useless Loop, Shark Bay, Western Australia subject to the variation of the action accepted by the Minister under section 156B on 15 April 2021.

Approval decision

My decisions on whether or not to approve the taking of the action for the purposes of each controlling provision for the action are as follows.

Controlling Provisions

World Heritage	
Section 12	Approve
Section 15A	Approve

National Heritage values of a National heritage place	
Section 15B	Approve
Section 15C	Approve

Listed Threatened Species and Communities	
Section 18	Approve
Section 18A	Approve

Listed migratory species	
Section 20	Approve
Section 20A	Approve

Period for which the approval has effect

This approval has effect until 01 September 2036.

Decision-maker

Name and position	Kylie Calhoun Assistant Secretary Environment Assessments West (WA, SA, NT) Branch Department of Agriculture, Water and the Environment
Signature	
Date of decision	6 October 2021

Conditions of approval

This approval is subject to the conditions under the EPBC Act as set out in ANNEXURE A.

ANNEXURE A – CONDITIONS OF APPROVAL

Part A – Conditions specific to the action

1. To minimise direct impacts to the **World Heritage value/s** of the **Shark Bay World Heritage property** and the **National Heritage value/s** of the **Shark Bay National Heritage place**, including but not limited to **protected matter/s Loggerhead Turtles**, **Humpback Whales**, and **Dugong** the approval holder must:
   a. Not conduct **seabed levelling operations** outside the **berth pocket levelling area Zone of High Impact (BPLAZoHI)**.
   b. Not conduct **dredging operations** outside of the **entrance channel dredge area Zone of High Impact (ECDAZoHI)**.
   c. Not dispose of more than 80,000 cubic metres (m^3) of **dredge material** at the **dredge disposal site**.
   d. Not dispose of **dredge material** outside of the **dredge disposal site**.
2. To mitigate impacts to **marine fauna**, as a **World Heritage value/s** of the **Shark Bay World Heritage Area** and as a **National Heritage value/s** of the **Shark Bay National Heritage place** including but not limited to **protected matter/s**, the approval holder must:
   a. Ensure that a **Marine Fauna Observer is** present and able to monitor **marine fauna** at all times during **operations** as well as during transit to/from the **BPLAZoHI**, **ECDAZoHI**, and/or the **dredge disposal site**. The **Marine Fauna Observer must** have access to equipment suitable to detect, monitor, and record **marine fauna** at all times during **operations** and transit to/from the **BPLAZoHI**, **ECDAZoHI**, and/or the **dredge disposal site**;
   b. Ensure that if **marine fauna**, including, but not limited to, **protected matter/s** is sighted within the **observation zone**, a **Marine Fauna Observer must** continuously monitor the **marine fauna** and record the required data in the **Marine Fauna Observation Log**;
   c. Cease **dredging operations** and/or **dredge disposal operations** if one or more whales, other marine mammals, or marine turtles are sighted within the **shut down zone** applicable for the particular **marine fauna** type at any time during **dredging operations** or **dredge disposal operations;**
   d. Ensure that, if **dredging operations** and/or **dredge disposal operations** have ceased in accordance with condition 2c, that **dredging operations** and/or **dredge disposal operations** do not recommence until the **Marine Fauna Observer** confirms that all whales, marine mammals, and turtles have moved out of the **shut down zone** or the sighted marine turtle has not been seen within 300m, or for other **marine fauna** within 500m, of the dredge vessel for a period of at least 30 minutes;
   e. Ensure the **Marine Fauna Observer** undertakes a **pre-start-up visual observation** for at least 20 minutes before each commencement of a **soft start procedure** and records the required data in the **Marine Fauna Observation Log**;
   f. Ensure that, if no **protected matter/s** have been observed during the **pre-start-up visual observation**, a **soft start procedure**, is implemented in the 20 minutes prior to commencement of **dredging operations** and/or **dredge disposal operations**. Visual observation by a **Marine Fauna Observer** must continue to be undertaken during each **soft start procedure** to enable the **Marine Fauna Observer** to determine if any **marine fauna** are within the **observation zone**;
   g. Ensure that during night-time and times of low visibility, **soft start procedures** are undertaken, and **operations** may commence only if:
      i. There have not been 3 or more **protected matter/s** instigated power-down or shut-down situations during the preceding 24 hours period, or

ii. If **operations** were not previously underway during the preceding 24 hours, the vessel has been in the vicinity (approximately 10km) of the proposed start up position for at least 2 hours (under good visibility conditions) within the preceding 24 hour period and no **protected matter/s** has been sighted.

h. Utilise marine turtle deflectors or exclusion devices on all **dredge equipment**;

i. Leave engines, thrusters, and other noise generating equipment associated with **dredge equipment**, including support vehicles, in standby or switched off when not in use; and

j. Keep suction pumps switched off unless within 2 m of the seabed within the **ECDAZoHI**.

3. To minimise indirect impacts of poor water quality on the **World Heritage value/s** of the **Shark Bay World Heritage Area** and the **National Heritage value/s** of the **Shark Bay National Heritage place**, and habitat for **protected matter/s** including **Loggerhead Turtles** and **Dugong**, the approval holder must:

   a. Implement the monitoring and management actions to protect Benthic Communities and Habitat as specified in the **Dredging Environmental Management Plan** (**DEMP)**;

   b. Ensure that **photosynthetically active radiation (PAR)** levels do not exceed the threshold values specified in the **DEMP;**

   c. Undertake dredge plume visual observations as specified in the **DEMP;**

   d. In the event that threshold values for water quality specified in the **DEMP** are exceeded, cease whichever of **dredging operations** and/or **dredge disposal operations** is associated with the exceedance of threshold values and submit a report to the **Department** within 21 **business days** of the approval holder receiving verified results confirming a threshold criterial exceedance detailing the likely cause of the exceedance and a revised version of the **DEMP** containing proposed revised operating procedures that will ensure water quality will return to and remain above the threshold values; and

   e. Not recommence whichever of **dredging operations** and/or **dredge disposal operations** is associated with the exceedance of threshold values until the **Minister** has approved in writing a revised version of the **DEMP** addressing the reported exceedance of threshold values.

4. To minimise indirect impacts on seagrass which supports the **World Heritage value/s** of the **Shark Bay World Heritage Area** and the **National Heritage value/s** of the **Shark Bay National Heritage place**, and habitat for **protected matter/s**, the approval holder must:

   a. Conduct surveys of the location, benthic habitat type/quality, species/description, area of recoverable loss, and proportion of recoverable loss of all seagrass in **potentially affected areas** within 3 months prior to the commencement of any **seabed levelling operations**, **dredging operations** or **dredge disposal operations**. Should the location, benthic habitat type/quality, species/description, area of recoverable loss, or proportion of recoverable loss of seagrass differ from that specified in the **DEMP**, the approval holder must submit for the **Minister**'s approval a revised version of the **DEMP** in which description of the project area has been revised to reflect the up-to-date location, mapping, benthic habitat type/quality, species/description, area of recoverable loss, and proportion of recoverable loss within the **potentially affected areas**.;

   b. Not commence **dredging operations** or **dredge disposal operations** until the **Minister** has approved in writing a revised version of the **DEMP**, if a revised version is required under condition 4(a); and

   c. Undertake a survey of the location, benthic habitat type/quality, species/description, area of recoverable loss, and proportion of recoverable loss of all seagrass in the **potentially affected areas** within 60 **business days** of the cessation of **seabed levelling operations**, **dredging operations**, and **dredge disposal operations**, as specified in the **DEMP**.

5. The approval holder must submit a copy of a Compliance Assessment Report to the **Department** within 60 business days following the cessation of **seabed levelling operations**, **dredging operations**, and **dredge disposal operations.** The Compliance Assessment Report must include:

    a. Details of the monitoring that was undertaken before and during the implementation of the proposal;

    b. Results of the monitoring undertaken to demonstrate that the environmental protection objectives specified in table 2.1 of the **DEMP** related to Benthic communities and habitats, marine environmental quality, and marine fauna;

    c. Details of any management actions undertaken during the implementation of the proposal to meet the environments protection objectives indicated in condition 5(b);

    d. The completed **Marine Fauna Observation Log** and **Marine Fauna Interaction Log** as required under Conditions 2, 3, and 4, and as specified in the **DEMP;**

6. Unless otherwise demonstrated in the Compliance Assessment Report required by condition 5, within eighteen (18) months following the cessation of **seabed levelling operations**, **dredging operations**, and **dredge disposal operations**, the approval holder must submit a copy of a Seagrass Report to the **Department** that reports on whether post-operation seagrass validation monitoring (as required by condition 4(c) above) indicated any change of location, benthic habitat type/quality, species/description, area of recoverable loss, or proportion of recoverable loss of seagrass outside the **BPLAZoHI**, the **ECDAZoHI**, or the **dredge disposal site Zone of High Impact** . If changes in any of these categories has been observed, the Seagrass Report must include a discussion of the likely cause(s) of the change with sufficient evidence, as confirmed in writing by the **Department**, to rule out the possibility of the approved action being the cause.

7. If the approval holder cannot demonstrate that the impact to seagrass was due to natural processes, the approval holder must submit a seagrass offset proposal for approval by the **Minister** within six (6) months of the submission of the Seagrass Report required by condition 6. The seagrass offset proposal must be within the **Shark Bay World Heritage Property** and be consistent with the **Department's Environmental offset policy**, and must include:

    a. A discussion of how the offset meets relevant environmental objects as outlined by the **Department's Environmental offset policy**, how it will offset the residual significant impacts of relevant **EPBC Act protected matter/s**, and a reference to **EPBC Act** approval conditions to which the seagrass offset proposal refers;

    b. Endorsement from a **suitably qualified seagrass ecologist** from a tertiary institution or government department with experience in seagrass rehabilitation undertaking;

    c. A table of commitments made in the seagrass offset proposal to achieve the objectives, and a reference to where the commitments are detailed in the seagrass offset proposal;

    d. Reporting and review mechanisms, and documentation standards to demonstrate compliance with the seagrass offset proposal;

    e. An assessment of risks to achieving seagrass offset proposal environmental objectives and risk management strategies that will be applied; and

    f. A monitoring program, which must include:

        i. measures of success that are linked to the purpose of the offsets and provide clear benchmarks about their success or failure;

        ii. the timing and frequency of monitoring to indicate whether benchmarks are being met;

        iii. trigger values for corrective actions; and

        iv. proposed corrective actions, if trigger values are reached.

When the **Minister** approves the seagrass offset proposal, then the seagrass offset proposal must be implemented within six (6) months of approval of the offset proposal or as required to align with the monitoring commitments of the seagrass offset proposal.

Part B – Standard administrative conditions

Notification of date of commencement of the action

8. The approval holder must notify the **Department** in writing of the date of **commencement of the action** within 10 **business days** after the date of **commencement of the action**.
9. If the **commencement of the action** does not occur within 5 years from the date of this approval, then the approval holder must not **commence the action** without the prior written agreement of the **Minister**.

Compliance records

10. The approval holder must maintain accurate and complete **compliance records**.
11. If the **Department** makes a request in writing, the approval holder must provide electronic copies of **compliance records** to the **Department** within the timeframe specified in the request.

Note: **Compliance records** may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the **EPBC Act**, and or used to verify compliance with the conditions. Summaries of the result of an audit may be published on the **Department**'s website or through the general media.

Preparation and publication of plans

12. Unless otherwise agreed to in writing by the **Minister,** the approval holder must:
    a. publish the **DEMP** on the **website** within 20 **business days** of any of the following:
        i. **commencement of the action**,
        ii. a revised version of the **DEMP** being approved by the **Minister** in writing;
        iii. a revised version on the **DEMP** having been submitted to the **Department** under condition 21**;** and
    b. keep all versions of the **DEMP** published on the **website** from the date that they are first published until the end date of this approval.
13. The approval holder must ensure that any **monitoring data** (including **sensitive ecological data**), surveys, maps, and other spatial and metadata required under the **DEMP** is prepared in accordance with the **Department's** *Guidelines for biological survey and mapped data* (2018) and submitted electronically to the **Department** in accordance with the requirements of the **DEMP** and within the requirements of condition 2, 3, 4, 5, and 6 above.

Annual compliance reporting

14. The approval holder must prepare a **compliance report** for each 12 month period following the date of **commencement of the action**, or as otherwise agreed in writing by the **Minister**. The approval holder must:
    a. publish each **compliance report** on the **website** within 60 **business days** following the relevant 12 month period;
    b. notify the **Department** by email that a **compliance report** has been published on the **website** and provide the weblink for the **compliance report** within 5 **business days** of the date of publication;
    c. keep all **compliance reports** publicly available on the **website** until this approval expires;

d. exclude or redact **sensitive ecological data** from **compliance reports** published on the **website;** and

e. where any **sensitive ecological data** has been excluded from the version published, submit the full **compliance report** to the **Department** within 5 **business days** of publication.

Note: **Compliance reports** may be published on the **Department**'s website.

Reporting non-compliance

15. The approval holder must notify the **Department** in writing of any: **incident**; non-compliance with the conditions; or non-compliance with the commitments made in **plans**. The notification must be given as soon as practicable, and no later than 2 **business days** after becoming aware of the **incident** or non-compliance. The notification must specify:

    a. any condition which is or may be in breach;

    b. a short description of the **incident** and/or non-compliance; and

    c. the location (including co-ordinates), date, and time of the **incident** and/or non-compliance. In the event the exact information cannot be provided, provide the best information available.

16. The approval holder must provide to the **Department** the details of any **incident** or non-compliance with the conditions or commitments made in **plans** as soon as practicable and no later than 10 **business days** after becoming aware of the **incident** or non-compliance, specifying:

    a. any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future;

    b. the potential impacts of the **incident** or non-compliance; and

    c. the method and timing of any remedial action that will be undertaken by the approval holder.

Independent audit

17. The approval holder must ensure that **independent audits** of compliance with the conditions are conducted as requested in writing by the **Minister**.

18. For each **independent audit**, the approval holder must:

    a. provide the name and qualifications of the independent auditor and the draft audit criteria to the **Department;**

    b. only commence the **independent audit** once the audit criteria have been approved in writing by the **Department;** and

    c. submit an audit report to the **Department** within the timeframe specified in the approved audit criteria.

19. The approval holder must publish the audit report on the **website** within 10 **business days** of receiving the **Department's** approval of the audit report and keep the audit report published on the **website** until the end date of this approval.

Revision of action management plans

20. The approval holder may, at any time, apply to the **Minister** for a variation to the **DEMP**, by submitting an application in accordance with the requirements of section 143A of the **EPBC Act**. If the **Minister** approves a revised **DEMP** then, from the date specified, the approval holder must implement the revised **DEMP** in place of the previous **DEMP**.

21. The approval holder may choose to revise the **DEMP** without submitting it for approval under section 143A of the **EPBC Act**, if the taking of the action in accordance with the revised DEMP would not be likely to have a **new or increased impact**.

22. If the approval holder makes the choice under condition 21 to revise the **DEMP** without submitting it for approval, the approval holder must:

    a. notify the **Department** in writing that the **DEMP** has been revised and provide the **Department** with:

        i. an electronic copy of the revised **DEMP**;

        ii. an electronic copy of the revised DEMP marked up with track changes to show the differences between the **DEMP** and the revised **DEMP**;

        iii. an explanation of the differences between the **DEMP** and the revised **DEMP**;

        iv. the reasons the approval holder considers that taking the action in accordance with the revised **DEMP** would not be likely to have a **new or increased impact;** and

        v. written notice of the date on which the approval holder will implement the revised **DEMP** (implementation date), being at least 20 **business days** after the date of providing notice of the revision of the action management plan, or a date agreed to in writing by the **Department**.

    b. subject to condition 24 implement the revised **DEMP** from the implementation date.

23. The approval holder may revoke its choice to implement the revised **DEMP** under condition 21 at any time by giving written notice to the **Department**. If the approval holder revokes the choice under condition 21, the approval holder must implement the **DEMP** in force immediately prior to the revision undertaken under condition 21.

24. If the **Minister** gives a notice to the approval holder that the **Minister** is satisfied that the taking of the action in accordance with the revised **DEMP** would be likely to have a **new or increased impact**, then:

    a. condition 21 does not apply, or ceases to apply, in relation to the revised **DEMP**; and

    b. the approval holder must implement the version of the **DEMP** specified by the **Minister** in the notice.

25. At the time of giving the notice under condition 24 the **Minister** may also notify that for a specified period of time, condition 21 does not apply for the **DEMP**.

Note: conditions 21, 22, 23, 24 are not intended to limit the operation of section 143A of the **EPBC Act** which allows the approval holder to submit a revised action management plan, at any time, to the **Minister** for approval.

Completion of the action

26. Within 30 days after the **completion of the action**, the approval holder must notify the **Department** in writing and provide **completion data**.

Part C - Definitions

In these conditions, except where contrary intention is expressed, the following definitions are used:

Berth pocket levelling area Zone of High Impact (BPLAZoHI) means the area enclosed by the red polygon and designated '**Zone of High Impact'** on the map at Attachment A.

Business day(s) means a day that is not a Saturday, a Sunday or a public holiday in the state or territory of the action.

Commence(ment) of the action means the first instance of any specified activity associated with the action including clearing and construction. **Commencement of the action** does not include minor physical disturbance necessary to:

i. undertake pre-dredging surveys or monitoring programs.

ii. install signage and /or temporary fencing to prevent unapproved use of the project area.

iii. install temporary site facilities for persons undertaking pre-commencement activities so long as these are located where they have no impact on the **protected matters.**

Completion data means an environmental report and spatial data clearly detailing how the conditions of this approval have been met. The **Department**'s preferred spatial data format is **shapefile**.

Completion of the action means the date on which the **Minister** advises in writing that the approval holder no longer must submit any **compliance reports**.

Compliance records means all documentation or other material in whatever form required to demonstrate compliance with the conditions of approval in the approval holder's possession or that are within the approval holder's power to obtain lawfully.

Compliance report(s) means written reports:

i. providing accurate and complete details of compliance, **incidents**, and non-compliance with the conditions and the **plans**

ii. consistent with the **Department's** *Annual Compliance Report Guidelines* (2014)

iii. include a **shapefile** of any removal of any **protected matter/s**, or their habitat, within the relevant 12 month period

iv. annexing a schedule of all **plans** prepared and in existence in relation to the conditions during the relevant 12 month period.

Department means the Australian Government agency responsible for administering the **EPBC Act**.

Dredge disposal operations means all activities related to the act of disposing of material collected during **dredging operations**.

Dredge disposal site means the area outlined in black and designated 'Disposal Area' at Attachment B and defined by the coordinates (GDA94):

Latitude	Longitude
25° 51' 25.51" S	113° 15' 18.01" E
25° 51' 25.48" S	113° 15' 41.96" E
25° 51' 46.50" S	113° 15' 42.00" E
25° 51' 46.51" S	113° 15' 18.00" E

Dredge disposal site Zone of High Impact means the **ZoHI** around the **Dredge disposal site** as designated by the red polygon labelled '**Zone of High Impact'** around the **Dredge disposal site** at Attachment B.

Dredge equipment means a trailing suction hopper dredger, or any equipment intended to disturb the ocean floor or undertake any **dredging operations**.

Dredge material means material below the seabed that is excavated or removed from the **Entrance channel dredge area Zone of High Impact**.

Dredging Environmental Management Plan (DEMP) means the document entitled *Shark Bay Resources: Dredging Environmental Management Plan*, version 5, dated June 2021, prepared by BMT Commercial Australia Pty Ltd (BMT), or a version subsequently revised in accordance with these conditions.

Dredging operations means all activities related to removal of material from the seabed for the purpose of increasing the depth of the seabed.

Dugong means the **EPBC Act** listed migratory species Dugong (*Dugong dugon*).

Entrance channel dredge area Zone of High Impact (ECDAZoHI) means the area designated 'entrance channel dredge area' and shown by the purple polygon on the map at Attachment B.

Environmental offset policy means the document titled *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offsets Policy (Department of Sustainability, Environment, Water, Population and Communities, 2012, available from: www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy).

EPBC Act means the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

Humpback Whale(s) means the **EPBC Act** listed Vulnerable and Migratory species Humpback Whale (*Megaptera novaenangliae*).

Incident means any event which has the potential to, or does, impact on one or more **protected matter(s)** other than as authorised by this approval.

Independent audit(s) means an audit conducted by an independent and **suitably qualified person** as detailed in the *Environment Protection and Biodiversity Conservation Act 1999 Independent Audit and Audit Report Guidelines* (2019).

Irreversible means lacking a capacity to return or recover to a state resembling that prior to being impacted within a timeframe of five years

Loggerhead Turtles means the **EPBC Act** listed Endangered and Migratory species Loggerhead Turtle (*Caretta caretta*).

Marine Fauna means all cetaceans, pinnipeds, dugongs, sharks, and marine turtles listed under the EPBC Act.

Marine Fauna Interaction Log means the reporting documentation of the same name as specified in the **Dredging Environmental Management Plan**.

Marine Fauna Observation Log means the reporting documentation of the same name, as specified in the **Dredging Environmental Management Plan**.

Marine Fauna Observers means persons trained and experienced in marine fauna identification and behaviour and on-water distance estimation, and capable of making accurate identifications and observations of marine fauna in Australian waters, and meet the definition as described in *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales* (Department of the Environment, Water, Heritage and the Arts, 2008, *available from: www.environment.gov.au/epbc/publications/epbc-act-policy-statement-21-interaction-between-offshore-seismic-exploration-and-whales*).

Monitoring data means the data required to be recorded under the conditions of this approval.

Minister means the Australian Government Minister administering the **EPBC Act** including any delegate thereof.

National Heritage value/s means the official values of **Shark Bay National Heritage place** as inscribed by the **Minister** on the National Heritage List.

New or increased impact means a new or increased environmental impact or risk relating to any **protected matter**, when compared to the likely impact of implementing the **DEMP**, as outlined in the *Guidance on 'New or Increased Impact' relating to changes to approved management plans under EPBC Act environmental approvals (2017).*

Observation zone means the entire area within 3 km radius of the **dredge equipment.**

Operations means **dredging operations**, **dredge disposal operations**, and/or **seabed levelling operations**.

Photosynthetically active radiation (PAR) means the spectral range (wave band) of solar radiation from 400 to 700 nanometres that photosynthetic organisms are able to use in the process of photosynthesis.

Plan(s) means any of the documents required to be prepared, approved by the **Minister**, implemented by the approval holder and/or published on the **website** in accordance with these conditions (includes action management plans and/or strategies).

Potentially affected areas means the Dredge Disposal Site Zone of Moderate Impact, as designated by the yellow polygon and labelled as 'Dredge Disposal Site Zone of Moderate Impact' at Attachment B, as well as seagrass meadows adjacent to the Entrance Channel Dredge Area, Dredge Disposal Site Zone of High Impact, and the Berth Pocket Levelling Area Zone of High Impact.

Pre-start-up visual observation means the process described in *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales* (Department of the Environment, Water, Heritage and the Arts, 2008, *available from: www.environment.gov.au/epbc/publications/epbc-act-policy-statement-21-interaction-between-offshore-seismic-exploration-and-whales*) where during daylight hours visual observations for the presence of **marine fauna** (including but not limited to the **protected matter/s**).

Protected matter(s) means one or more matter protected under a controlling provision in Part 3 of the **EPBC Act** for which this approval has effect, including but not limited to:

a. **Loggerhead Turtles**,

b. **Humpback Whales**, and

c. **Dugong**.

Seabed levelling operations means the sweeping or levelling of sediment with the intention of removing high spots within a designated area but without any removal of sediment to a secondary location, as well as all actions associated with the sweeping or levelling.

Sensitive ecological data means data as defined in the Australian Government Department of the Environment (2016) *Sensitive Ecological Data – Access and Management Policy V1.0.*

Shapefile means location and attribute information of the action provided in an Esri shapefile format. Shapefiles must contain '.shp', '.shx', '.dbf' files and a '.prj' file that specifies the projection/geographic coordinate system used. Shapefiles must also include an '.xml' metadata file that describes the shapefile for discovery and identification purposes**.**

Shark Bay National Heritage place means the property of the same name, as inscribed on the National Heritage List on 21 May 2007 and any subsequent updates adopted by the **Department**.

Shark Bay World Heritage property means the property of the same name, as inscribed on the World Heritage List by the World Heritage Committee on 13 December 1991 and any subsequent updates adopted by the World Heritage Committee.

Shut down zone means the area around the **dredge equipment** which, if entered by a type of **marine fauna** specified in this definition, **operations** must be shut down. The radius of the **shut down zone** is specific to the type of **marine fauna** as follows:

a. Whale/s – the entire area within 1500 m radius of the **dredge equipment**,

b. Other marine mammals – the entire area within 500 m radius of the **dredge equipment, or**

c. Marine turtle/s – the entire area within 300 m radius of the **dredge equipment.**

Soft start procedure means the process of this name as described in *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales* (Department of the Environment, Water, Heritage and the Arts, 2008, *available from:*

www.environment.gov.au/epbc/publications/epbc-act-policy-statement-21-interaction-between-offshore-seismic-exploration-and-whales).

Suitably qualified person means a person who has professional qualifications, training, skills and/or experience related to the nominated subject matter and can give authoritative independent assessment, advice and analysis on performance relative to the subject matter using the relevant protocols, standards, methods and/or literature.

Suitably qualified seagrass ecologist means a person who has relevant professional qualifications and at least three (3) years of work experience designing and implementing surveys and/or rehabilitation programs for seagrass and can give an authoritative assessment and advice on the ecology of seagrass in Western Australia using relevant protocols, standards, methods and/or literature.

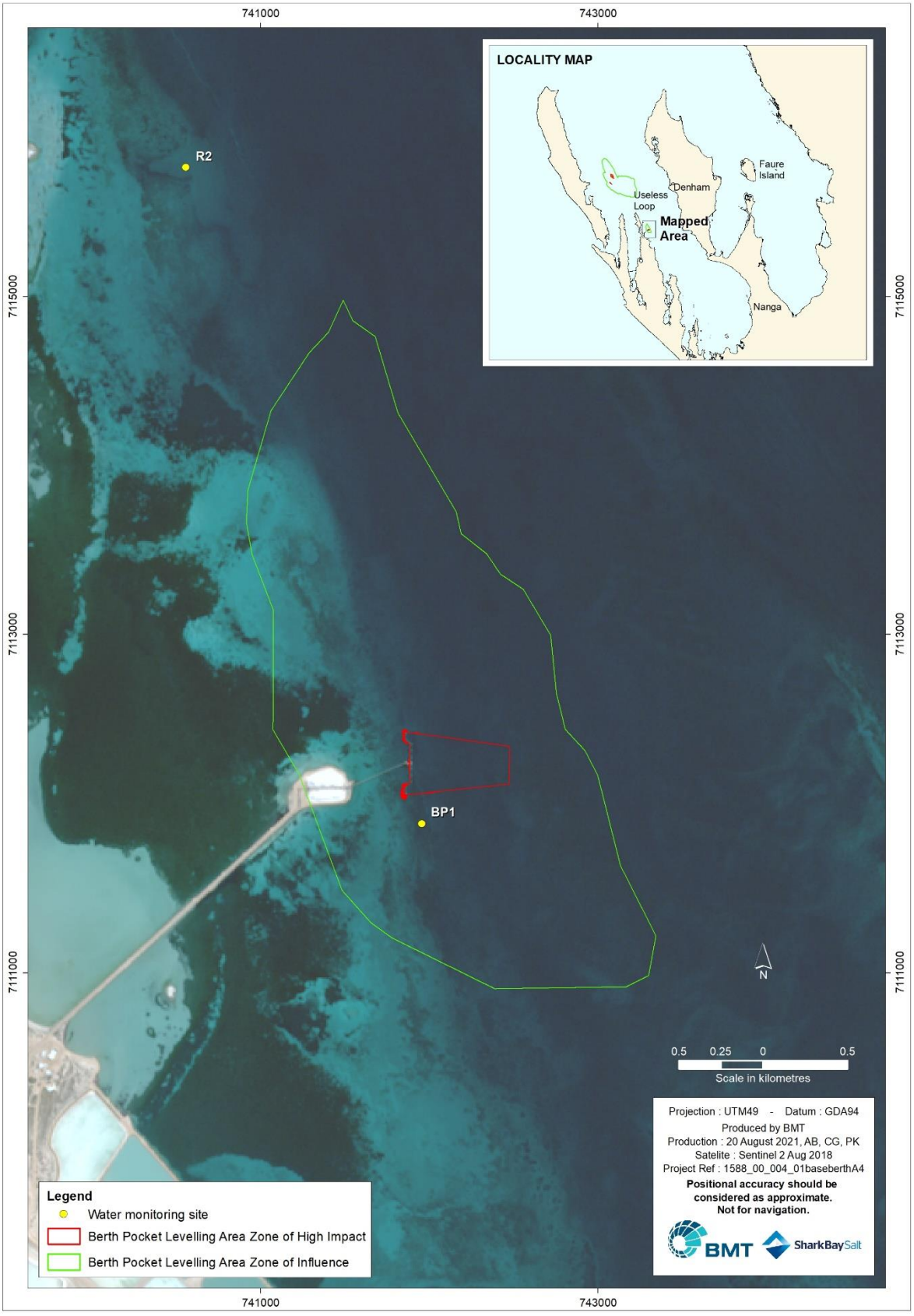
Website means a set of related web pages located under a single domain name attributed to the approval holder and available to the public.

World Heritage value/s means the values inscribed by the World Heritage Committee for the Shark Bay area under Criterion vii, viii, ix, and x and expressed in the Statement of Outstanding Value.

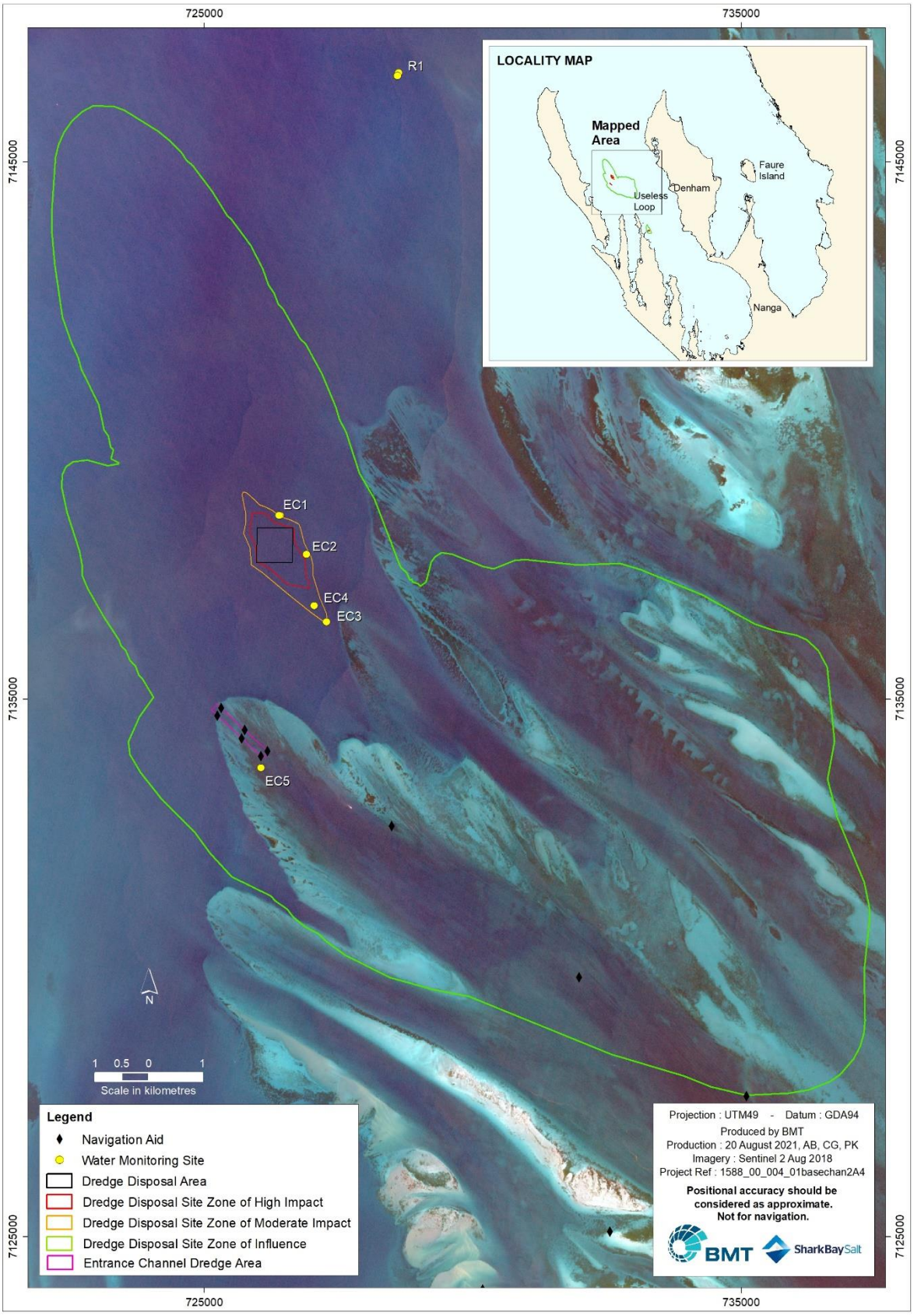
ZoHI means the Zone of High Impact, the area where impacts on benthic communities and habitats (including seagrass) are predicted to be **irreversible**.

ATTACHMENTS

Attachment A – map of the berth pocket levelling area

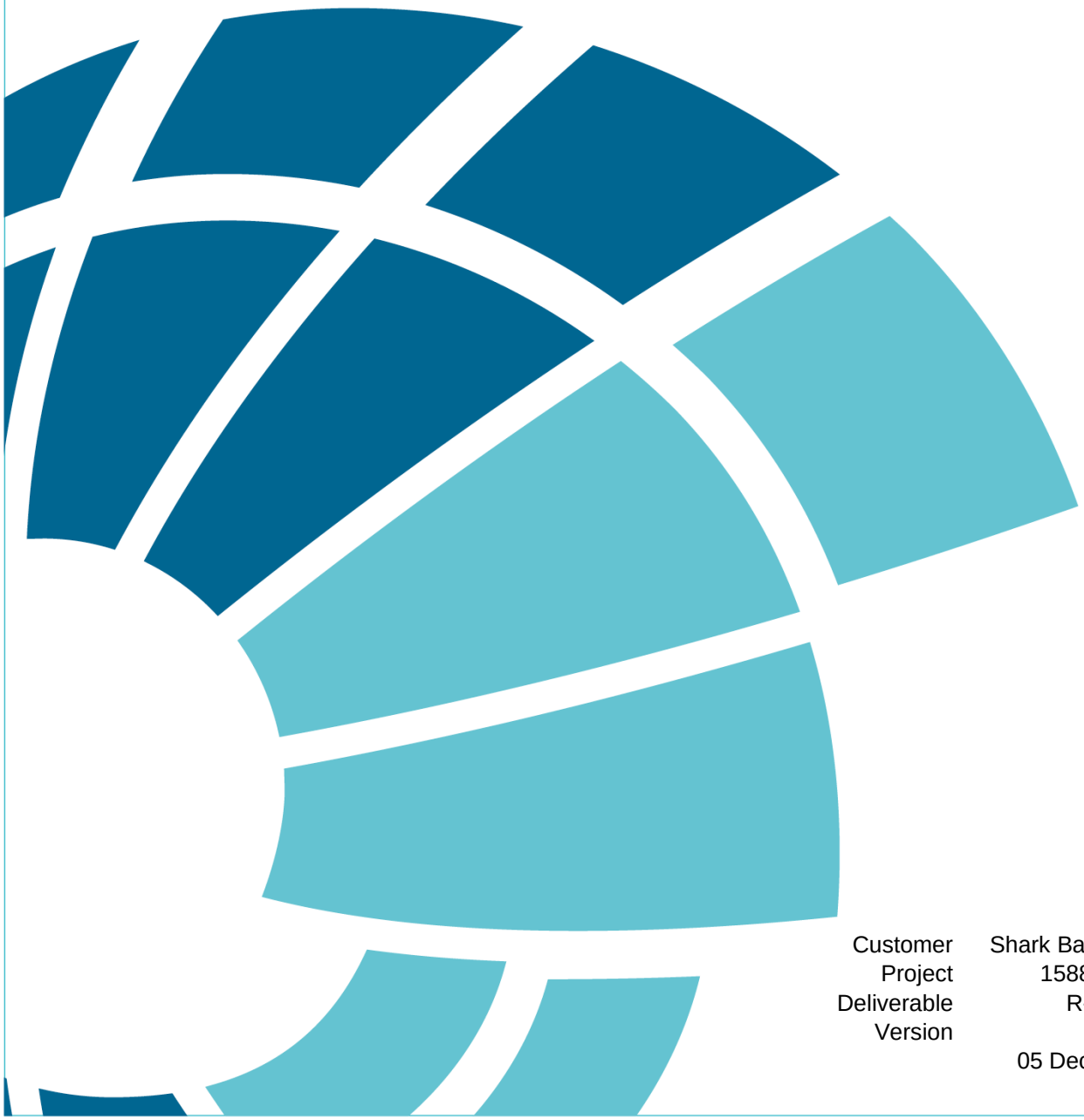


Attachment B – map of the entrance channel dredging site, and dredge disposal site



Shark Bay Resources Dredging

Dredging Environment Management Plan Implementation: Environmental Close Out Report



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Project	158800.000_004
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Customer Contact	William Jones
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Author	Connor Gorham
Reviewed By	Ashley Lemmon
Project Manager	Ashley Lemmon

Amendment Record

The Amendment Record below records the history and issue status of this document.

Version	Version Date	Distribution	Record
A	25 November 2022	Ashley Lemmon	Technical and Editorial Review
B	27 November 2022	William Jones	Client Review
C	30 November 2022	William Jones	Client Review
0	05 December 2022	William Jones	Final Issue For Use

Executive Summary

The Shark Bay salt field occupies 130 km^2 and was constructed by enclosing natural inlets at the southern end of Useless Inlet and Useless Loop. The port facility that supports the salt field operations consists of a stockpile, jetty and loader for export of salt products (hereafter, the Port). The Port is accessed via the Denham Channel, a natural feature that extends through to the northern entrance of Denham Sound at Bar Flats. A man made 'Entrance Channel' (hereafter, the Entrance Channel) has been created at bar flats to allow ships to access Denham Sound and the Port facility. The Entrance Channel is located within the Shark Bay Marine Park (SBMP), though the salt field and Port facility is surrounded by, but excised from, the Shark Bay World Heritage Area (SBWHA) and SBMP.

A hydrographic survey conducted in 2018 identified that natural accretion of material in the Port's Berth Pocket (hereafter, the Berth Pocket) and the Entrance Channel would begin to impede on optimal vessel loading in the near-term and so studies to inform the engineering design and risk to the marine environment of dredging, disposal and seabed levelling of the Port commenced in 2019. Numerous baseline studies informed a comprehensive environmental impact assessment (EIA), which supported the referral of the proposal under State and Commonwealth legislation. After extensive consultation with the broad range of stakeholders, including State and Federal Government regulatory bodies, the proposal was approved under the following:

- Sections 130(1) and 133(1) of the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (the EPBC Act), as a Controlled Action, on 6 October 2021. The action is controlled under the approval conditions of EPBC 2020/8717

- The *Environmental Protection Act 1986* subject to the conditions and procedures outlined in Ministerial Statement 1173 (MS 1173), published 21 October 2021.

- A Sea Dumping Permit (SDP) with approval to dispose material at sea under the *Environment Protection (Sea Dumping) Act 1981,* published 9 November 2021

The Dredging Environmental Management Plan (DEMP; BMT 2021a) is the primary document outlining the environmental monitoring and management requirements for the proposal and was prepared to align with the conditions of MS 1173. Additional environmental monitoring and management requirements relating to the protection of the values of the SBWHA were required by EPBC 2020/8717, which largely pertain to the seagrass communities and marine fauna of the SBWHA. The SDP predominantly refers to the environmental monitoring and management requirements detailed in the DEMP.

Recently, a dredging, disposal and seabed levelling campaign (hereafter, Campaign) was undertaken over four weeks from 15 August 2022 to 12 September 2022. During the Campaign, ~1,403 m^3 of material was levelled at the Berth Pocket using a levelling bar hauled behind a tugboat. At the Entrance Channel ~63,150 m^3 of material was removed using a trailing suction hopper dredge (TSHD) and disposed at an approved disposal area (hereafter, the Disposal Area) located ~3 km north-east of the Entrance Channel, outside the SBMP.

Various forms of environmental monitoring and management were implemented prior to, during and after the Campaign including vessel position monitoring, visual plume observations and the assessment of benthic light data recorded by scientific instruments deployed in seagrass habitat adjacent to the relevant impact areas. This report present details of the environmental monitoring and management that was undertaken prior to, during and after the campaign completed in accordance with the relevant environmental approvals.

Review of the monitoring data indicates that project-induced light reduction was consistently within satisfactory bounds to prevent loss of benthic communities and habitats (BCH) that had been identified in the EIA. The turbid plumes observed throughout the Berth Pocket, Entrance Channel and Disposal Area appeared localised and remained largely confined with the respective zone of high impact. This observation was further substantiated by measurements of light and turbidity at the seabed (where sensitive receptors such as seagrass reside) immediately adjacent to areas of heightened disturbance, which recorded no trigger or threshold criterion exceedances.

A large-scale benthic habitat assessment was undertaken to assess cover of BCH (predominantly seagrass) before and after the Campaign to establish any associated loss. Overall, the benthic communities and habitat coverage data collected pre- and post- campaign operations indicate both gain and loss of seagrass habitat across locations and time. Differences in seagrass cover were observed pre- and post-dredging activities in the seagrass adjacent to the Berth Pocket Zone of High Impact (ZoHI) and Offshore Disposal area Zone of Moderate Impact (ZoMI). This observed variability in seagrass cover among locations is likely indicative of ineffective paired impact and control sites owing to varying density of seagrass or assemblage of benthic communities before dredging commenced, and natural variability among sparse ephemeral seagrass meadows.

Multiple lines of evidence demonstrate that the identified impacts to seagrass habitat and communities have been managed in line with the DEMP and the EPOs as defined within the approval conditions specified by both state and federal regulators have been met for BCH. Permanent loss of seagrass beyond the ZoHI has not been demonstrated. The decline of seagrass observed within the ZoMI is below the acceptable level of recoverable loss as defined in the DEIA (BMT 2021b) and is expected to recover within a period of 5 years following completion of the campaign. The observed differences in seagrass cover are not anticipated to result in a significant impact to the ecological values of the SBWHA or the SBMP or reflect the loss of habitat critical for survival of threatened and migratory marine fauna in the region. The risks posed by the project to key sensitive receptors and the SBWHA values have been shown to be low and acceptable. Likewise, the EPOs for the other key environmental factors; Marine Environmental Quality, Marine Fauna and Social Surroundings were also met through the successful implementation of comprehensive environmental monitoring and management commitments during the Campaign.

One non-conformance with the environmental approval conditions has been noted. Condition 1 (b) of MS 1173 states dredging to a maximum depth of -10.5 m at lowest astronomical tide (LAT) is permitted at the Entrance Channel. Final post-dredging hydrographic survey data of the Entrance Channel revealed some isolated areas of seabed where dredging occurred that are deeper than the permitted vertical depth. The localised pockets where over-dredge occurred were ≤80 cm deeper than the intended maximum dredge design depth. Overall, 63,490 m^3 of material was removed from the Entrance Channel, of which ~11% was below -10.5 m LAT. While all environmental monitoring commitments were implemented, there were none that directly mitigated the risk of vertical over-dredging. Given the relatively small degree of turbidity generated by the dredging as observed in benthic monitoring data and visual plume observation data, the predominant potential environmental impact pathway from dredging below depth tolerance is considered to be the potential release of toxicants that may be contained within the sediment. However, over-dredge of material in the Entrance Channel by ~80 cm (max) is unlikely to present a material risk to the marine environment for the following reasons:

- Data indicates that there is no significant geological feature present at this location and prior sediment analyses within the Entrance Channel indicates that the material is broadly similar regarding particle size distribution and TOC (BMT 2020)

- Contaminant analyses of the overlying sediment conducted in July 2019 and February 2020 noted that Entrance Channel sediments are characterised by clean undisturbed sediment that are suitable for unconfined disposal at sea (BMT 2020).

Contents

Tables

Figures

Acronyms and Measurement Units

Acronyms	Measurements
BACIP	Before-After-Control-Impact-Paired
BCH	Benthic communities and habitat
DAWE	Department of Agriculture, Water and the Environment
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEMP	Dredging Environmental Management Plan
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
EPBC	Environmental Protection, Biodiversity and Conservation Act (1999)
EPO	Environmental protection objective
GIS	Geographical information system
GPS	Geographical positioning system
LAT	Lowest astronomical tide
MFO	Marine fauna observer
MS	Ministerial Statement
NATA	National Association of Testing Authorities
NTU	Nephelometric turbidity unit
PAR	Photosynthetically active radiation
PQL	Practical quantitation limit
RIU	Remote imagery units
SAP	Sampling and analysis plan
SBMP	Shark Bay Marine Park
SBR	Shark Bay Resources
SBWHA	Shark Bay World Heritage Area
SDP	Sea Dumping Permit
SPV	Species protection value
TBT	Tributyltin
TOC	Total organic carbon
TSHD	Trailing suction hopper dredge
ZoI	Zone of influence
ZoHI	Zone of high impact

Acronyms	Measurements
ZoMI	Zone of moderate impact

1 Introduction

1.1 Background

Shark Bay Resources Pty Ltd (SBR) operates two solar salt fields within Western Australia. The Shark Bay salt field was constructed in 1960, with first shipment in 1967. The field occupies 130 km^2 and was constructed by enclosing natural inlets at the southern end of Useless Inlet and Useless Loop (Figure 1.1). The port facility that supports the salt field operations consists of a stockpile, jetty and loader for export of salt products (hereafter, the Port). The Port is accessed via the Denham Channel, a natural feature that extends through to the northern entrance of Denham Sound at Bar Flats. A man made 'Entrance Channel' (hereafter, the Entrance Channel) has been created at bar flats to allow ships to access Denham Sound and the Port facility. The Entrance Channel is located within the Shark Bay Marine Park (SBMP), though the salt field and Port facility is surrounded by, but excised from, the Shark Bay World Heritage Area (SBWHA) and SBMP (Figure 1.1).

Recent hydrographic surveys (circa. 2018) indicated that the accretion of material in the Port's berth pocket (hereafter, the Berth Pocket) and the Entrance Channel would begin to impede on optimal vessel loading in the near-term and is required to be removed. Recently a dredging and disposal and seabed levelling campaign (hereafter, the Campaign) was undertaken over four weeks from 15 August 2022 to 12 September 2022. During the Campaign, ~1,403 m^3 of material was levelled at the Berth Pocket using a levelling bar hauled behind a tugboat. At the Entrance Channel ~63,150 m^3 of material was removed using a trailing suction hopper dredge (TSHD) and disposed at an approved Disposal Area (hereafter, the Disposal Area) located ~3 km north-east of the Entrance Channel, outside the SBMP (Figure 1.1). The Campaign was completed in accordance with the following regulatory instruments/no

- SBR's Dredging Environmental Management Plan (DEMP; BMT 2021a)
- Ministerial Statement (MS) No. MS 1173 issued by the Western Australian Government's Department of Water and Environmental Regulation (DWER)
- Approval under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) EPBC 2020/8717 issued by the Australian Government's Department of Agriculture, Water and the Environment (DAWE[1])
- Sea Dumping Permit (SDP) No. SD 2020-3993 issued by DAWE[1].

The DEMP (BMT 2021a) is the primary document outlining the environmental monitoring and management requirements for the Campaign and was prepared to align with the conditions of MS 1173 issued by DWER. Additional environmental monitoring and management requirements relating to the protection of the values of the SBWHA were required by EPBC 2020/8717, which largely pertain to the seagrass communities and marine fauna of the SBWHA. The SDP predominantly refers to the environmental monitoring and management requirements detailed in the DEMP.

[1] Now administered by the Department of Climate Change, Energy, the Environment and Water (DCCEEW)

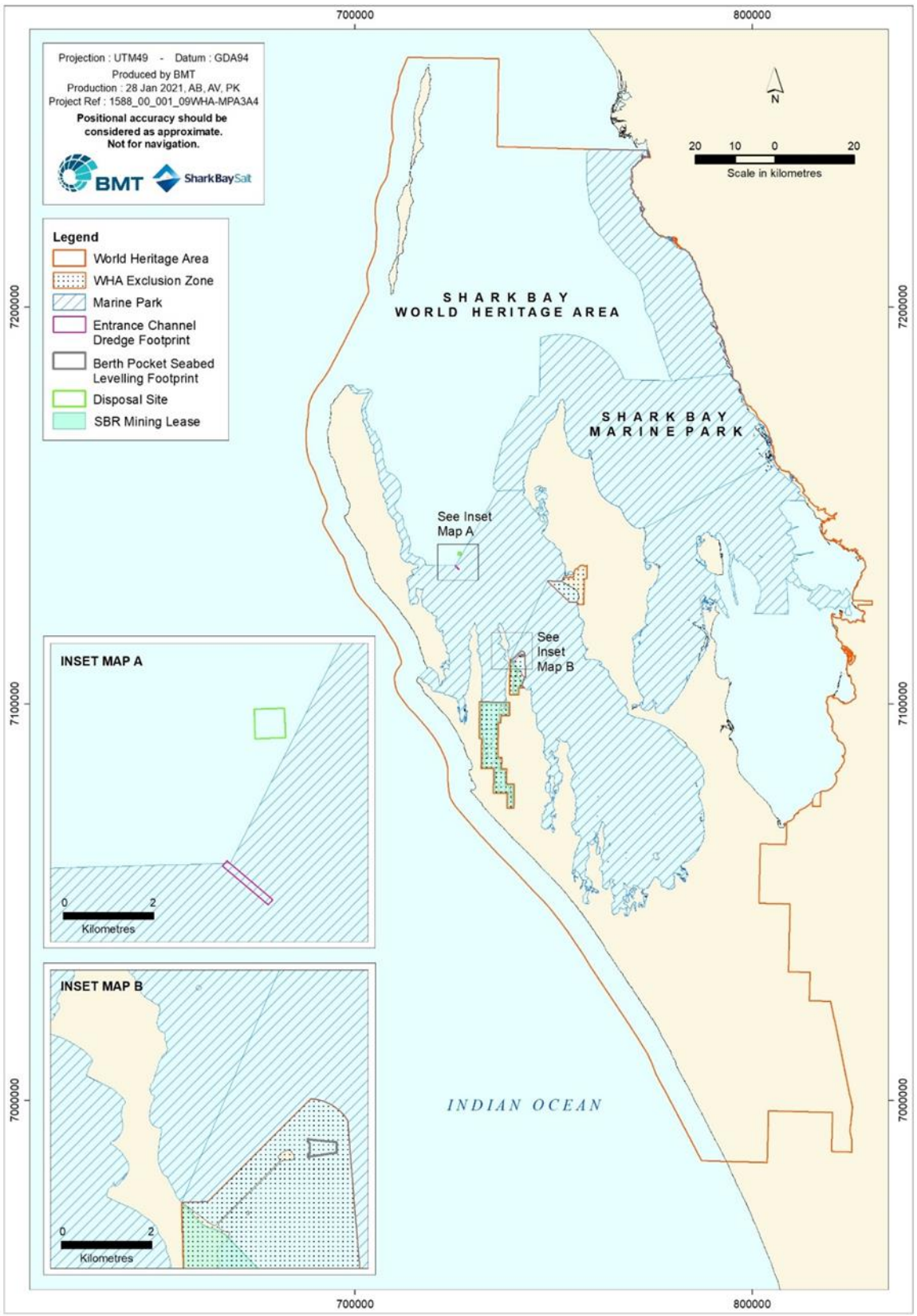


Figure 1.1 Shark Bay Resources entrance channel and Port facility location within the wider Shark Bay World Heritage Area

1.2 Purpose of this document

The purpose of this document is to present details of the environmental monitoring and management that was undertaken prior to, during and after the Campaign completed in accordance with the relevant environmental approvals. Environmental monitoring included:

- Dredging, disposal, and seabed levelling position monitoring (Section 2.1)
- Visual plume observations (Section 2.2)
- Benthic light monitoring (Section 2.3)
- Water and sediment quality monitoring (Section 2.4 and Section 2.5, respectively)
- Benthic communities and habitat surveys (Section 2.6)
- Marine fauna monitoring (Section 2.6.4)
- Introduced marine species (Section 2.8)
- Indigenous heritage (Section 2.9)

Environmental management required during the campaign is detailed in Section 3.1. A summary of the environmental monitoring and management measures undertaken and conclusions from the Campaign are provided in Section 4.

2 Environmental Monitoring

2.1 Dredging, disposal and seabed levelling position monitoring

Berth Pocket

Seabed levelling of the Berth Pocket was undertaken by the Australian flagged utility tug Edi. Sweeping operations commenced on 15 August 2022 and adhered to 12-hour operational workdays (6:00AM to 6:00PM). Seabed levelling within the Berth Pocket covered a duration of twelve days, finishing on 26 August 2022. Throughout this time, overall operability of Edi in the Berth Pocket was 75.6% with down time associated with o weather induced delays and standby/shutdown resulting from marine fauna observer (MFO) monitoring and management procedures (see Section 2.6.4).

During seabed levelling at the Berth Pocket, Edi's position was tracked with data presented as waypoints. Waypoints were taken from a handheld geographical positioning system (GPS) that recorded the track log at 1 min intervals for the daily works duration. Edi's levelling areas are inferred to be the areas densely populated with waypoints, as the vessel typically required multiple passes to redistribute material. Waypoints located outside the designated Berth Pocket permit boundary correspond to Edi's transit to the overnight anchorage (Figure 2.1).

Edi's position data was retrieved daily, digitised and plotted in a geographical information system (GIS) to compare with spatial boundaries associated with the project. These data were reviewed each subsequent day and reported in a daily compliance summary report. Position monitoring data demonstrates that seabed levelling was confined to within the approved area at the berth pocket (Figure 2.1).

Entrance Channel and Disposal Area

Dredging of the Entrance Channel and disposal activities in the Disposal Area were undertaken by the dredge vessel Modi R. Position data from the navigation system aboard Modi-R was exported daily and reviewed each subsequent day. The position of the vessel while operational (i.e. either actively dredging or disposing of material) was corroborated with vessel logs to confirm timing of operational activities, digitised and plotted in a GIS to compare with spatial boundaries associated with the project. These data were then reviewed and reported in a daily compliance report.

Dredging operations commenced on 01 September 2022 and followed a 24-hour working schedule. Dredging and disposal operations over seven days. Disposal of the final load occurred at 11:13 AM on 07 September 2022. Modi R recorded no standby time for poor weather and the operational time was impacted only by MFO monitoring and management procedures (see Section 2.6.4). In addition to dredging and disposal operations, seabed levelling of the Entrance Channel was undertaken by Edi, which commenced operations in the Entrance Channel on 02 September 2022. Seabed levelling operations were non-continuous over a 10-day period and concluded at 12:10 PM on 12 September 2022. Throughout this time Edi's operability was affected by strong winds, position and was dependent on the progress dredging by Modi R. Furthermore, no seabed levelling at the Entrance Channel occurred on 08 September 2022 as Edi was required to respond to a search and rescue beacon setoff ~21 nautical miles from the area.

Position data was retrieved for each vessel daily, reviewed each subsequent day and reported in a daily compliance report. Position monitoring data demonstrates that dredging and disposal operations were confined to within the approved areas for the Entrance Channel and Disposal Area (Figure 2.2 and Figure 2.3) and that seabed levelling operations were confined to within the approved area at the Entrance Channel (Figure 2.2). Waypoints relative to the outer channel and disposal area indicate the

transit route of the Modi R to and from the disposal area (Figure 2.3). Similarly, waypoints located outside the channel permit boundary correspond Edi's transit to the overnight anchorage and Edi's response to an offshore emergency beacon (Figure 2.2 and Figure 2.3).

During the Campaign, 63,150 m^3 of material was dredged from the Entrance Channel and disposed at the Disposal Area, below the permitted volume of 80 000 m^3. At the Disposal Area, in the areas of greatest disturbance where material was dumped, post-dredging hydrographic survey data show the seabed height increased by 0.7 – 1.0 m (BMT 2022a).

Following a day of inclement weather, which prevented routine daily hydrographic surveys of the Entrance Channel and Disposal Area, an interim hydrographic survey was undertaken from which the average depth of the Entrance Channel was calculated to be approximately -10.5 m below lowest astronomical tide (LAT). However, isolated areas of seabed where dredging had occurred exceeded the target depth of -10.5 m LAT. BMT directed Modi R to halt dredging once this information was known and retained Modi R onsite while the information was verified. Subsequent hydrographic surveys showed that natural accretion and infilling was occurring into the low-lying areas of the Entrance Channel, which was expected to be advanced by seabed levelling operations.

A final post-dredging hydrographic survey was undertaken on 7 September 2022. Following a preliminary review of the post-dredging survey data, several isolated pockets of seabed lower than -10.5 m LAT remained in the Entrance Channel ZoHI. In accordance with environmental approval conditions, the CEO of DWER and CEO of DCCEEW were notified of the potential non-conformance on 06 October 2022. Following quality control and processing of hydrographic survey data, some isolated areas below the permitted depth of - 10.5 m LAT were confirmed to remain. The maximum dredge depth was -11.3 m LAT, 80 cm below the permitted depth (BMT 2022a).

All environmental monitoring and management measures defined in the DEMP (BMT 2021a) were implemented. However, the isolated over-dredging has resulted in a small number of low spots deeper than the permitted depth of -10.5 m LAT at the Entrance Channel ZoHI, representing a non-conformance with Condition 1(b) of MS 1173.

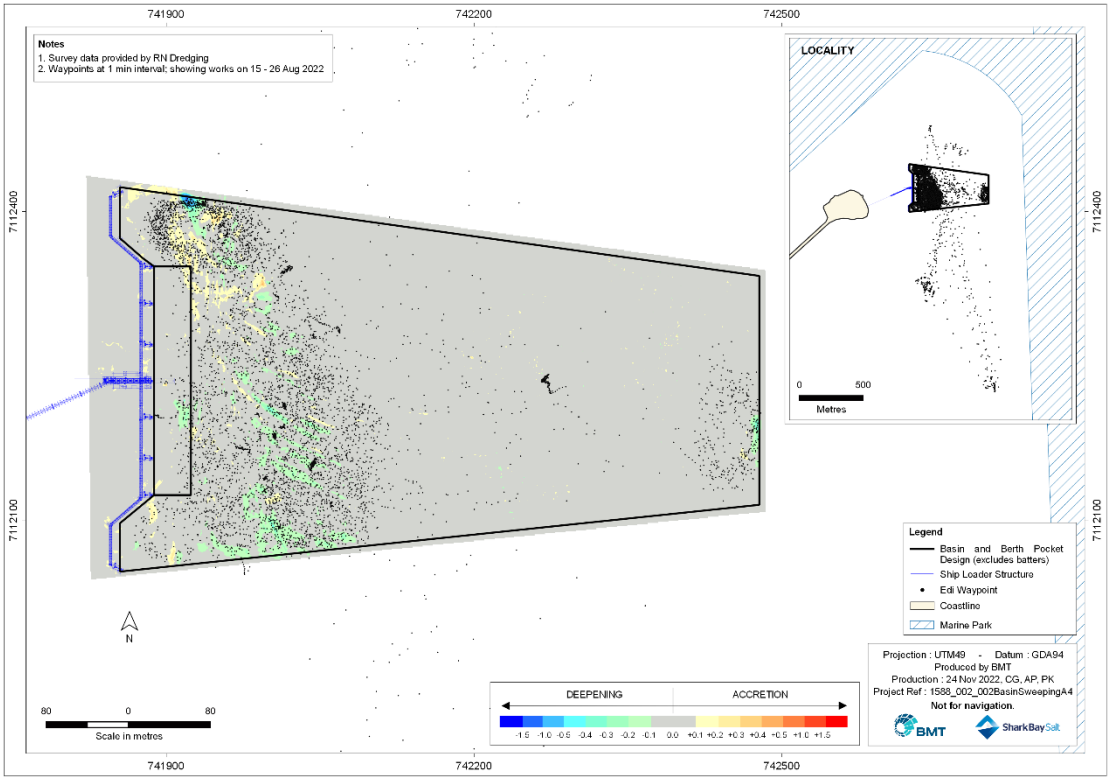


Figure 2.1 Edi waypoints during seabed levelling of the Berth Pocket

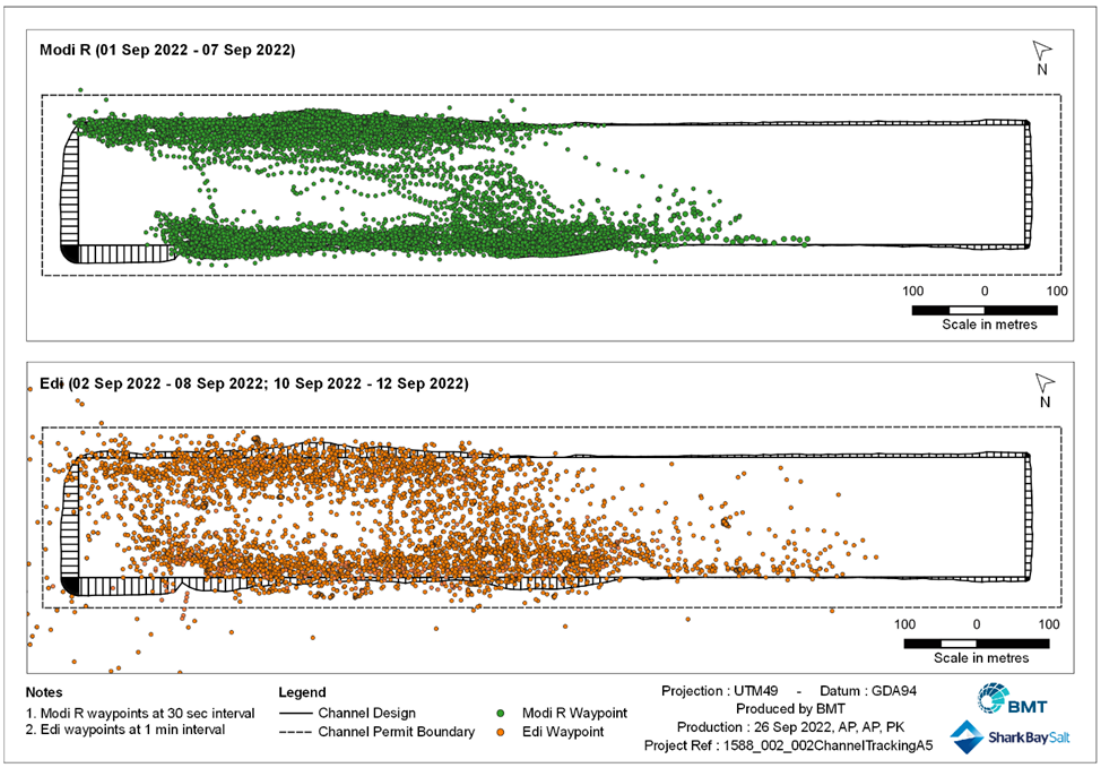


Figure 2.2 Modi R (top) and Edi (bottom) waypoints during dredging and seabed levelling of the Entrance Channel

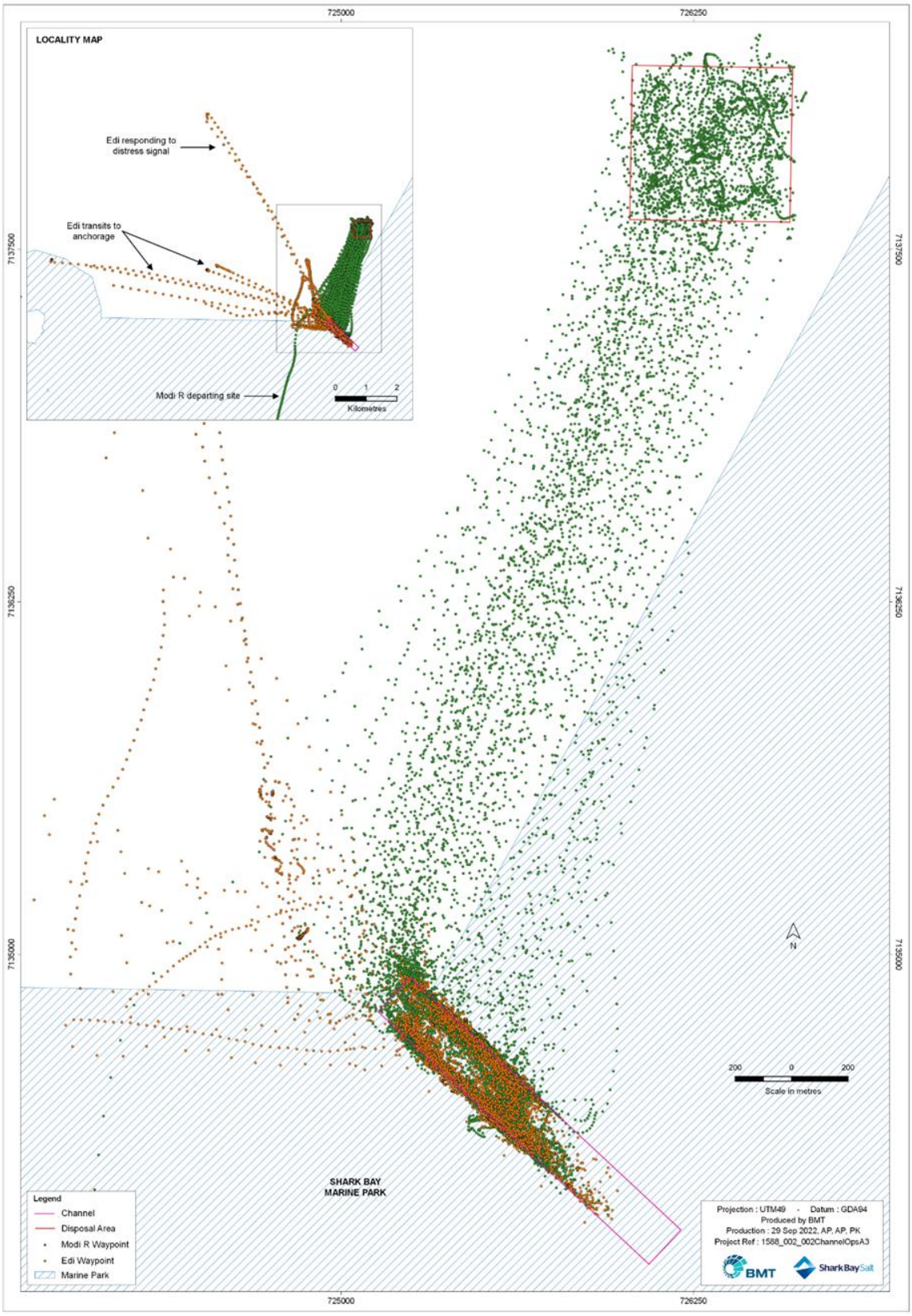


Figure 2.3 Modi R and Edi waypoints during dredging and seabed levelling of the Entrance Channel and disposal at the Disposal Area.

2.2 Visual Plume Observations

During the Campaign, seabed levelling, dredging and disposal resulted in the generation small scale temporary plumes (from mobilisation of suspended sediments in the water column). Turbid plumes were visually monitored throughout the Campaign to assess the risk of potential environmental impacts associated with increased water column turbidity, as described in the DEMP (BMT 2021a). The methods for visual plume observation monitoring included plume sketches, site photographs and remote imagery (Sections 2.2.1 – 2.2.3).

2.2.1 Plume Sketches

In accordance with the DEMP (BMT 2021a), the dredge contractor was required to complete plume sketches of the visible turbid extent at the seabed levelling, dredging and disposal area on every working day during the Campaign. Plume sketches were completed on a pre-designed template that included aesthetic water quality observations of significant changes to biological and ecological indicators (e.g. significant localised algae blooms and/or presence of rubbish, foams or oils on water surface). Plume sketches were completed on all 23 operational working days and were reviewed by BMT daily during the Campaign. There were no water quality observations of significant changes to biological or ecological indicators recorded during the Campaign.

Plume sketches during the Campaign for seabed levelling at the Berth Pocket indicated that small, localised turbid plumes were predominantly confined within the Zone of High Impact (ZoHI), extending a small distance (~≤250 m) northward or southward beyond this zone (Figure 2.4). Plume sketches completed for dredging, disposal and seabed levelling at the Entrance Channel show a turbid plume confined within the ZoI. Specifically, the plume sketches indicate a plume extending westward (north westerly and south westerly plume direction) and eastward (predominantly north easterly) adjacent to the ZoI boundary up to ~1 km from the Entrance Channel ZoHI (Figure 2.5). The plume coverage map provides an overview of the plume extent and proportionate direction at a 1 km pixel resolution and gives the impression the plume extent was beyond the ZoI north west of the Entrance Channel (Figure 2.5), however this is actually an artefact of the mapping exercise. The plume sketches completed for the Disposal Area indicate the turbid plume was predominantly confined within the ZoHI with a ~200 m perimeter extending into the Disposal Area Zone of Moderate Impact (ZoMI). In all instances, the plume sketches provided for the Berth Pocket, Entrance channel, and Disposal Area indicate that the observed plume occurred within the Zone of Influence (ZoI) for each respective area.

It is recognised that the reliability of plume sketches can be limited by the distance over which personnel from a low vantage point can see turbidity in the water. Therefore, site photographs (Section 2.2.2) and remote Imagery (Section 2.2.3) were collected to verify the plume coverage map (Figure 2.4 and Figure 2.5). Based on these data, the plume coverage map is considered to provide an accurate representation of plume coverage during the campaign.

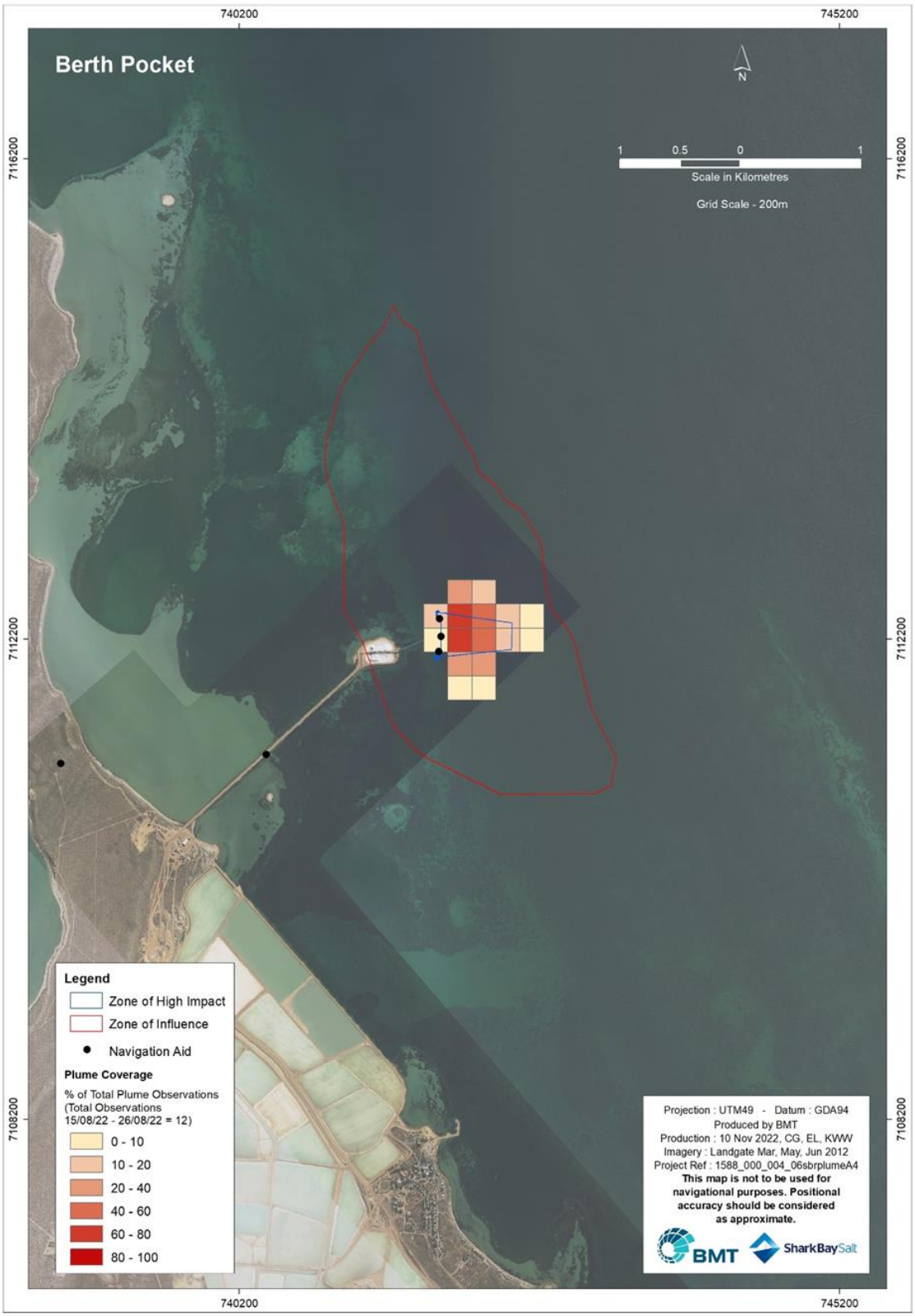


Figure 2.4 Plume coverage map of the seabed levelling operations in the Berth Pocket during the Useless Loop maintenance dredging campaign

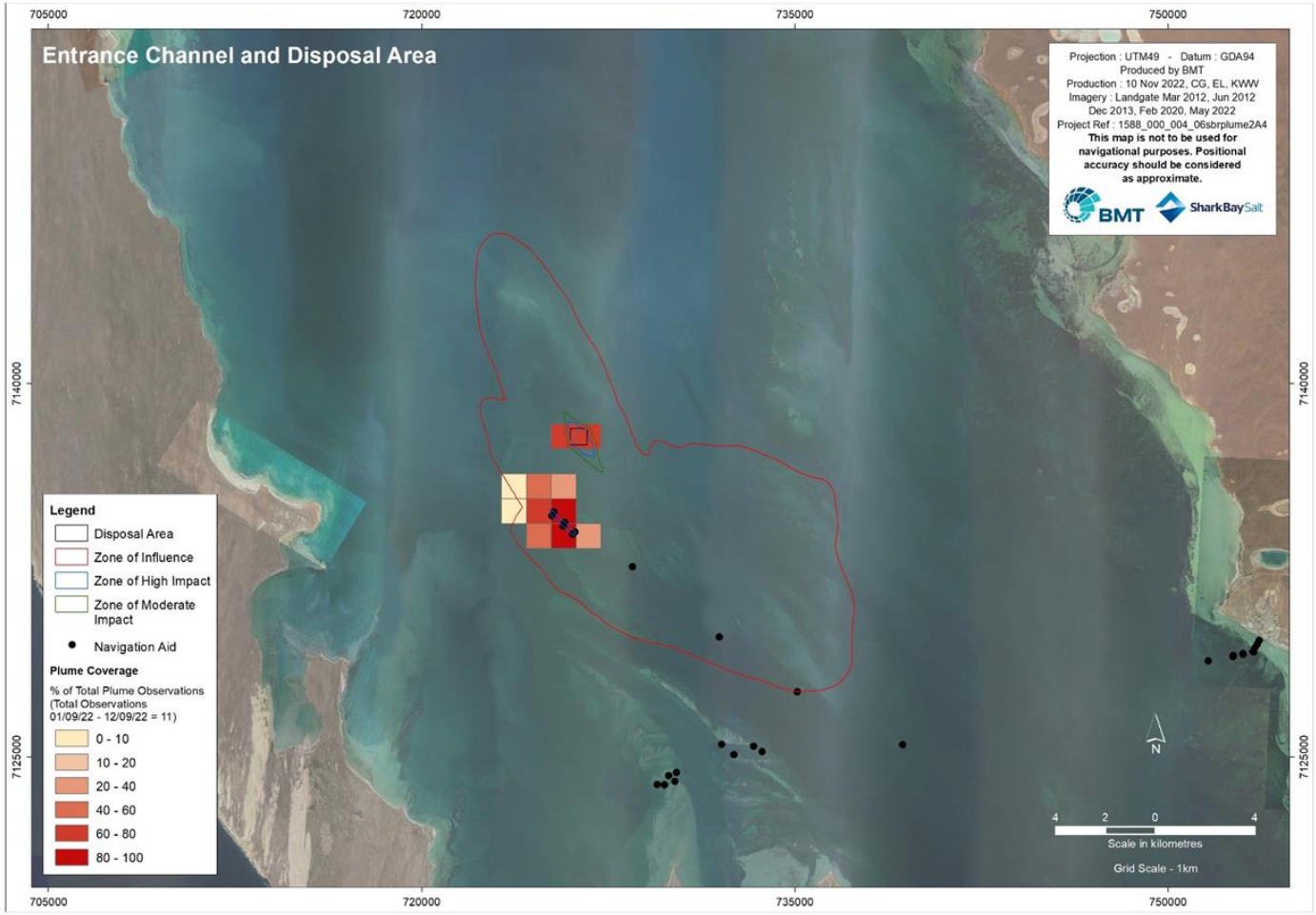


Figure 2.5 Plume coverage map of the seabed levelling and dredging operation in the Entrance Channel and Disposal Area during the Useless Loop maintenance dredging campaign

2.2.2 Site Photographs

In accordance with the DEMP (BMT 2021a), daily site photographs of the Berth Pocket, Entrance Channel and Disposal Area were required to be captured on each operational working day during the Campaign to monitor the extent of turbidity. Site photographs were utilised as the remote imagery units (RIU) on each vessel experienced transmittal issues throughout the campaign (refer to Section 2.2.3). All site photographs were reviewed daily by BMT throughout the Campaign.

Site photographs taken during the seabed levelling operations at the Berth Pocket show localised turbid plumes behind the operation tugboat (Edi) and dissipating within ~100 m from vessel. The plumes were generally lightly coloured which is indicative of the relatively minor quantity of material that was levelled at the Berth Pocket (~1,403 m^3) across 13 operational days, coupled with consistent flushing from the localised tidal regime. Occasionally, site photographs provided by the crew onboard Edi indicate that plumes were not observed during seabed levelling at the Berth Pocket (Figure 2.6). Site photographs captured from the dredge vessel (Modi R) at the Entrance Channel show a turbid plume trailing linearly behind the vessel within in the vicinity of the ZoHI (identifiable by the channel markers; Figure 2.7). The site photographs taken during disposal at the Disposal Area as provided by Modi R indicate that turbid plumes were more omnidirectional compared to those observed during dredging operations at the Entrance Channel (Figure 2.8). The reliability of the site photographs to capture entire extent of Disposal Area turbid plumes was limited by the camera's restricted field of view and low vantage point above the water.

Figure 2.6 Site photographs of seabed levelling operation in the Berth Pocket captured during the 2022 Useless Loop maintenance dredging campaign on 15th August 2022 (Left) and 25th August 2022 (Right)

Figure 2.7 Site photographs of dredging operations in the Entrance Channel captured during the 2022 Useless Loop maintenance dredging campaign on 02 September 2022 (Left) and 04 September 2022 (Right)

Figure 2.8 Site photographs of disposal operation in the Disposal Area captured during the 2022 Useless Loop maintenance dredging campaign on 03 September 2022 (Left) and 04 September 2022 (Right)

2.2.3 Remote Imagery

Satellite Imagery

In accordance with the DEMP (BMT 2021a), satellite imagery was captured and reviewed daily to assist with confirming the extent of the visual plume. Imagery from the Aqua and Terra MODIS satellites was reviewed and the image with greatest clarity and/or least cloud obstruction was selected for environmental monitoring. There was no discernible plume observed in aqua or terra satellite imagery throughout the entirety of the maintenance dredging Campaign. The relatively small-scale plumes generated by seabed levelling, dredging and disposal activities during the Campaign were likely too fine to be observed within MODIS satellite imagery. Throughout the campaign, cloud cover obscured 100% of the project area on 3 out of 12 operational days during seabed levelling at the Berth Pocket and 4 out of 11 operational days during seabed levelling, dredging and disposal activities at the Entrance Channel and Disposal Area (~30% of images obscured overall). Example satellite imagery for each operational area which was not obstructed by cloud cover are provided in Figure 2.9 and Figure 2.10.

Following the completion of the campaign, high-resolution (10 m/pixel) Sentinal-2 satellite imagery from Copernicus Sentinel 2A data was assessed to further validate existing visual plume observation data. The sentinel-2 satellite imagery captured 25 August 2022 during seabed levelling at the Berth Pocket indicates a minor turbid plume contained entirely within the ZoHI (Figure 2.11). Similarly, the sentinel-2 satellite imagery captured 04 September 2022 during seabed levelling, dredging and disposal operations at the Entrance Channel and Disposal Area show that existing turbid plumes remained within the predicted extents as outlined in the EIA (Figure 2.12). The improved resolution of these satellite images provides additional confidence to the accuracy of the plume sketches and site photographs collected on the respective dates at each location.

Figure 2.9 Terra-MODIS satellite imagery of the Berth Pocket captured during seabed levelling operations for the 2022 Useless Loop maintenance dredging campaign on 25 August 2022

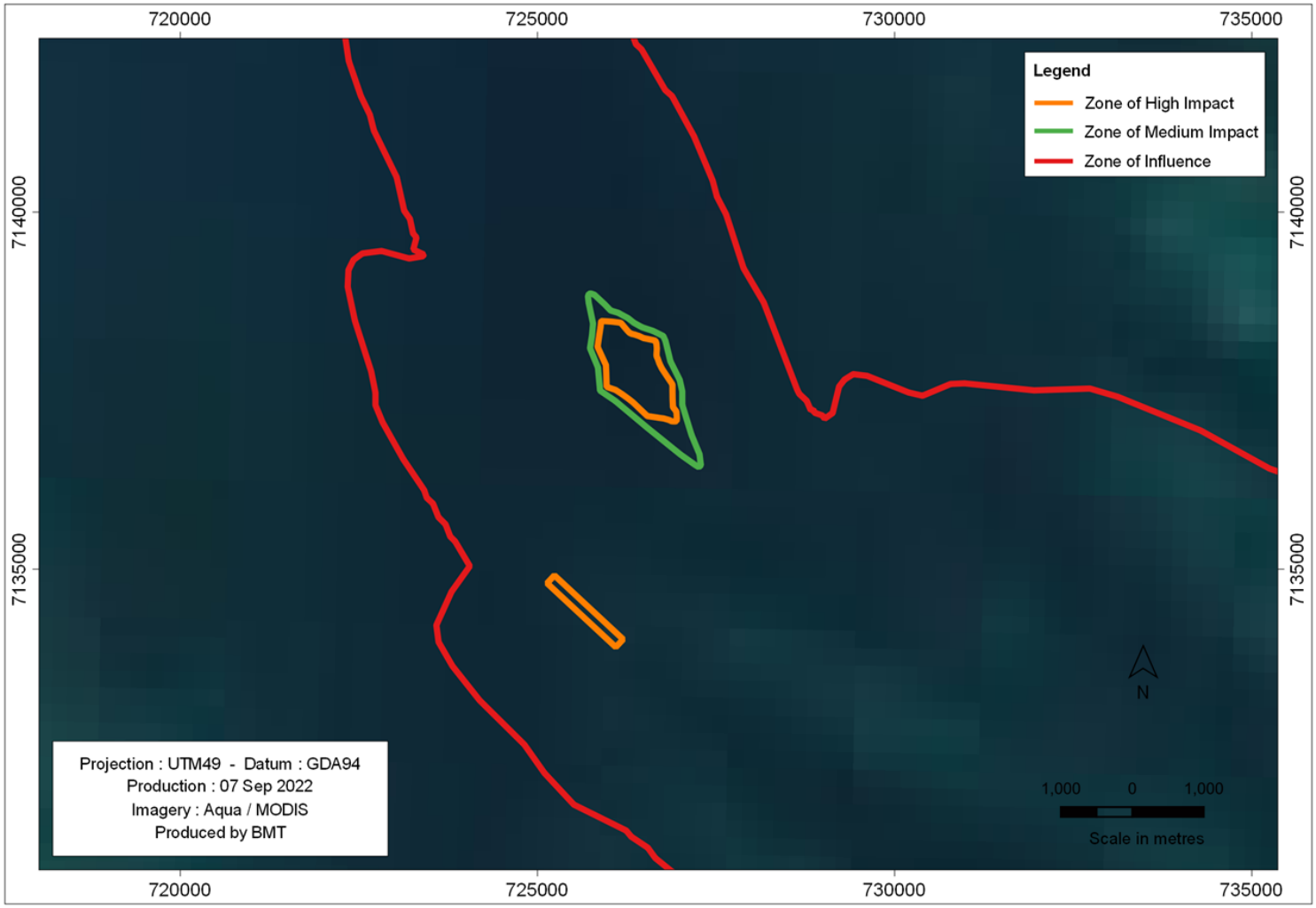


Figure 2.10 Aqua-MODIS satellite imagery of the Entrance Channel and Disposal Area captured during seabed levelling, dredging and disposal operations for the 2022 Useless Loop maintenance dredging campaign on 07 September 2022.

Figure 2.11 Sentinal-2 satellite imagery of the Berth Pocket captured during seabed levelling operations for the 2022 Useless Loop maintenance dredging campaign on 25 August 2022.

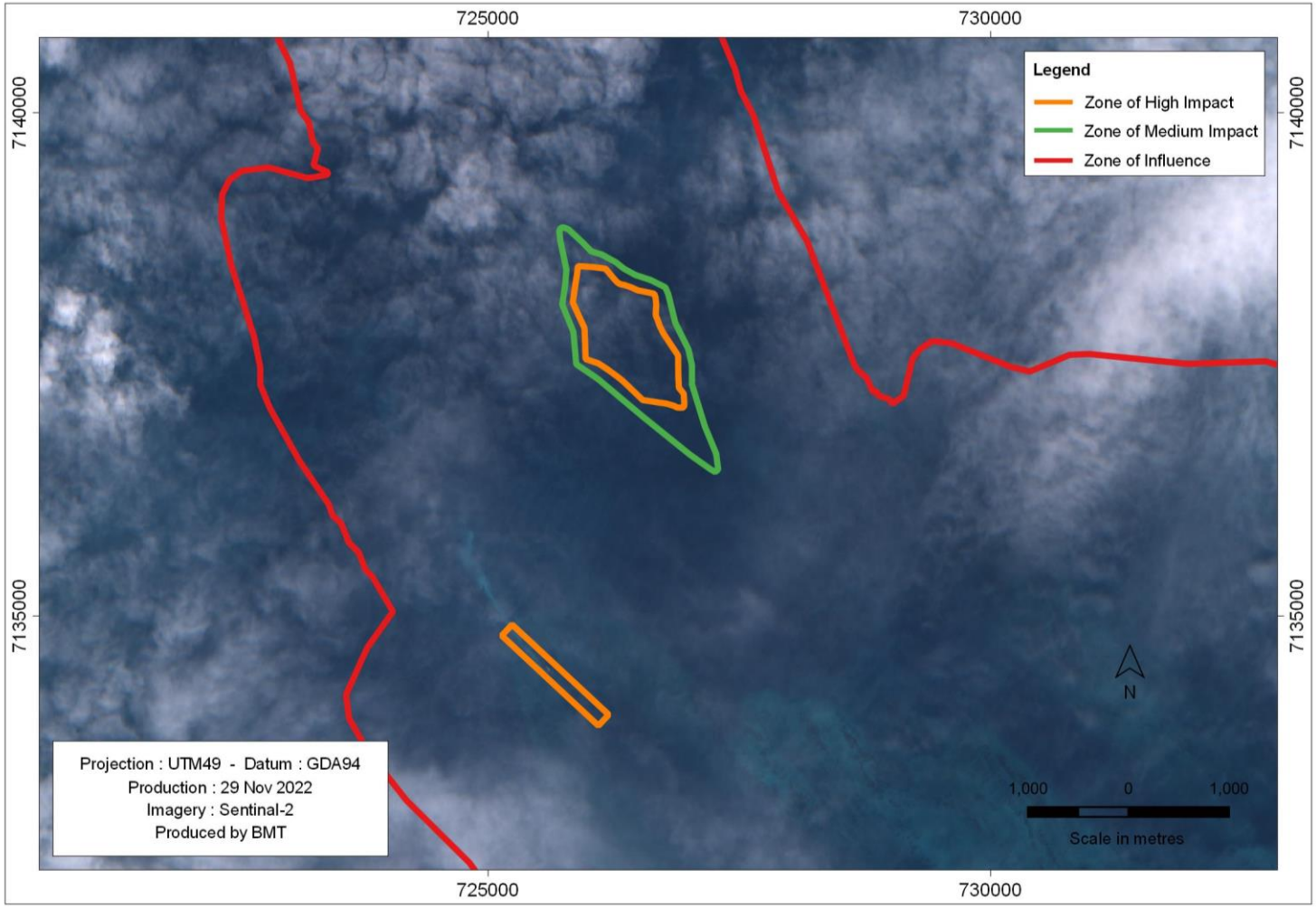


Figure 2.12 Sentinal-2 satellite imagery of the Entrance Channel and Disposal Area captured during seabed levelling, dredging and disposal operations for the 2022 Useless Loop maintenance dredging campaign on 04 September 2022

Remote Imagery Units

In accordance with the DEMP (BMT 2021a), one RIU was installed on the tugboat, Edi (for seabed levelling operations) and one RIU was installed on the dredge vessel, Modi R (for dredging and disposal operations). The RIUs on both vessels captured high-resolution images every 30 minutes for continuous 24 hours periods. Poor cellular reception throughout the project area prevented transmission by either RIU daily for review of the imagery throughout the Campaign. However, representative site photographs were collected daily during all seabed levelling, dredging, and disposal operations and were assessed daily by BMT (Section 2.2.2). Despite the transmission issues experienced throughout the Campaign, no data was lost, and all imagery captured by both vessels during operational activity was saved on the SD card and uploaded as high-resolution imagery. The high-resolution imagery from the RIUs were downloaded and compiled to form three individual time-lapse videos representative of the Berth Pocket sweeping operations, the Entrance Channel sweeping operations, and the Dredging and Disposal operations at the Entrance Channel and Disposal Area, respectively.

Remote imagery captured at the Berth Pocket indicates that turbid plumes surrounding the tug vessel were light in colour and often no turbid plume was observed at all. The small-scale localised turbid plumes that were observed behind the tug vessel dissipated within a distance of ~50–100 m (Figure 2.13). Similarly, the remote imagery captured from the tug vessel during seabed levelling operations in the Entrance Channel observed minimal turbid plumes surrounding or trailing behind the operation vessel (Figure 2.14). Where turbid plumes were observed in the Entrance Channel, they were typically in the vicinity of the operational dredge vessel. The remote imagery captured from the dredge vessel show trailing turbid plumes situated largely within the Entrance Channel which appear to dissipate within ~500–1000 m (Figure 2.15). The turbid plumes observed in the Disposal Area were more evenly dispersed compared to the linear trailing turbid plumes observed in the Entrance Channel (Figure 2.15). The reliability of the RIUs to capture the extent of turbid plumes generated from seabed levelling, dredging and disposal was often limited by the restricted field of view, low vantage point and/or sun glint on the water. However, monitoring data compared from RIU imagery, satellite imagery, and daily plume sketches, are well aligned and indicating they provide an accurate representation of plume coverage during the campaign.

Figure 2.13 Remote imagery captured during seabed levelling operations in the Berth Pocket as part of the 2022 Useless Loop maintenance dredging campaign on 15 August 2022 (top left), 17 August 2022 (top right), 20 August 2022 (bottom left) and 25 August 2022 (bottom right).

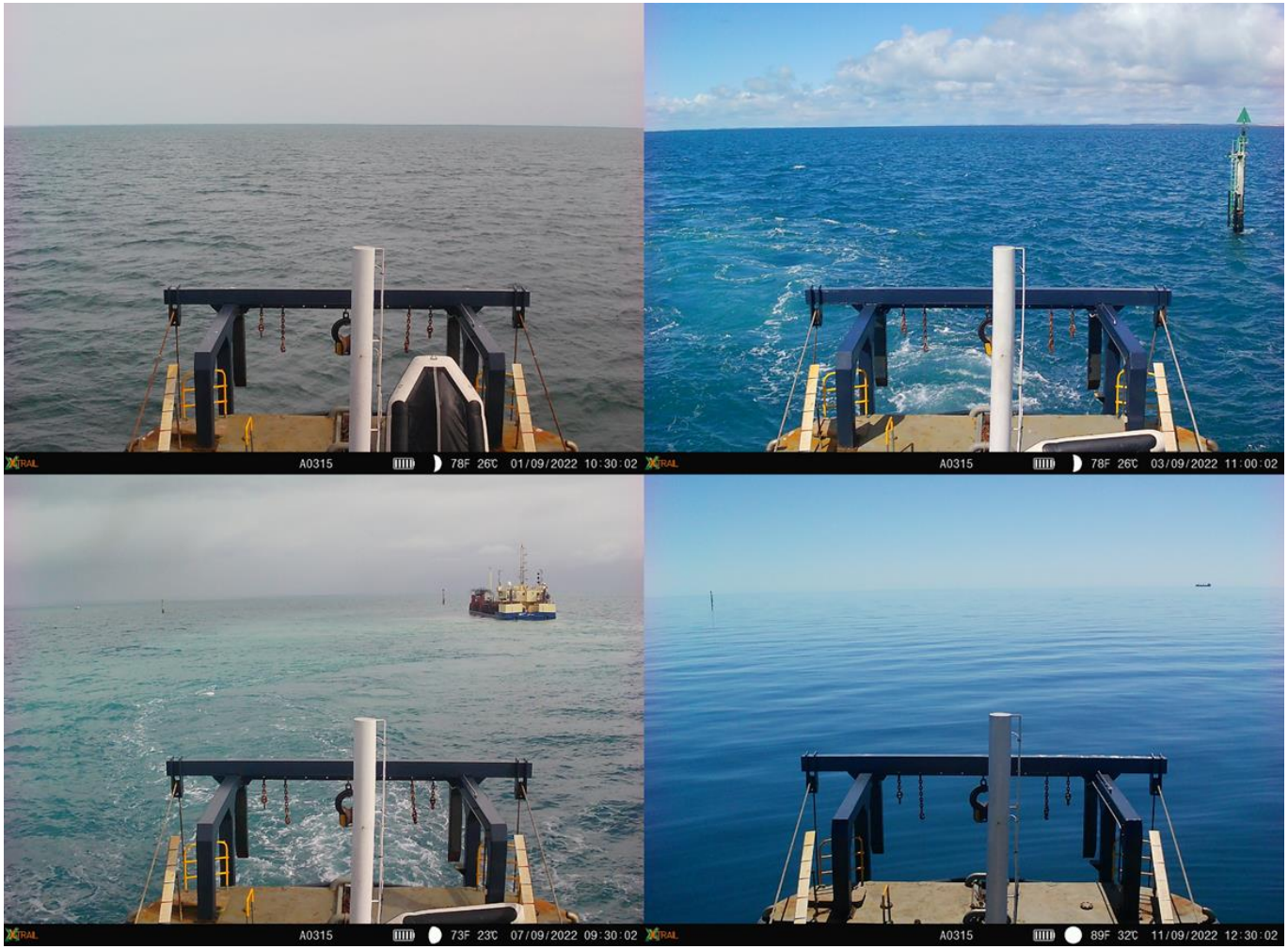


Figure 2.14 Remote imagery captured during seabed levelling and dredging operations in the Entrance Channel as part of the 2022 Useless Loop maintenance dredging campaign on 1 September 2022 (top left), 3 September 2022 (top right), 7 September 2022 (bottom left) and 11 September 2022 (bottom right).

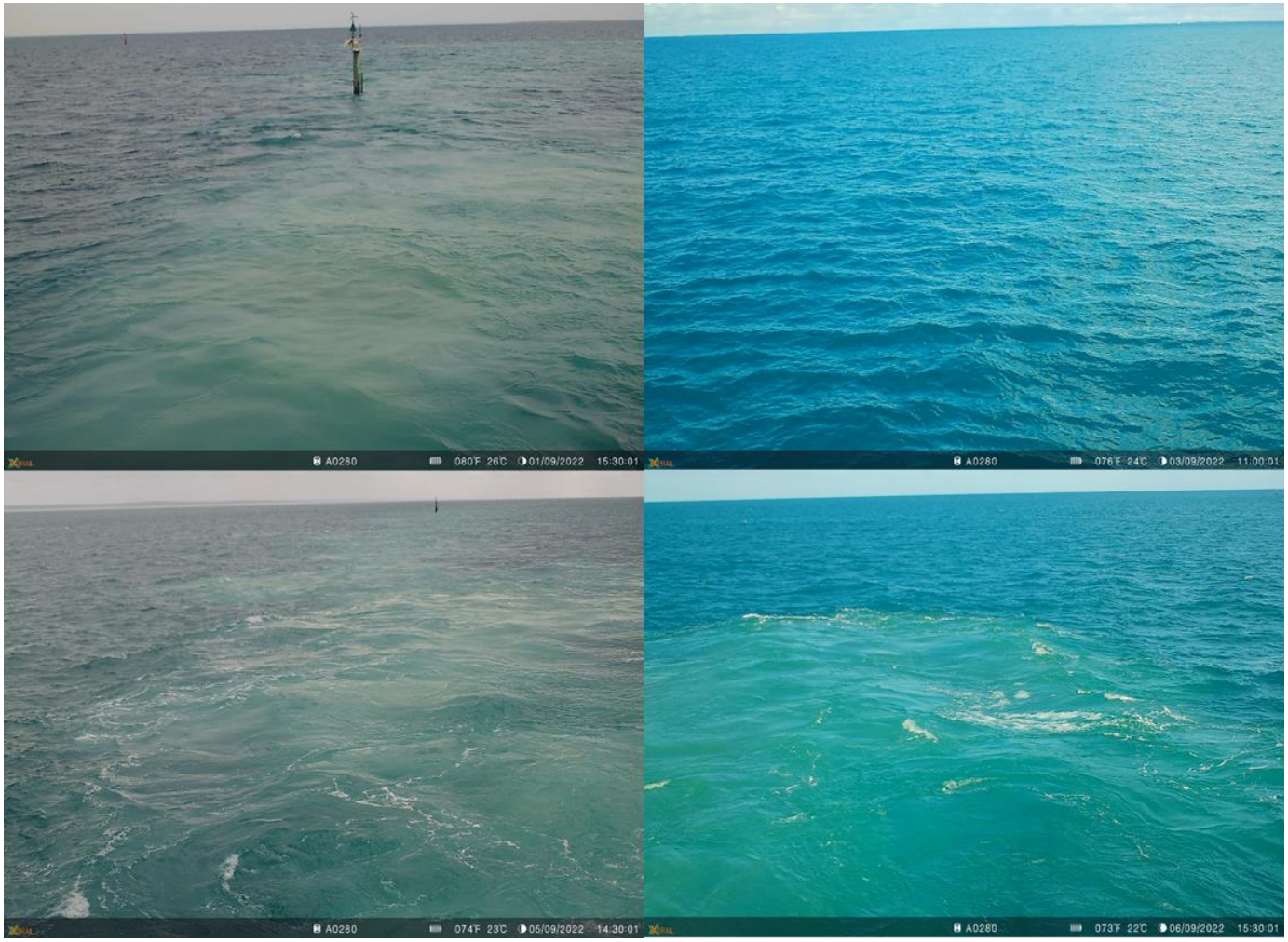


Figure 2.15 Remote imagery captured dredging and disposal operations in the Entrance Channel and Disposal Area as part of the 2022 Useless Loop maintenance dredging campaign on 1 September 2022 (top left), 3 September 2022 (top right), 5 September 2022 (bottom left) and 6 September 2022 (bottom right)

2.3 Benthic photosynthetically active radiation monitoring

In accordance with the DEMP (BMT 2021a), photosynthetically active radiation (PAR) was measured at the seabed pre, during, and post-dredging, and seabed levelling. Telemetered PAR loggers were deployed at six compliance monitoring sites (EC1–5 and BP1), with non-telemetered loggers deployed at two reference sites (R1 and R2; Figure 2.16 and Figure 2.17) and one site located south of the berth pocket beyond the ZoI (CS1; Table 2.1). The function of CS1 was to provide contextual information should the turbid plume be observed to extend beyond the ZoI. Unlike impact monitoring sites, data from CS1 was not required to be monitoring for reactive monitoring purposes. PAR loggers were deployed with redundancy loggers at all sites to limit potential for data loss. Additionally, nephelometric turbidity unit loggers (NTU) were deployed alongside PAR loggers to provide additional insight should PAR be significantly impacted by project operations.

All PAR loggers were deployed at least 1 day prior to the commencement of seabed levelling, dredging and disposal activities and continued logging during and 5 days after completion of project operations. Instrument malfunction at three sites (EC1, EC4 and EC5) prior to commencement of dredging and disposal, required service and manual download of data from the loggers. Logger telemetry was able to be reinstated at EC1 and EC4 though telemetry instrumentation was unable to be rectified at EC5. The logger at EC5 was set to autonomous logging (non-telemetered) and was able to be downloaded manually by personnel undertaking MFO monitoring support throughout the dredging and disposal operational period.

In accordance with the DEMP (BMT 2021a), a trigger criterion exceedance was declared if PAR was ≤0.75 mol photons m^{-2} d^{-1} for three (3) consecutive days at any individual compliance monitoring site (EC1–5 and BP1) during the dredging and disposal and seabed levelling operational period. A threshold criterion exceedance was declared if PAR was ≤2.5 mol photons m^{-2} d^{-1} for 14 consecutive days at any individual compliance monitoring site (EC1–5 and BP1). To determine whether the measured PAR adhered to the trigger/threshold criteria throughout project operations, BMT personnel processed the PAR data daily within 24 hours of data receipt (via logger retrieval/download or telemetry) and provided the outcome within a daily compliance monitoring report.

Table 2.1 Photosynthetically active radiation (PAR) compliance monitoring sites as part of the 2022 Useless Loop maintenance dredging campaign

Location	Site	Average depth of instruments (m)	Coordinates	
			Easting	Northing
Berth Pocket	BP1	8.0	741953	7111891
	CS1	5.0	741590	7110700
Entrance Channel / Disposal Area	EC1	16.0	726396	7138425
	EC2	15.0	726906	7137695
	EC3	14.0	727277	7136441
	EC4	14.5	727049	7136741
	EC5	10.0	726055	7133722
Reference	R1	15.0	728597	7146607
	R2	7.0	740580	7115795

Note:

1. **Coordinates (eastings and northings) are in UTM 49 and GDA94.**

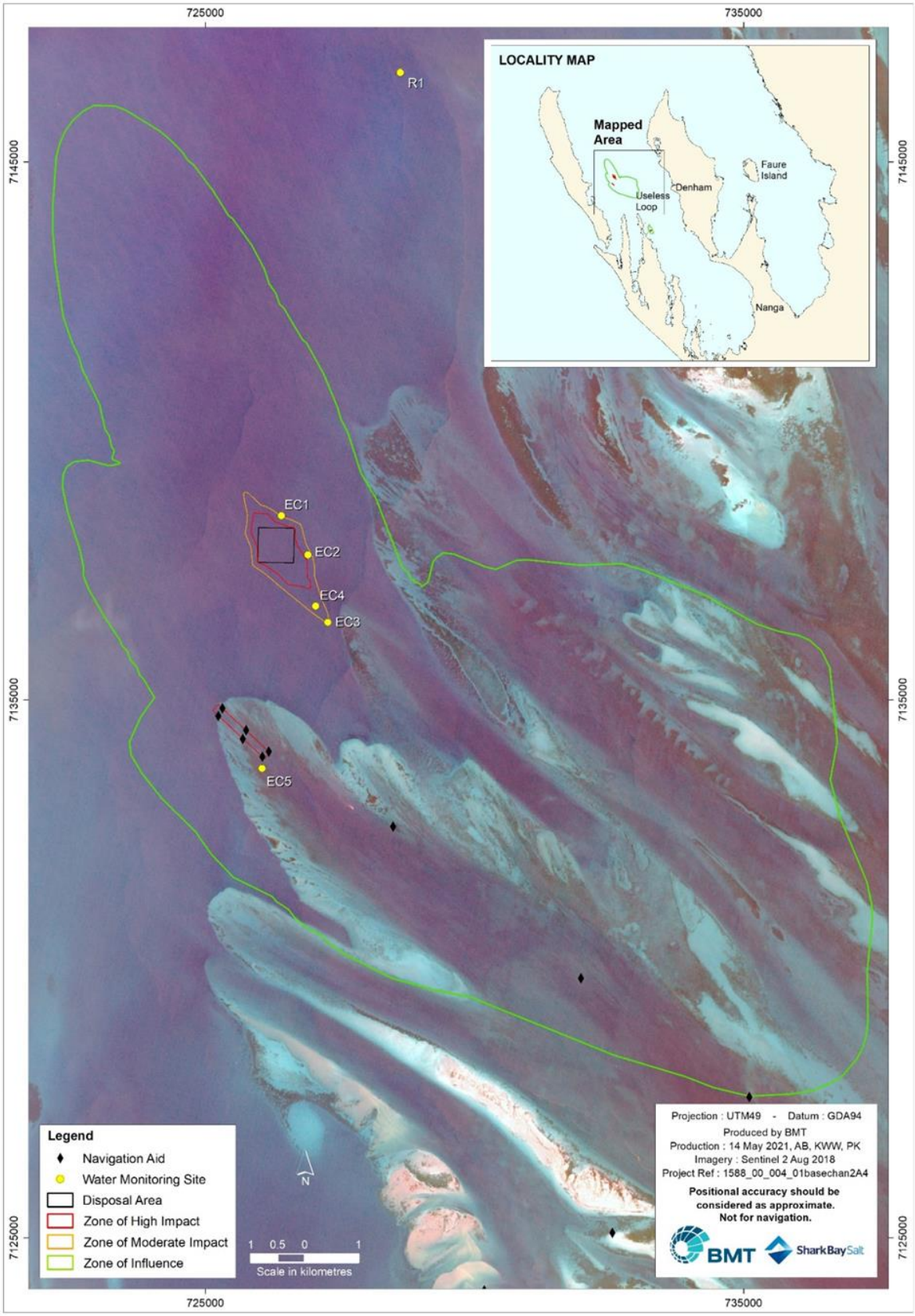


Figure 2.16 Photosynthetically active radiation (PAR) compliance monitoring sites adjacent to the Entrance Channel and Disposal Area

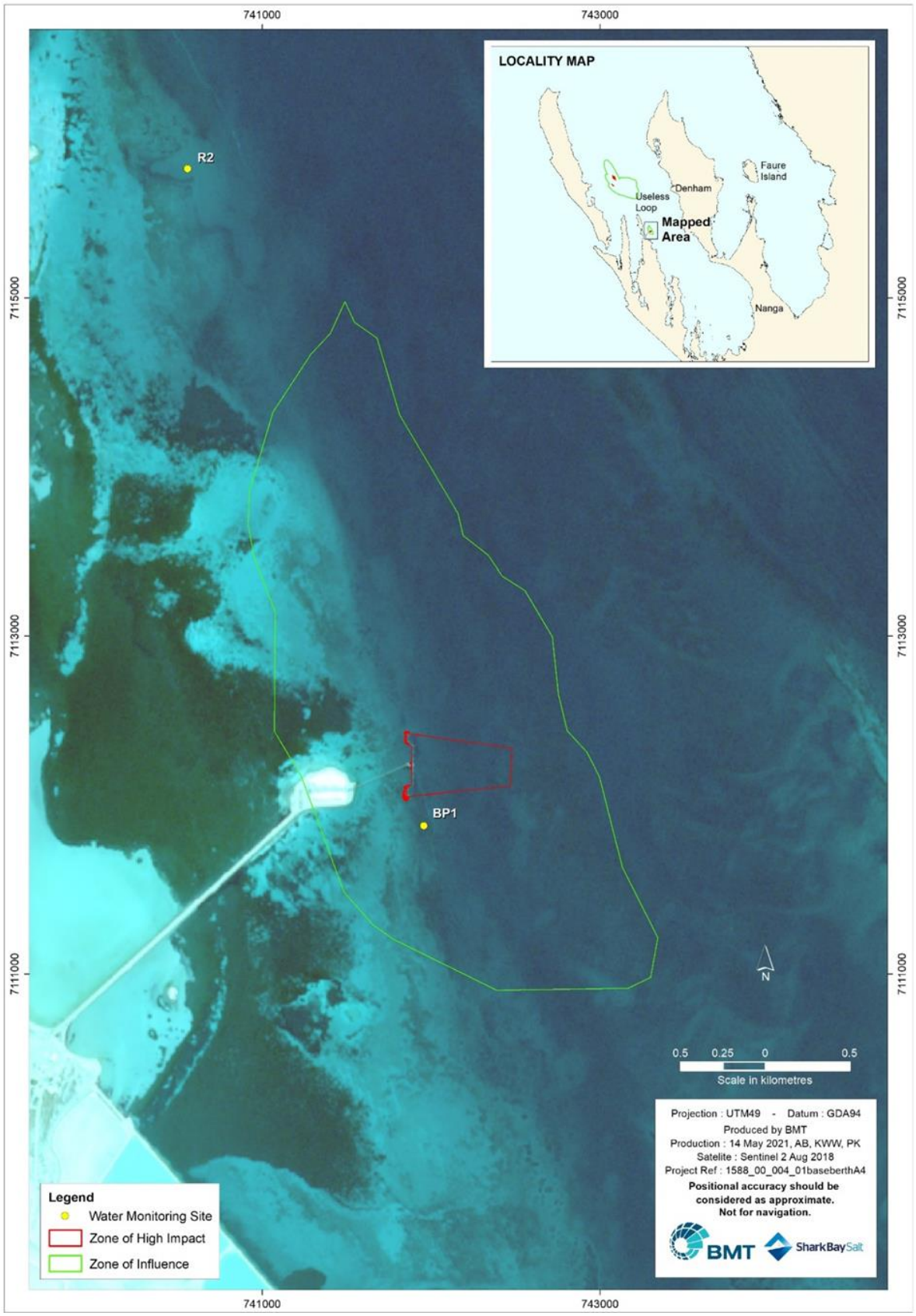


Figure 2.17 Photosynthetically active radiation (PAR) compliance monitoring sites adjacent to the Berth Pocket

2.3.2 Compliance Monitoring PAR Results

Berth Pocket

Trigger or threshold criterion were not exceeded during at the Berth Pocket during the Campaign (Figure 2.18). PAR values below the trigger value (though not constituting a trigger exceedance) were recorded at BP1 on 31 August 2022, which is mostly likely an artefact of reduced intensity regime owing to retrieval of the logger prior to exposure to peak daily saturation (Figure 2.18). Comparison between data recorded at BP1 and at the Berth Pocket reference site (R2) indicates that seabed levelling influenced light availability within the Berth Pocket to a degree. However, PAR was not recorded below the threshold value (≤2.5 mol m^{-2} d^{-1}) for more than five consecutive days at BP1, demonstrating that light availability at the benthos in the berth pocket was within the tolerance of environmental monitoring criteria and the risk to sensitive receptors was low.

Benthic PAR recorded at CS1 was consistently above the threshold value throughout seabed levelling operations. The trend observed in PAR values recorded at the coral site are comparable to those recorded at the reference site, R2 (Figure 2.18). Therefore, it is unlikely that turbid plumes generated by seabed levelling in the Berth Pocket extended to the coral site situated south of the ZoI, which is corroborated by data from visual monitoring of the plume (Section 2.2).

Entrance Channel and Disposal Area

Trigger or threshold criterion were not exceeded during seabed levelling, dredging and disposal operations at the Entrance Channel and Disposal Area (Figure 2.19). It should be noted that the PAR data from EC3 indicated the logger array at the seabed was impacted around 30 August 2022, resulting in partial obstruction of the PAR sensors. At the time it was assumed the fault occurred in the telemetry unit however the misalignment of the loggers was confirmed visually upon retrieval following completion of the Campaign and validated when the raw (instantaneous) PAR values (µmol m^{-2} sec^{-1}) were subsequently examined. Review of the data indicated the fault occurred two days before the commencement of dredging and disposal (Figure 2.20), possibly during maintenance of the unit. Unfortunately, this renders all data recorded at EC3 throughout the dredging and disposal operations unreliable. As EC3 was situated at the furthest point away from the Disposal Area, ostensibly it would be least likely to be impacted by a reduction of PAR from turbid plumes generated at the Disposal Area. Therefore, data from EC4 was observed for monitoring purposes as a conservative proxy for EC3 owing to it being located between EC3 and the Disposal Area ZoHI.

The lowest daily PAR measurement occurred at each logger location (EC1-5 and R1) on the same day, 2 September 2022 (Figure 2.19). The consistently low PAR measured across compliance monitoring and reference sites on 2 September 2022 indicates these recording likely reflect the overcast conditions on the day, as opposed to project-induced light reduction. Additionally, the low PAR values recorded at EC1 on 31 August 2022 and at R1 on 17 September 2022 are an artefact of the reduced irradiance exposure owing to the loggers being deployed and retrieved outside of peak irradiance saturation times, respectively (Figure 2.19). The proportionally higher PAR observed at EC5 is likely indicative of the shallower depth of the site (~10 m), particularly in comparison to the reference location R1 (~15 m; Table 2.1). The trend in PAR data observed at EC4 is comparable with reference site R1, indicating that EC4 (and likely EC3) experienced relatively natural light intensity regimes and that project-induced light reduction, if any, was negligible.

The threshold criteria of ≤2.5 mol m^{-2} d^{-1} for no more than 14 consecutive days was not exceeded. Daily PAR values <2.5 mol m^{-2} d^{-1} were recorded over a maximum duration of three (3) consecutive days at one monitoring location, the reference site (R1). Therefore, it is reasonable to conclude that minimal disruption to the natural light regime at the benthos occurred beyond the respective ZoHI throughout the Campaign.

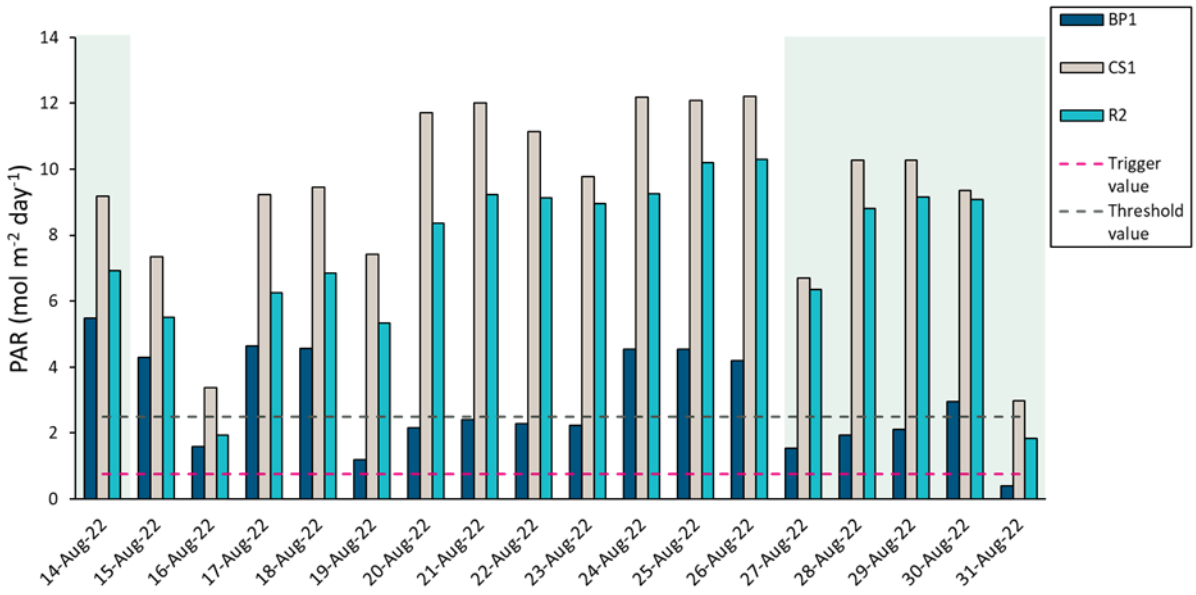


Figure 2.18 Daily photosynthetically active radiation (PAR) recorded adjacent to the Berth Pocket (BP1), coral site (CS1), and at the reference location (R2). Dashed lines indicate management trigger and threshold values. Light blue background indicates PAR measurements recorded before and after seabed levelling.

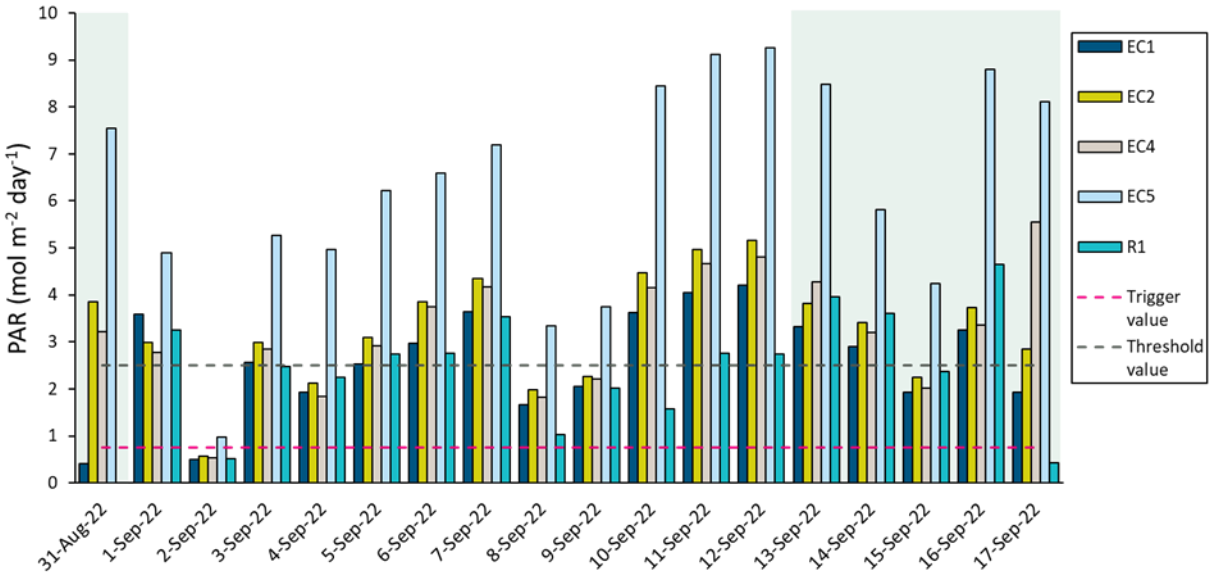


Figure 2.19 Daily photosynthetically active radiation (PAR) recorded adjacent to the Entrance Channel (EC5), Disposal Area (EC1-EC4), and at the reference location (R1). Dashed lines indicate management trigger and threshold values. Light blue background indicates PAR measurements recorded before and after dredging, disposal and seabed levelling.

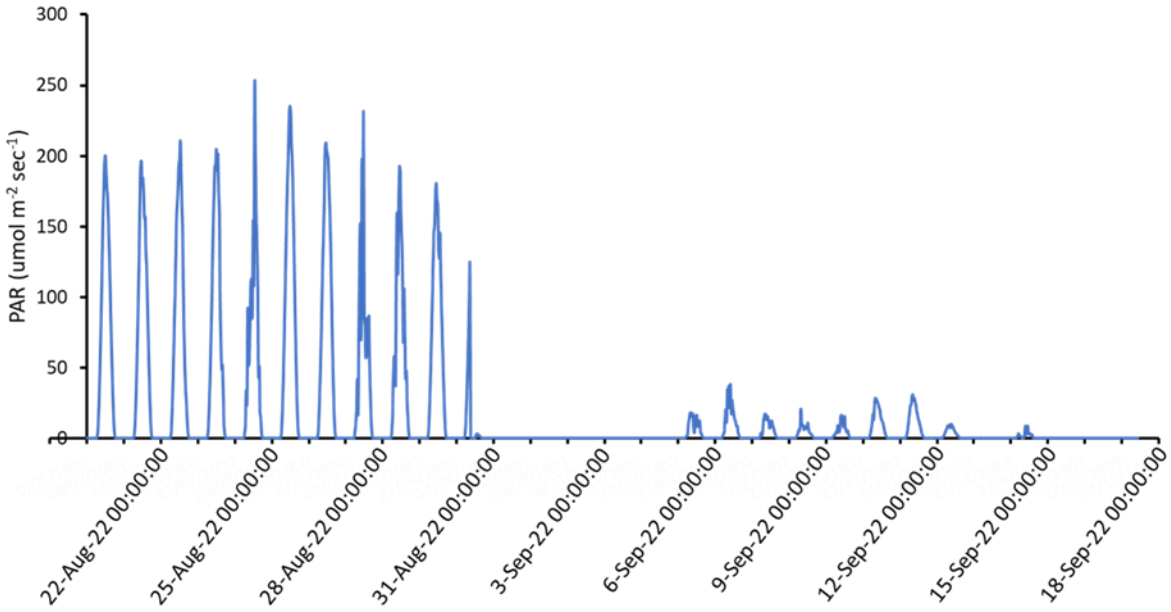


Figure 2.20 Instantaneous photosynthetically active radiation (PAR) recorded at 30-minute intervals at compliance monitoring site EC3.

2.4 Water quality monitoring

In accordance with the DEMP (BMT 2021a), the water column was sampled at the required frequency at seven sites within the Berth Pocket ZoI using a pump and hose or Niskin sampler as appropriate. Three sites situated on the boundary (WQ1, WQ2, and WQ3; Figure 2.21) were sampled pre-, during and post-seabed levelling operations to test whether concentrations of tributyltin (TBT) met the 90% species protection value (SPV; 0.02 µg/L). Similarly, the water column was sampled at four sites along the boundary of the SBMP (WQ4, WQ5, WQ6, and WQ7; Figure 2.21) pre-, during and post-seabed levelling operations to test whether concentration of TBT met the 99% SPV (0.0004 µg/L). In addition to these samples, two reference sites (R1 and R2; Figure 2.21) were sampled outside the ZoI pre- and post-seabed levelling operations. All collected samples were sent to a National Association of Testing Authorities (NATA) accredited analytical laboratory (MPL Laboratories Perth) for analyses.

The lowest practical quantitation limit (PQL) achievable during laboratory operating conditions for TBT within water samples was restricted to 0.002 µg/L. This PQL was an order of magnitude below what was required to assess the 99% SPV. However, the PQL was above what was needed to assess the 90% SPV. As laboratories were unable to reliably produce a PQL which adheres to the 99% SPV as per Section 3.2.3 of the DEMP (BMT 2021a), the laboratory PQL was adopted as a proxy trigger for the purpose of this campaign.

Water quality samples collected pre- and post-seabed levelling from reference sites (R1 and R2) identified concentrations below the PQL (<0.002 µg/L) in both instances (Table 2.2). Similarly, all water quality samples collected within the Berth Pocket and along the boundary of the SBMP identified concentrations of TBT below the PQL throughout the Campaign (Table 2.3). This indicated that seabed levelling within the Berth Pocket did not suspend proportionally high concentrations of total and/or elutriate TBT potentially stored within marine sediments into the water column and therefore did not introduce risk to species protection.

Table 2.2 Concentration of TBT as measured in water samples at reference sites beyond the Berth Pocket Zone of Influence as part of the 2022 Useless Loop maintenance dredging campaign

Seabed Levelling status[1]	Date Sampled	R1 (µg/L)	R2 (µg/L)
Pre-	10/08/2022	<0.002	<0.002
Post-	18/09/2022	<0.002	<0.002

Table 2.3 Concentration of TBT as measured in water samples within the Berth Pocket and at the surrounding Shark Bay Marine Park boundary as part of the 2022 Useless Loop maintenance dredging campaign

Seabed Levelling status[1]	Date Sampled	WQ1 (µg/L)	WQ2 (µg/L)	WQ3 (µg/L)	WQ4 (µg/L)	WQ5 (µg/L)	WQ6 (µg/L)	WQ7 (µg/L)
		Species Protection Value = 0.02 µg/L			Species Protection Value = 0.0004 µg/L			
Pre-	10/08/2022	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
During	15/08/2022	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
During	16/08/2022	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
During	17/08/2022	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
During	22/08/2022	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Post-	18/09/2022	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

2.5 Sediment quality monitoring

Sediment samples were collected using a Van Veen grab sampler (hereafter, grab). The grab was deployed upstream of the vessel engines and discharge points to reduce the risk of sample contamination. Sediment samples were collected pre- and post-seabed levelling operations to assess concentrations of TBT. Total organic carbon (TOC) was also measured in sediment samples to provide aid in further investigation should TBT be detected at concentrations beyond the relevant species protection values. Sediment samples were collected in conjunction with water samples at four sites along the boundary of the SBMP (WQ4, WQ5, WQ6, and WQ7) and at the berth pocket reference site (R2; Figure 2.17). All collected samples were sent to a NATA accredited analytical laboratory (MPL Laboratories Perth) for analyses. The lowest PQL achievable during laboratory operating conditions for TBT and TOC within sediment samples was 0.50 µg/kg and 100 mg/kg, respectively.

Sediment quality samples collected pre- and post-seabed levelling from all sites recorded concentrations of TBT below the PQL (<0.50 µg/L) in both instances (Table 2.4). This indicates that there is no discernible risk to species protection from total and/or elutriate TBT stored within marine sediments along the marine park boundary.

Table 2.4 Concentration of TBT and TOC as measured in sediment samples along the Shark Bay Marine Park boundary adjacent to the Berth Pocket as part of the 2022 Useless Loop maintenance dredging campaign

Seabed Levelling status[1]	Date Sampled	Analyte	WQ4 (TBT: µg/kg) (TOC: mg/kg)	WQ5 (TBT: µg/kg) (TOC: mg/kg)	WQ6 (TBT: µg/kg) (TOC: mg/kg)	WQ7 (TBT: µg/kg) (TOC: mg/kg)	R2 (TBT: µg/kg) (TOC: mg/kg)
Pre-	10/08/2022	TBT	<0.50	<0.50	<0.50	<0.50	<0.50
Post-	18/09/2022	TBT	<0.50	<0.50	<0.50	<0.50	<0.50
Pre-	10/08/2022	TOC	1900	2200	2500	2900	1200
Post-	18/09/2022	TOC	3000	2700	2800	8000	4200

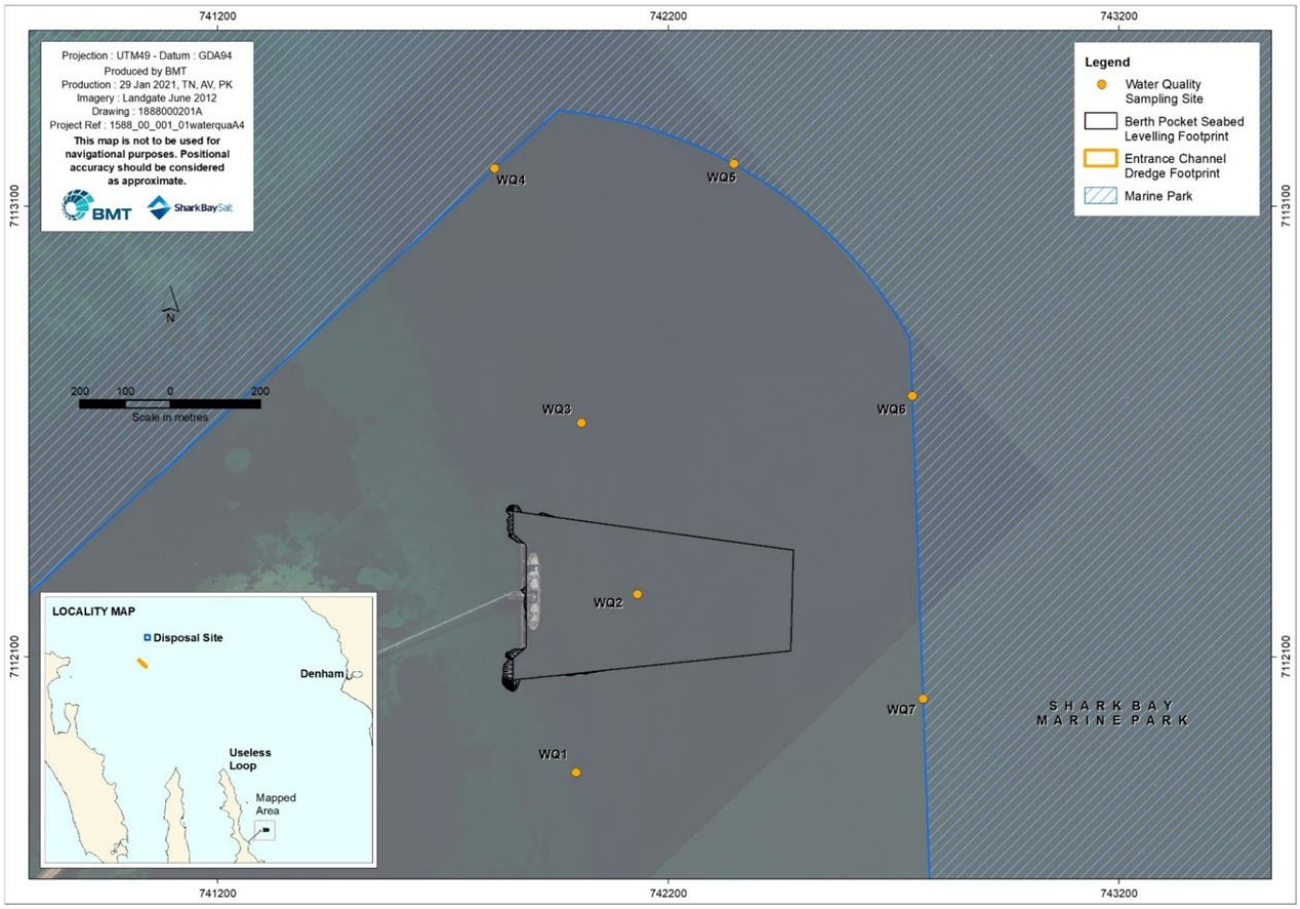


Figure 2.21 Water (all inclusive) and Sediment (WQ4−7) quality monitoring sites within the Berth Pocket and at the surrounding Shark Bay Marine Park boundary as part of the 2022 Useless Loop maintenance dredging campaign

2.6 Benthic Communities and Habitats

2.6.1 Seagrass Density Habitat Assessment

In accordance with the DEMP (BMT 2021a), a towed video survey was undertaken to complete additional ground truthing of benthic communities and habitat (BCH) mapping adjacent to the ZoHI at the Entrance Channel, Berth Pocket and Disposal Area. The objective of the additional ground truthing was to assess benthic cover (i.e. percent cover of seagrass, algae, sand etc.) of dominant BCH in and adjacent to the project area to confirm whether the habitat map, and consequently, the environmental risk profile was contemporary. The additional ground truthing survey also aimed to confirm appropriate positioning of proposed in-water monitoring sites relative to representative BCH (seagrass) and to provide reconnaissance data to establish an appropriate survey design to enable the assessment of potential impacts to BCH from dredging, disposal and seabed levelling activities.

The additional ground truthing survey was implemented in June 2022 and provided further confidence in the habitat map used to inform the environmental impact assessment (EIA; BMT 2021b) and develop the DEMP (BMT 2021a). The majority of the classified habitat point data from the June 2022 survey was well aligned with the existing habitat map, which is considered characteristic of the Shark Bay marine environment. However, variability between the 2019/20 and 2022 habitat data was observed in two areas: 1) north of the berth pocket ZoHI and, 2) south east of the entrance channel ZoHI. The differences in the observed data were reduced seagrass cover (i.e. increased bare substrate) at these two areas and is considered to be representative of natural temporal and spatial variability of seagrasses present among survey years and areas. It was concluded that there was no new or increased risk of impact to BCH, or World Heritage values of the Shark Bay World Heritage Area (BMT 2022b).

To assess potential impact to BCH from dredging, disposal and seabed levelling activities, towed video transects were analysed to measure BCH cover pre- and post-dredging. At the Berth Pocket and Entrance Channel the survey design involved three asymmetrical 90,000 m^2 polygons adjacent to the ZoHI and three replicate 90,000 m^2 polygons outside the ZoI for each location (Figure 2.22. and Figure 2.23, respectively). Within each polygon, seven randomly selected ~100 m transects were conducted, totalling 84 replicate transects that were distributed to be spatially representative of the survey areas (polygons) among control and impact locations at the Berth Pocket and Entrance Channel.

The sample design at the Disposal Area was conducted within the ZoMI adjacent to the Disposal Area, in accordance with the DEMP (BMT 2021a). Owing to the confined area (~100 m wide), limited seagrass habitat, and homogenous seagrass density within the ZoMI, a single ~300,000 m^2 polygon was assessed and paired with an equal-sized control site polygon outside the ZoI (Figure 2.24). The control and ZoMI polygons were sampled with 21 randomly located ~100 m transects that were distributed to be spatially representative of the survey area. In total, 252 towed video transect lines were collected and analysed to assess BCH cover throughout pre- and post-dredging, disposal and seabed levelling operations.

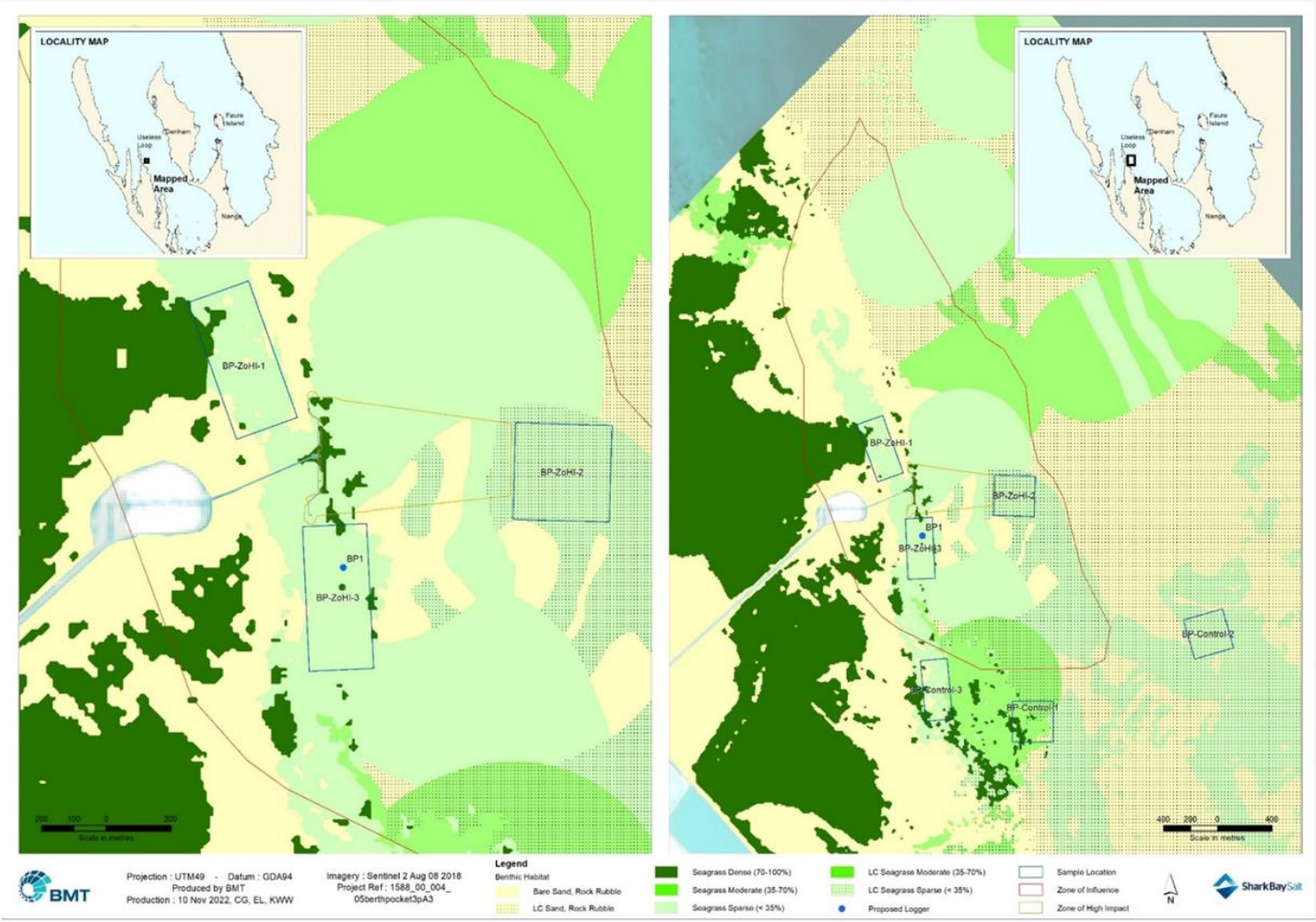


Figure 2.22 Survey locations adjacent to Zone of High Impact (Left) and control sites external of Zone of Influence (Right) for the Berth Pocket as part of the 2022 Useless Loop maintenance dredging campaign

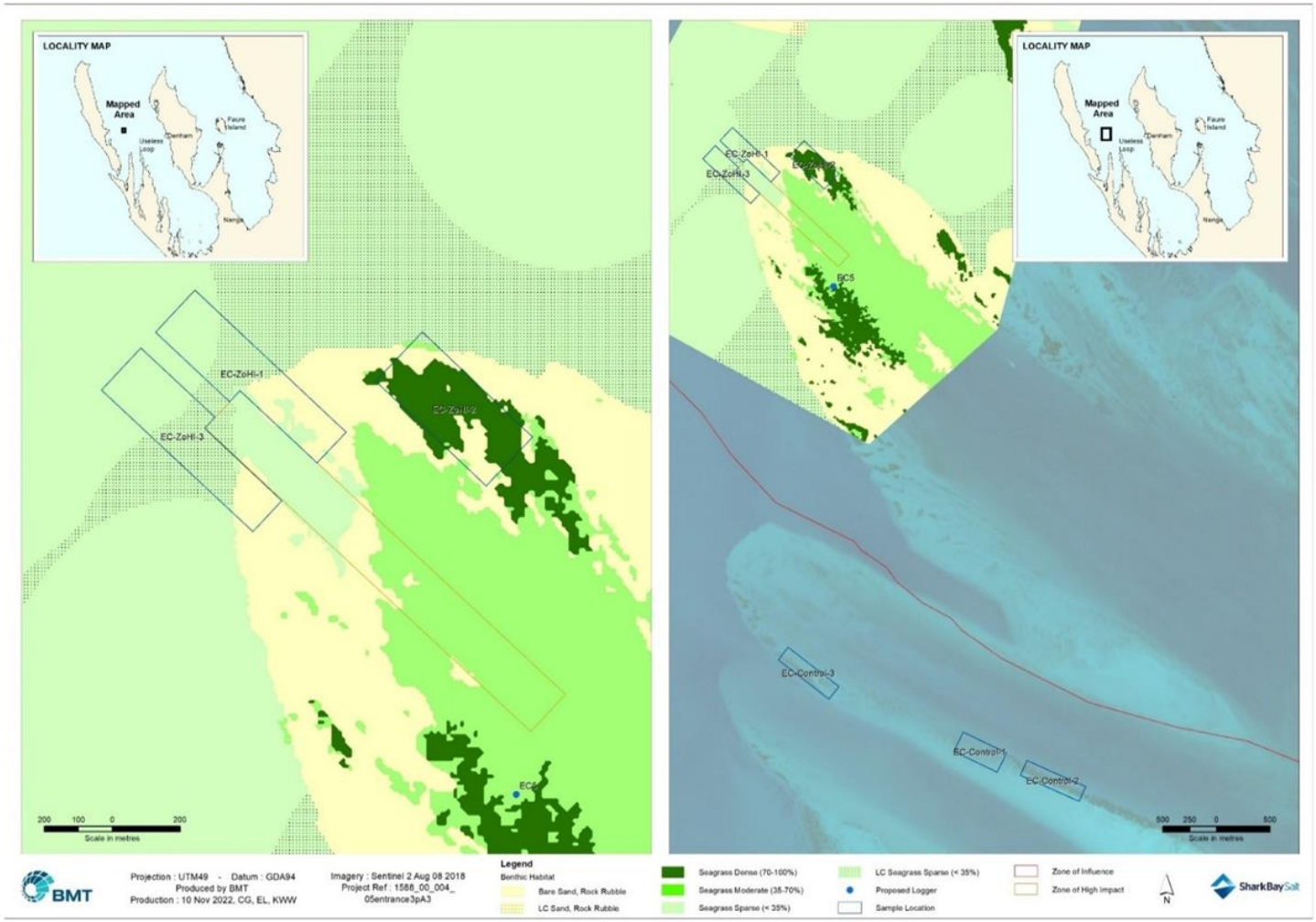


Figure 2.23 Survey locations adjacent to Zone of High Impact (Left) and control sites external of Zone of Influence (Right) for the Entrance Channel as part of the 2022 Useless Loop maintenance dredging campaign

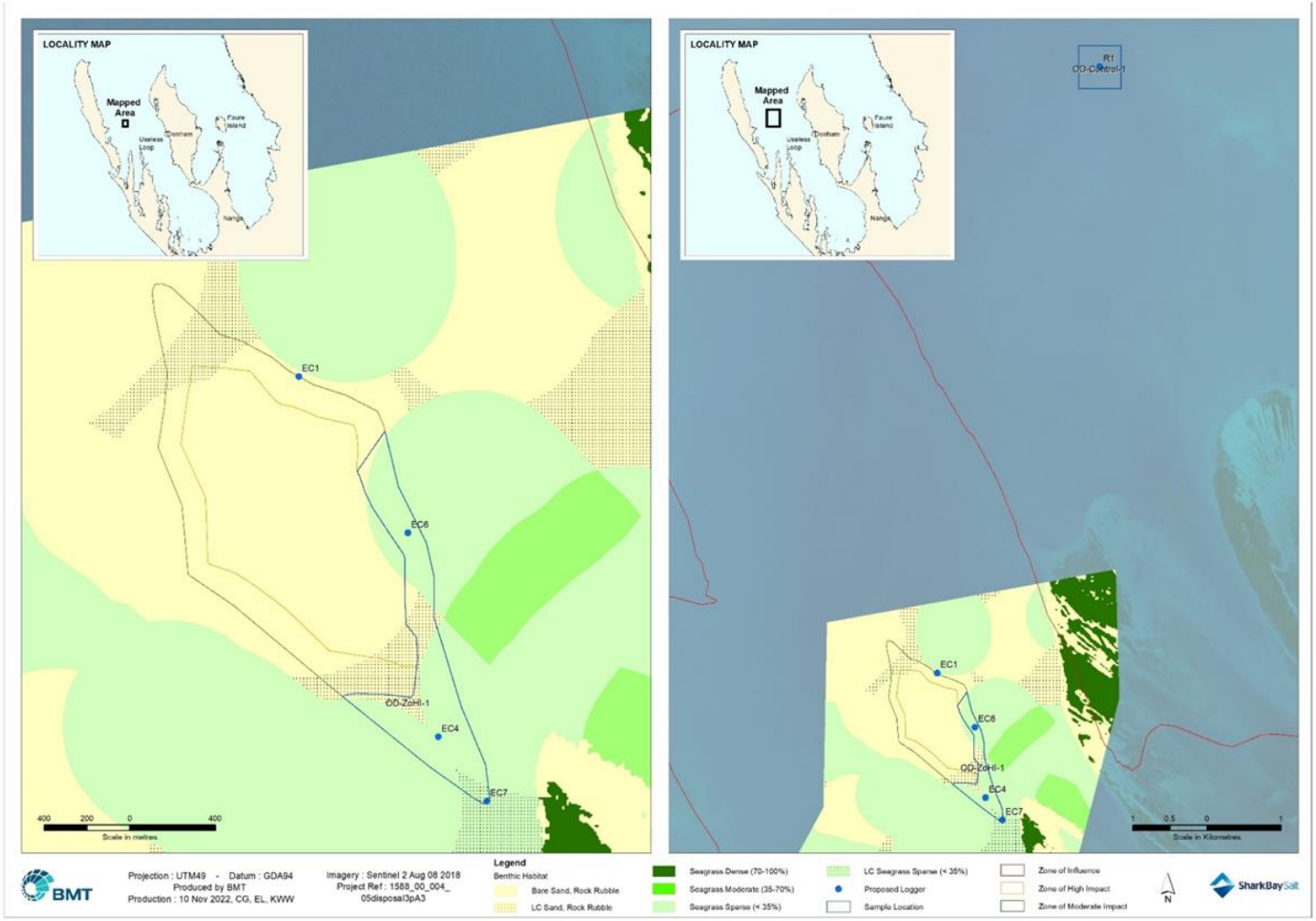


Figure 2.24 Survey location within the Zone of Moderate Impact (Left) and control site external of Zone of Influence (Right) for the Disposal Area as part of the 2022 Useless Loop maintenance dredging campaign

2.6.2 Statistical Methods

Video footage was analysed by an experienced marine scientist using TransectMeasure (SeaGIS 2021) to determine the benthic community type. The percent cover of BCH was assessed under 10 points on 10 randomly selected frames yielding 100 points per transect and 2,100 points per site. Four benthic categories were assessed including five seagrass species (*Halophila spp*., *Posidonia spp*., *Amphibolis spp*., *Cymodocea spp*., and 'other'), filter feeders, sand, and rock substrate (bare rock/reef/rubble). The original statistical design, as outlined in the sampling and analysis plan (SAP; BMT 2022c), consisted of three factors: Time, Treatment and Polygon; as seagrass and benthic cover at the Entrance Channel, Berth Pocket, and Disposal Area were proposed to be examined separately. However, due to the varying densities of seagrass at the polygon level that may confound the overall results (e.g. sparse ephemeral seagrass meadows respond faster to reduced light availability than dense perennial dominated seagrass meadows; Collier et al., 2007, Longstaff & Dennison, 1999), seagrass and benthic cover were examined between paired polygons to mitigate the introduction of type-1 error (false-positive). As such, the statistical approach consisted of a two-factor mixed-model Before-After- Control-Impact-Paired (BACIP) statistical design. The factors tested in the statistical design included:

- Time (fixed factor, orthogonal with two levels: Before, After)
- Treatment (fixed factor, orthogonal with two levels: Control, Impact)

The replication level within each polygon were the still images collected from each transect containing 10 data-points each (70 images and 700 data-points per polygon; or 210 images and 2,100 data-points within the Disposal Area ZoMI). The interaction term 'Time x Treatment' is of interest and indicates whether seagrass and benthic cover at impact versus control sites have responded differently to potential disturbance over time.

Statistical analyses could not be completed on polygon pairs EC-ZoHI-1/Control, and EC-ZoHI-3/Control as each pair contained different seagrass densities, and as such, were not statistically comparable. Instead, these polygons were examined using descriptive statistics.

All statistical analyses, including post-hoc tests on significant factors, were completed using non-parametric analysis of variance (PERMANOVA) in the software package PRIMER with PERMANOVA+ (Primer-E Ltd, Version 7.0.18; Anderson 2001a, b). This method enabled analysis of univariate and multivariate datasets, without explicitly requiring normalised data or homogeneous variances. All analyses were run using permutations of residuals under a reduced model (n = 9999 permutations).

Seagrass cover (univariate analyses)

Seagrass cover were arcsine-square root transformed prior to analysis. This type of transformation can be used for data that represents percentages. Euclidean distance was used as a dissimilarity measure for univariate analyses. By using the Euclidean measure, PERMANOVA returns an equivalent test statistic to a standard analysis of variance (Anderson et al. 2008). If the interaction term (Time x Treatment) were significant ($p < 0.05$), the terms were interpreted using post-hoc, pair-wise comparisons to test for differences among levels within each factor (Time and Treatment). Results from the univariate analyses were presented using bar graphs of means and standard errors for each paired polygon.

Benthic cover (multivariate analyses)

For multivariate analysis of benthic cover, data were square-root transformed prior to analysis to down-weigh the contribution of dominant benthic categories and allowed intermediate or rarer groups to play a part in the analyses (Clarke 1993). Prior to analysis with PERMANOVA, the Bray-Curtis dissimilarity measure was used (Clarke & Gorley 2006). If the interaction term (Time x Treatment) were significant ($p < 0.05$), the terms were interpreted using post-hoc, pair-wise comparisons to test for differences among

levels within each factor (Time and Treatment). Results from the multivariate analyses were presented using bar graphs of means and standard errors for each paired polygon.

2.6.3 Results

Seagrass Cover

With the exception of impact (ZoHI) sites at Berth Pocket Polygon 1 and Impact (ZoMI) Disposal Area Polygon 1, higher seagrass cover was observed across the remaining polygon pairs after dredging operations (Figure 2.25). Lower seagrass cover was observed after dredging operations at impact sites Berth Pocket Polygon 1 and Disposal Area Polygon 1 (Figure 2.25).

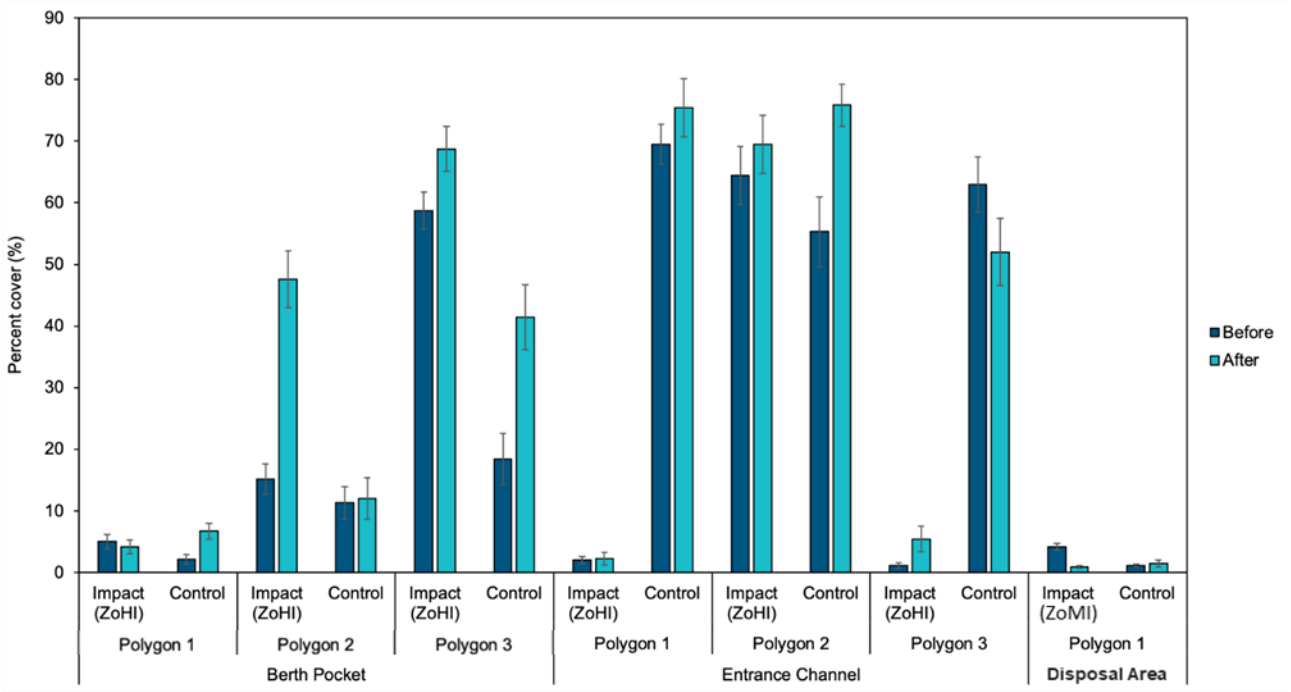


Figure 2.25 Seagrass cover (%; mean ± SE) for each paired polygon within Berth Pocket, Entrance Channel and Disposal Area across time (before and after)

The univariate analyses on seagrass cover showed significant results for the interaction term (Time x Treatment) for polygon pairs Berth Pocket Polygon 1, Berth Pocket Polygon 2 and Disposal Area Polygon 1 (Table 2.5). These results however, must be interpreted with caution, as paired impact and control sites did not necessarily have the same density of seagrass before dredging commenced, as presented in Figure 2.25 and Figure 2.26.

Post-hoc interpretations:

- At Berth Pocket ZoHI Polygon 1, there were no significant difference in seagrass cover between before (5.0 ± 1.2% cover) and after (4.1 ± 1.1%) dredging (Table 2.6). However, there was a significant difference in seagrass cover from before (2.1 ± 0.8%) and after (6.7 ± 1.3%) dredging at the Control site. Significant differences in seagrass density between impact and control polygons were evident before dredging commenced.
- At Berth Pocket ZoHI Polygon 2, seagrass cover was significantly different before (15.1 ± 2.5%) and after (47.6 ± 4.6%) dredging. Significant differences in seagrass density between impact and control polygons were evident after dredging operations.

- At Disposal Area ZoMI Polygon 1, there was a significant difference in seagrass cover before (4.2 ± 0.5%) and after (0.9 ± 0.2%) dredging operations. However, significant differences in seagrass density exist between impact and control polygons before dredging commenced.

Table 2.5 PERMANOVA results to test for differences in seagrass cover across time (before and after) and treatment (control vs impact)

	Berth Pocket Polygon 1					Berth Pocket Polygon 2			
Source	**df**	**SS**	**MS**	**Pseudo-F**	**P(perm)**	**SS**	**MS**	**Pseudo-F**	**P(perm)**
Time	1	0.1168	0.1168	3.1460	0.0818	2.9610	2.9610	16.252	**0.0001**
Treatment	1	2.9016E-06	2.9016E-06	7.8184E-05	0.9920	7.2048	7.2048	39.545	**0.0001**
Time x Treatment	1	0.2770	0.2771	7.4649	**0.0072**	3.3222	3.3222	18.234	**0.0001**
Residual	276	10.243	0.0371			50.285	0.1822		
Total	279	10.637				63.773			

	Berth Pocket Polygon 3					Entrance Channel Polygon 2			
Source	**df**	**SS**	**MS**	**Pseudo-F**	**P(perm)**	**SS**	**MS**	**Pseudo-F**	**P(perm)**
Time	1	4.4846	4.4846	17.241	**0.0001**	2.6329	2.6329	7.4337	**0.0070**
Treatment	1	17.217	17.217	66.189	**0.0001**	0.0473	0.0472	0.1335	0.7210
Time x Treatment	1	0.6066	0.6066	2.3322	0.1270	0.6731	0.6731	1.9003	0.1740
Residual	276	71.790	0.2601			97.754	0.3542		
Total	279	94.098				101.11			

	Disposal Area Polygon 1				
Source	**df**	**SS**	**MS**	**Pseudo-F**	**P(perm)**
Time	1	0.3651	0.3651	19.607	**0.0001**
Treatment	1	0.2458	0.2458	13.203	**0.0003**
Time x Treatment	1	0.3454	0.3454	18.550	**0.0001**
Residual	836	15.566	0.0186		
Total	839	16.522			

Note:

1. Bold font in P(perm) column indicates a significant difference ($p < 0.05$) for the term of interest

Table 2.6 Post-hoc tests for seagrass cover (Time x Treatment)

		Berth Pocket Polygon 1		Berth Pocket Polygon 2		Disposal Area Polygon 1	
Source	Groups	t	P (perm)	t	P (perm)	t	P (perm)
Within level 'Impact' of factor 'Treatment'							
Time	Before, After	0.6587	0.5281	5.4107	**0.0001**	5.8305	**0.0001**
Within level 'Control' of factor 'Treatment'							
Time	Before, After	3.2839	**0.0011**	0.1861	0.8604	0.0913	0.9443
Within level 'Before' of factor 'Time'							
Treatment	Impact, Control	2.1035	**0.0398**	1.7618	0.0781	5.1426	**0.0001**
Within level 'After' of factor 'Time'							
Treatment	Impact, Control	1.7981	0.0746	6.4407	**0.0001**	0.5297	0.6071

Note:

1. Bold font in P(perm) column indicates a significant difference ($p < 0.05$) for the term of interest

Multivariate statistics

Bare sand and seagrass were the dominant benthic habitat categories (ranging between 24.1–99.1% and 0.9–75.9% cover, respectively) found across most polygons for both times (before and after; Figure 2.26). Of the seagrasses present, *Amphibolis spp*. and *Posidonia spp*. were the dominated groups. Macroalgae was predominately present in polygons within the Berth Pocket, ranging from 0–3.6% and 0–11.7% cover, before and after dredging, respectively (Figure 2.26).

Statistical analyses on benthic cover showed significant differences in the interaction term (Time x Treatment) for polygon pairs Berth Pocket Polygon 1, Berth Pocket Polygon 2 and Disposal Area Polygon 1 (Table 2.7). As with seagrass cover, results must be interpreted with caution, as paired impact and control sites did not necessarily have the same density of seagrass before dredging commenced.

Post-hoc interpretations:

- Benthic cover at Berth Pocket Polygon 1 showed significant differences between time at both impact and control polygons, and between treatments at both impact and control polygons.
- Similarly, Berth Pocket Polygon 2 also showed significant different within all levels for time and treatment, with the exception of the control polygon before and after. There were no significant differences in benthic cover between before and after dredging operations at the control polygon.
- At Disposal Area ZoMI Polygon 1, there was a significant difference in benthic cover when comparing before and after dredging operations. This was primarily driven by the presence of filter feeders and macroalgae before dredging and the absence after dredging. Significant differences in benthic cover exist between impact and control polygons before dredging commenced. This difference was caused by the differences in presence/absence of some benthic groups (e.g., macroalgae was only recorded in the ZoMI whereas the unknown category (images that were obscured or were of poor quality) was only present in the control polygon.

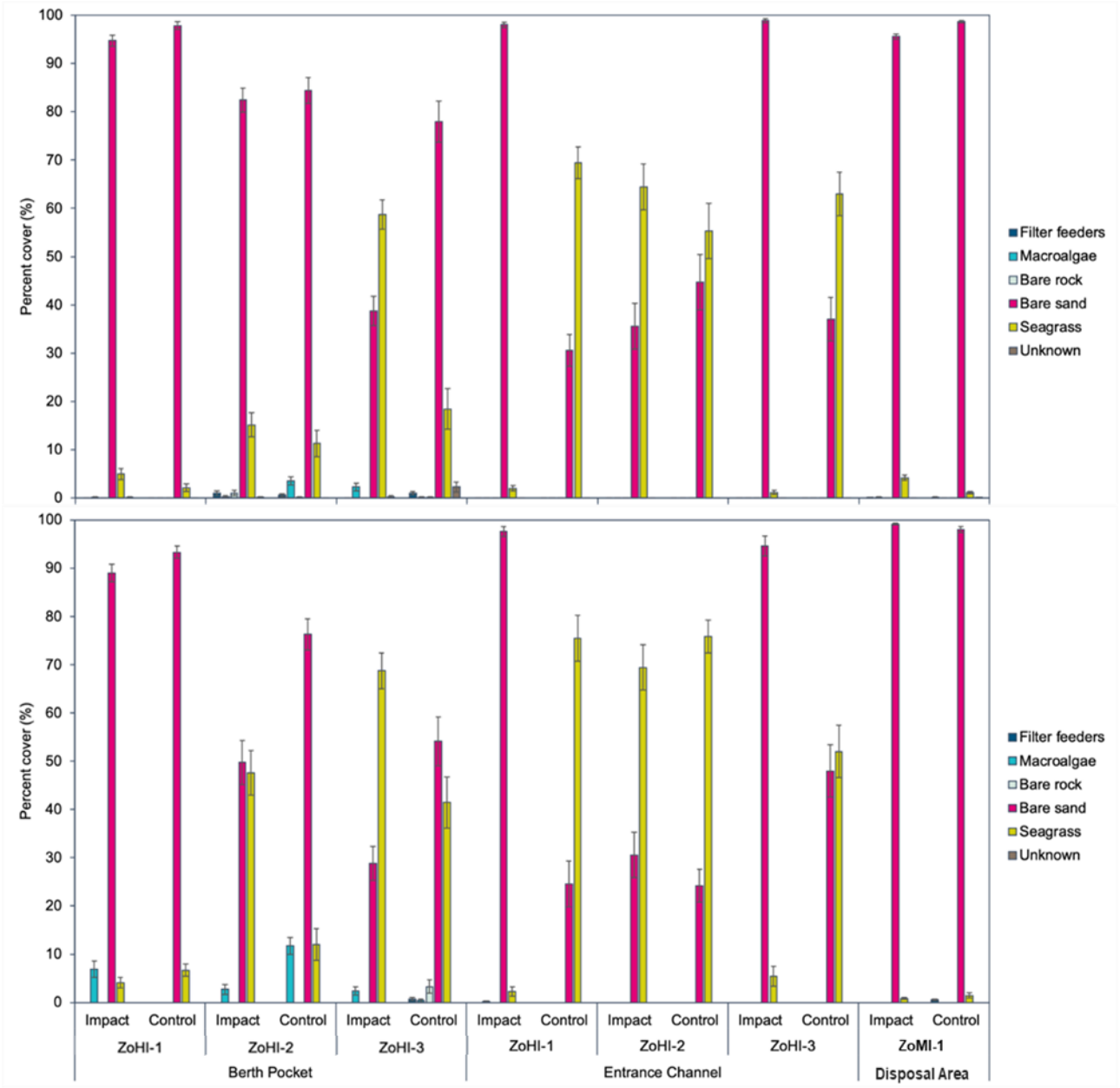


Figure 2.26 Benthic cover (%; mean ± SE) for each paired polygon within Berth Pocket, Entrance Channel and Disposal Area across time (before [top] and after [bottom])

Table 2.7 PERMANOVA results to test for differences in benthic cover across time (before and after) and treatment (control vs impact)

Berth Pocket Polygon 1						Berth Pocket Polygon 2			
Source	**df**	**SS**	**MS**	**Pseudo-F**	**P(perm)**	**SS**	**MS**	**Pseudo-F**	**P(perm)**
Time	1	1293.7	1293.7	8.9922	**0.0009**	14027	14027	19.232	**0.0001**
Treatment	1	1254.1	1254.1	8.7171	**0.0003**	29320	29320	40.201	**0.0001**
Time x Treatment	1	1843.1	1843.1	12.811	**0.0001**	11281	11281	15.468	**0.0001**
Residual	276	39707	143.86			2.013E+05	729.34		
Total	279	44097				2.5593E+05			

Berth Pocket Polygon 3						Entrance Channel Polygon 2			
Source	**df**	**SS**	**MS**	**Pseudo-F**	**P(perm)**	**SS**	**MS**	**Pseudo-F**	**P(perm)**
Time	1	17967	17967	17.565	**0.0001**	10821	10821	7.4371	**0.0066**
Treatment	1	55807	55807	54.559	**0.0001**	178.54	178.54	0.1227	0.7308
Time x Treatment	1	997.7	997.7	0.9754	0.3336	3000.4	3000.4	2.0621	0.1489
Residual	276	2.8232E+05	1022.9			4.0158E+05	1455		
Total	279	3.5709E+05				4.1558E+05			

Disposal Area Polygon 1					
Source	**df**	**SS**	**MS**	**Pseudo-F**	**P(perm)**
Time	1	711.08	711.08	14.412	**0.0002**
Treatment	1	525.93	525.93	10.659	**0.0015**
Time x Treatment	1	827.71	827.71	16.776	**0.0001**
Residual	836	41248	49.34		
Total	839	43313			

Note:

1. Bold font in P(perm) column indicates a significant difference ($p < 0.05$) for the term of interest

Table 2.8 Post-hoc tests for benthic cover (Time x Treatment)

		Berth Pocket Polygon 1		Berth Pocket Polygon 2		Disposal Area Polygon 1	
Source	Groups	t	P (perm)	t	P (perm)	t	P (perm)
Within level 'Impact' of factor 'Treatment'							
Time	Before, After	3.3051	**0.0003**	5.3704	**0.0001**	5.6202	**0.0001**
Within level 'Control' of factor 'Treatment'							
Time	Before, After	3.2946	**0.0011**	1.7494	0.0688	1.7494	0.0688
Within level 'Before' of factor 'Time'							
Treatment	Impact, Control	2.1051	**0.0354**	2.2087	**0.0238**	4.9217	**0.0001**
Within level 'After' of factor 'Time'							
Treatment	Impact, Control	3.6803	**0.0001**	6.2339	**0.0001**	1.1752	0.2998

Note:

1. Bold font in P(perm) column indicates a significant difference ($p < 0.05$) for the term of interest

2.6.4 Discussion of Statistical Results and Field Observations

Overall, the benthic communities and habitat coverage data collected pre- and post- campaign operations indicate both gain and loss of seagrass habitat across locations and time. Univariate statistical analysis indicated significant change in seagrass habitat cover within three paired-polygons; however, this data must be interpreted with caution, as paired impact and control sites did not have the same density of seagrass or assemblage of benthic communities before dredging commenced, as presented in Figure 2.25 and Figure 2.26.

The statistical difference observed in Berth Pocket Polygon 1 and Polygon 2 represent an observed increase of seagrass cover following the cessation of seabed levelling operations at the control location (beyond the ZoI) and at the impact location adjacent to the ZoHI, respectively (Figure 2.25). Whereas the statistical difference observed in the Disposal Area ZoMI polygon indicates an observed decrease in seagrass cover following disposal operations. This perceived variability in seagrass cover among locations is likely indicative of a multitude of factors. Specifically, natural variability of inter-annual growth/decline processes within seagrass meadows and difficulty obtaining a high level of accuracy when assessing extremely sparse seagrass meadows and inherent limitation of field survey methods such as towed video survey.

Seagrass within the Disposal Area control polygon and the ZoMI polygon were extremely sparse before the commencement of disposal activities (1.1% and 4.2% total cover, respectively). Sparse ephemeral seagrass meadows are naturally dynamic systems which have been shown to respond to environmental stimuli up to 8.5-times faster than their perennial counterparts (Collier et al., 2007, Longstaff & Dennison, 1999). Drivers of natural variability in seagrass meadow cover has been shown to include species composition, meadow structure, hydrodynamic and physical setting, and grazing pressure (Lyons et al., 2013). Additionally, there are larger scale drivers (e.g. solar exposure, ocean temperature, anthropogenic climate change) that can be assumed to act on the entire Shark Bay area, though the response may vary between two locations owing to localised meadow differences. The variability observed in seagrass cover at the Disposal Area ZoMI (±3.3% total cover) is within natural variation (growth/decline processes) observed for similar ephemeral seagrass meadows (Roelfsema et al., 2014).

Owing to the sparsity of seagrass cover, consideration was given to applying higher replication to the image analysis in an attempt to improve the resolution of the statistical outputs; however, this was discounted following a risk-based assessment of the potential impact to BCH based on the more-conservative results provided above (Section 2.6.3). Specifically, the internal risk-based assessment

focussed on the observed decline in seagrass cover in the Disposal Area ZoMI, where seagrass was sparsest. The ZoMI has been designated to the Disposal Area directly and is located immediately outside of the ZoHI. It is defined as 'the area within which predicted impacts on benthic organisms are recoverable within a period of five years' (EPA 2016). It was anticipated that ~0.27 km^2 of sparse seagrass within the ZoMI would be lost but recoverable within a period of 5 years following completion of the campaign, which was accepted within the approval conditions as specified by both state and federal regulators. By extrapolating seagrass cover across the ZoMI polygon (300,000 m^2) the total loss of sparse seagrass within the ZoMI was ~0.01 km^2, an order of magnitude below the acceptable level of recoverable loss (Table 2.9). Additionally, no obvious excessive burial or sedimentation was identified during analysis of towed video transects from within the Disposal Area ZoMI. This provides additional confidence to the recoverable nature of any seagrass loss observed within the ZoMI.

Table 2.9 Recoverable seagrass loss within the Zone of Moderate Impact (ZoMI)

Project Status	Seagrass cover (%)	ZoMI Area (m^2)	Seagrass cover (m^2)	Seagrass cover (km^2)
Pre-Disposal	0.042	300,000	12,600	0.0126
Post-Disposal	0.009	300,000	2,700	0.0027
Seagrass loss	0.033	300,000	9,900	0.0099

Multiple lines of evidence demonstrate that the identified impacts to seagrass habitat and communities have been managed in line with the DEMP (BMT 2021a) and the EPOs as defined within the approval conditions specified by both state and federal regulators have been met for continued BCH health. Permanent loss of seagrass beyond the ZoHI has not been demonstrated. The observed loss of seagrass within the ZoMI is below the acceptable level of recoverable loss as defined in the DEIA (BMT 2021b) and is not anticipated to result in a significant impact to the ecological values of the SBWHA or the SBMP or reflect the loss of habitat critical for survival of threatened and migratory marine fauna in the region. The risks posed by the project to key sensitive receptors and the SBWHA values have been shown to be low and acceptable.

2.7 Marine fauna monitoring

Prior to the commencement of seabed levelling, dredging, or disposal operations, eight persons (five vessel operators and/or crewmembers, two traditional owners, and one JNCC certified marine mammal observer) underwent project-specific marine fauna observer (MFO) training from BMT to minimise the risk of marine fauna interactions during mobilisation and construction activities. The training included marine fauna behaviour and actions, and reporting requirements in the event of marine fauna injury or mortality. EPBC Regulations 2000 – Part 8 Division 8.1, Interacting with cetaceans were included in the training and adhered to, as required. All operational activities were completed with multiple BMT-trained MFOs on location where continuous observations were maintained for the duration of all operational works. Marine fauna observation field logs were completed daily by trained personnel and were reviewed by and reported by BMT daily during the Campaign.

During seabed levelling operations at the Berth Pocket (15 August 2022 – 26 August 2022), two MFOs were stationed on the Ship Loader Platform where a 360-degree view of the observational and shutdown zones was achieved, and one MFO was onboard the operational tug vessel (Edi). Across the 12 operational days at the Berth Pocket, visual observation time totalled ~109 hours, resulting in the observation of 32 mitigation species within the operation area and mitigation actions (operational shut down) being required on 21 occasions.

During dredging and disposal operations at the Entrance Channel and Disposal Area (01 September 2022 – 07 September 2022), two MFOs were stationed onboard the dredge vessel (Modi

R) and two MFOs were onboard the pilot vessel (Pelagic) where a 360-degree views of the observational and shutdown zones were achieved. In addition to dredging and disposal operations, seabed levelling of the Entrance Channel was undertaken by the tug vessel (02 September 2022 – 12 September 2022). Across the 11 operational days at the Entrance Channel and 7 operation days at the Disposal Area, visual observation time totalled ~96 hours, resulting in the observation of 23 mitigation species within the operation area and mitigation actions (operational shut down) being required on 7 occasions.

2.8 Introduced Marine Species

In accordance with the DEMP (BMT 2021a), a number of management measures were implemented to minimise the risk of introduction of marine pests to the SBMP and SBWHA. Hull inspections for potential introduced marine species (IMS) on vessels transiting from interstate or overseas prior to mobilisation to the project area. This included the dredger, Modi-R, and the tugboat, Edi, which conducted seabed levelling operations. Additional hull cleaning was undertaken on Edi prior to mobilisation to the project area and an IMS assessment was prepared for each vessel by a specialist following the hull cleaning and in-water IMS inspection. The IMS assessments conclude that Modi-R and Edi posed no risk of translocating IMS to the project area (BFS 2022a, b).

Both Modi-R and Edi undertook a risk assessment for IMS using the Department of Primary Industries and Regional Development (DPIRD) risk assessment tool, Vessel Check, which returned a low-risk rating.

The hydrographic survey vessel, Rind-R, was mobilised for the campaign from intrastate via road transport to Carnarvon, Western Australia. The hull of the Rind-R was cleaned and antifouled prior to being transported via road. DPIRD were consulted and confirmed that these measures were sufficient to mitigate the risk of IMS translocation to Shark Bay by the vessel. Photographs were also taken of the hull of Rind-R immediately prior to launching at Carnarvon to demonstrate the cleanliness of the hull (Figure 2.27).

Dredging contractor personnel were provided with IMS identification and guidance documentation for reference during the Project. Dredging contractor personnel monitored immersible equipment opportunistically and were required to report any observations of suspect or confirmed IMS. No suspect or confirmed IMS were observed on these vessels or equipment during the Campaign.

Figure 2.27 Images of the hull of hydrographic survey vessel Rind-R showing newly applied anti-foulant coating prior to launch at Carnarvon, Western Australia

2.9 Indigenous Heritage

The Malgana Aboriginal Corporation and Yamatji Marlpa Aboriginal Corporation are key stakeholders and have been engaged throughout the Project, to ensure heritage sites, seascapes, the enjoyment of country and customary practices are identified and preserved. To further engage with the Malgana Aboriginal Corporation and Yamatji Aboriginal Corporation, representatives were present onsite during the Campaign. These representatives primarily supported the Project by undertaking MFO monitoring in addition to overall observations of Project activities, though they were not present onboard the dredge or seabed levelling vessels due to operational limitations.

Monitoring of dredged materials was undertaken in accordance with the DEMP (BMT 2021a). No observations of indigenous or non-indigenous artefacts, suspect or otherwise, were reported during the Campaign indicating the there was no disturbance to or loss of indigenous heritage areas or values as a result of the Campaign.

3 Environmental Management

In addition to the environmental monitoring requirements outlined in Section 2, potential environmental impacts relating to hydrocarbon spills and waste generation were managed, as required, in accordance with the DEMP (BMT 2021a). To manage the potential for release of contaminants that could deteriorate water quality and impact marine fauna, and to ensure a clean and tidy work site the dredging contractor developed a work pack of documents that detailed how these factors would be managed. Hydrocarbons and waste generation were managed according to the dredging contractors Occupational Health and Safety Management Plan (RND 2022a). To address the management measures associated with marine turtles, BMT confirmed the installation of a turtle exclusion device to the suction head prior to commencement of dredging. As part of their operational work pack the dredging contractor developed their own DEMP, which outlined a number of other environmental management measures to be undertaken including soft-start procedures, noise mitigation actions and additional measures to mitigate the risk of vessel strike in low light conditions (RND 2022b).

Navigational (public) safety was managed through the communication of a Temporary Notice to Mariners (TNtM) issued by the Western Australian Department of Transport (DoT), which detailed the specifics of the vessel operations for dredging and seabed levelling and the installation and location of temporary moorings for environmental monitoring equipment.

There were no public complaints received during the campaign or reports of safety or environmental incidents reported by the dredge contractors. Following completion of the campaign, the work site was cleared of equipment and any associated rubbish or debris was removed and an update to the TNtM was issued to notify the public of the completion of the work and removal of navigational safety risks.

While no public complaints were received, two navigational incidents are thought to have occurred during the Campaign. Upon consistent receipt of unusual data, or lack thereof, from some of the telemetered water quality loggers, and owing to a minor delay in mobilisation schedule for the Modi R, BMT deployed a team from Perth to Shark Bay to conduct maintenance and troubleshooting of the water quality loggers installed (refer to Section 2.3) near the end of August 2022. Upon arrival at monitoring site EC1 BMT noted physical damage to the mooring buoy that housed the telemetry unit for the logger array. Upon inspection of the equipment, it became evident that a boat strike had occurred at some stage, with the mooring line and data cable showing obvious signs of being wrapped in a propellor. Furthermore, the telemetry unit on top of the buoy had been flooded and was no longer functional. BMT personnel were able to resolve the monitoring commitments using alternative equipment at the site. During the same maintenance trip, personnel arrived at reference site R1, to find that the entire logger array (including mooring and float) was not present at the location. The team conducted a comprehensive visual and acoustic search of the vicinity, though were unable to locate the logger array. The loggers at reference sites were non-telemetered so data prior to this time was not recovered. Fortunately, BMT were able to re-deploy another logger array at the site in time for dredging, disposal and seabed levelling operations at the Entrance Channel and Disposal Area.

The mooring buoys at each monitoring site had been fitted with a Sea light prior to initial deployment and deployment locations were communicated through issue of TNtM.

3.1 Management actions

Seabed levelling, dredging and disposal operations throughout the Campaign involved a total of ~205 hours of visual MFO monitoring observation time. This monitoring yielded the observation of a total of 55 migration species within the operational areas and instigated mitigation action (operational shut down of

dredging or seabed levelling) a total of 28 times throughout all operational works. There were nil non-compliance issues arising from MFO obligations or vessel operations throughout the Campaign.

As described in Section 2.1, localised over-dredging of the Entrance Channel occurred during the Campaign whereby isolated areas of seabed were observed in hydrographic survey data below the permitted vertical dredge depth (-10.5 m LAT). While all environmental monitoring commitments were implemented, there were none directly designed to mitigate the risk of vertical over-dredging. Once the low spots had been identified an effort was made to expedite the natural accretion and infilling that had been observed in subsequent hydrographic surveys by means of seabed levelling. However, this approach proved to be relatively ineffective, and the decision was made to cease levelling to limit ongoing turbidity generation and the associated potential environmental risk. Given the relatively small degree of turbidity generated by the dredging as observed in benthic monitoring data (Section 2.3) and visual monitoring data (Section 2.2), the predominant potential environmental impact pathway from dredging below depth tolerance could be considered to be the potential release of toxicants contained within the sediment. However, over-dredge of material in the Entrance Channel by a maximum of ~80 cm (see Section 2.1) is unlikely to present a material risk to the marine environment for the following reasons:

- Data indicates that there is no significant geological feature present at this location and prior sediment analyses within the Entrance Channel indicates that the material is broadly similar regarding particle size distribution and TOC (BMT 2020)

- Contaminant analyses of the overlying sediment conducted in July 2019 and February 2020 noted that Entrance Channel sediments are clean and suitable for unconfined disposal (BMT 2020).

4 Summary and Conclusion

Owing to the ecological significance of the geographic location of the Useless Loop maintenance dredging campaign, the project scope of works was heavily regulated, monitored and managed throughout the lifecycle, from baseline studies inform the EIA to implementation of the DEMP before, during and after the Campaign. This is reflected by the high degree of scrutiny and stringent conditions associated with governmental approvals/regulations and licencing requirements.

The assessment of vessel position monitoring, the collection of various visual plume observations, and the assessment of benthic PAR in seagrass habitat adjacent to the relevant ZoHI indicate that project-induced light reduction has been demonstrated to have been kept within satisfactory bounds imposed through environmental approvals conditions to prevent loss of BCH. The observed turbid plumes throughout the Berth Pocket, Entrance Channel and Disposal Area were localised and remained largely confined with the respective ZoHI (Section 2.2). This observation was further substantiated by measurements of PAR and NTU at the seabed (where sensitive receptors reside) immediately adjacent to areas of heightened disturbance, which recorded no trigger or threshold criterion exceedances (Section 2.3).

(EPOs) established in the DEMP for BCH, which are to 1) restrict permanent loss to the Zone of High Impact (ZoHI) and, 2) have no indirect damage due to reduced water quality, have been met.

The EPOs established in the DEMP were to restrict permanent loss of BCH to the ZoHI and have no direct damage to BCH due to reduced water quality. This was of particular importance to the local community of Denham and indigenous custodians for the area. As such, a suitable benthic habitat map was developed, and a large-scale benthic habitat assessment was undertaken to assess seagrass cover before and after the Campaign operations (Section 2.6). Overall, the benthic communities and habitat coverage data collected pre- and post- campaign operations indicate both gain and loss of seagrass habitat across locations and time. Differences in seagrass cover were observed pre- and post-dredging activities in the seagrass adjacent to the Berth Pocket ZoHI and Disposal Area ZoMI. This observed variability in seagrass cover among locations is likely indicative of ineffective paired impact and control sites owing to varying density of seagrass or assemblage of benthic communities before dredging commenced, and natural variability among sparse ephemeral seagrass meadows.

Multiple lines of evidence demonstrate that the identified impacts to seagrass habitat and communities have been managed in line with the DEMP (BMT 2021a) and the EPOs as defined within the approval conditions specified by both state and federal regulators have been met for BCH. Permanent loss of seagrass beyond the ZoHI has not been demonstrated. The recoverable loss of seagrass observed within the ZoMI is below the acceptable level as defined in the DEIA (BMT 2021b) and is not anticipated to result in a significant impact to the ecological values of the SBWHA or the SBMP or reflect the loss of habitat critical for survival of threatened and migratory marine fauna in the region. The risks posed by the project to key sensitive receptors and the SBWHA values have been shown to be low and acceptable. Likewise, the EPOs for the other key environmental factors; Marine Environmental Quality, Marine Fauna and Social Surroundings were also met through the successful implementation of comprehensive environmental monitoring and management commitments during the Campaign as demonstrated within this report.

5 References

Anderson MJ (2001a) A new method for non-parametric multivariate analysis of variance. Austral Ecology 26:32–46

Anderson MJ (2001b) Permutation tests for univariate or multivariate analysis of variance and regression. Canadian Journal of Fisheries and Aquatic Sciences 58:626–639

Anderson MJ, Gorley RN, Clarke KR (2008) PERMANOVA+ for PRIMER: Guide to software and statistical methods. PRIMER-E Ltd, Plymouth, United Kingdom

BFS 2022a Invasive Marine Species Assessment of Polaris Marine Tug: Edi July 2022. Unpublished report prepared by Biofouling Management Services for Polaris Marine, 30 July 2022

BFS 2022b Invasive Marine Species Assessment of RN Shipping Hopper Dredger: Modi-R September 2022. Unpublished report prepared by Biofouling Management Services for Polaris Marine, 09 September 2022

BMT (2020) Shark Bay Resources: Sediment Sampling and Analysis Plan Implementation Report. Prepared for Shark Bay Resources Pty Ltd by BMT, Report No R-1558_00-5_Rev0, Perth, Western Australia, June 2020

BMT (2021a) Shark Bay Resources: Dredging Environmental Management Plan. Prepared for Shark Bay Resources Pty Ltd by BMT, Report No R-1588_00-7_Rev5, Perth, Western Australia, June 2021

BMT (2021b) Shark Bay Resources: Dredging Environmental Impact Assessment. Prepared for Shark Bay Resources Pty Ltd by BMT, Report No R-1558_00-2_Rev5, Perth, Western Australia, June 2021

BMT (2022a) Useless Loop Maintenance Dredging: Project Closeout Report. Prepared for Shark Bay Resources Pty Ltd by BMT, Draft Report, Perth Western Australia, Unpublished

BMT (2022b) Shark Bay Resources Maintenance Dredging: Additional Ground Truthing Survey Report. Prepared for Shark Bay Resources Pty Ltd by BMT, Report No Tn-1588_00-7, Perth Western Australia, 18 July 2022

BMT (2022c) Shark Bay Resources; DEMP Benthic Habitat Survey 2022 Sampling and Analysis Plan. Prepared for Shark Bay Resources Pty Ltd by BMT, Report No R-1588_00-9_Rev0, Perth Western Australia, 8 June 2022

Cabaco S, Santos R, Duarte CM (2008) The impact of sediment burial and erosion on seagrasses: A review. Estuarine Coastal and Shelf Science 79(3):354–366

Clarke, K. R. (1993). Non-parametric multivariate analyses of changes in community structure. Australian journal of ecology, 18(1), 117-143.

Clarke, K. R., & Gorley, R. N. (2006). Primer. PRIMER-e, Plymouth, 866.

Collier, C. J., Lavery, P. S., Ralph, P. J., & Masini, R. J. (2009). Shade-induced response and recovery of the seagrass Posidonia sinuosa. Journal of Experimental Marine Biology and Ecology, 370(1-2), 89-103.

EPA (2016) Technical Guidance – Environmental Impact Assessment of Marine Dredging Proposals, Environmental Protection Authority, Perth, Western Australia, December 2016

Longstaff, B. J., & Dennison, W. C. (1999). Seagrass survival during pulsed turbidity events: the effects of light deprivation on the seagrasses Halodule pinifolia and Halophila ovalis. Aquatic Botany, 65(1-4), 105-121.

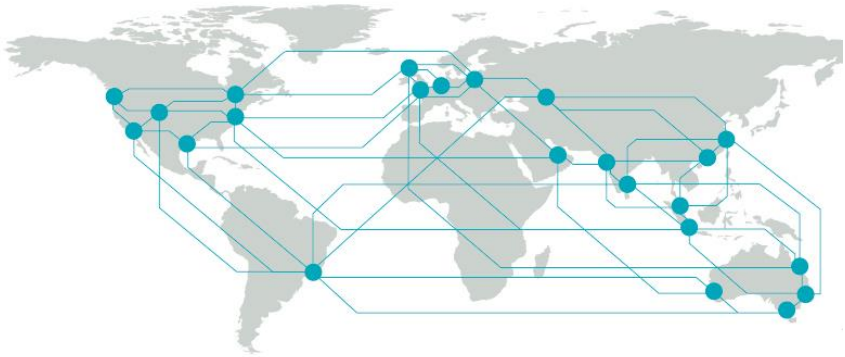
Lyons, M. B., Roelfsema, C. M., & Phinn, S. R. (2013). Towards understanding temporal and spatial dynamics of seagrass landscapes using time-series remote sensing. Estuarine, Coastal and Shelf Science, 120, 42-53.

RND 2022a Useless Loop Maintenance Dredging: Occupational Health and Safety Management Plan. Prepared for Shark Bay Resources Pty Ltd by RN Dredging Pty Ltd, Document No 20.2818-DOC-OHSMP-002, Revision 0, Perth, Western Australia, July 2022

RND 2022b Useless Loop Maintenance Dredging: Dredging Environmental Management Plan. Prepared for Shark Bay Resources Pty Ltd by RN Dredging Pty Ltd, Document No 22.2818-DOC-PMS-004, Revision 0, Perth, Western Australia, July 2022

Roelfsema, C. M., Lyons, M., Kovacs, E. M., Maxwell, P., Saunders, M. I., Samper-Villarreal, J., & Phinn, S. R. (2014). Multi-temporal mapping of seagrass cover, species and biomass: A semi-automated object based image analysis approach. Remote Sensing of Environment, 150, 172-187.

SeaGIS (2021) TransectMeasure – single camera biological analysis tool. SeaGIS Pty Ltd, Melbourne, Victoria. Available at < http://www.seagis.com.au/transect.html>



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Shark Bay Resources Seabed Levelling and Dredging Project 2022

MFO Final Report

Shark Bay Resources Seabed Levelling and Dredging Project

August – September 2022

Client	Shark Bay Resources
Area	Berth Pocket and Entrance to Channel
Project	Shark Bay Resources Seabed Levelling and Dredging Project
Work Order	47635
Dates	15th – 26th August 2022
	1st – 12th September 2022
Contractor	Shark Bay Resources
Platform/Vessel	Ship Loader Platform, Pelagic and Useless Loop
QC Consultant	Elizabeth Dean

To	**:**	**Shark Bay Resources**
Attn	**:**	**Will Jones**
cc	**:**	**Connor Gorham, Alana Pols and Ashley Lemmon**
From	**:**	**Elizabeth Dean**
Area	**:**	**Shark Bay Resources Berth Pocket and Entrance to Channel**
Platform/Vessel	**:**	**Ship Loader Platform, Pelagic and Useless Loop**
Project	**:**	**Shark Bay Resources Seabed Levelling and Dredging Project**

EXECUTIVE SUMMARY

This report covers the period of 15th – 26th of August 2022 and the period of 1st – 12th of September 2022.

MFO Elizabeth Dean is BMT MFO trained, JNCC certified, and has seismic survey experience under EPBC Act regulations (EPBC Act Policy Statement 2.1, 2008). MFO Elizabeth Dean was present, when possible, during the period of 15th – 26th of August 2022 to conduct observations and mitigation procedures on the Ship Loader Platform during seabed levelling of the berth pocket and the period of 1st – 6th of September 2022, when possible during seabed levelling and dredging of the channel entrance to conduct observations and assist with mitigation procedures onboard the vessel Pelagic. During the period of 7th – 12th of September MFO Elizabeth Dean was on call in Useless Loop as mobilisation difficulties to and from Useless Loop hampered the ability to observe from the channel entrance. MFO Elizabeth Dean could not conduct visual observations but maintained communication with crew members of BMT and Shark Bay Resources.

During the period of 15th – 21st of August 2022, one BMT trained MFO, Trevor Poland assisted on the Ship Loader Platform during seabed levelling of the berth pocket. During the period of 22nd – 26th of August 2022, one BMT trained MFO, Shane Mitchell assisted on the Ship Loader Platform during seabed levelling of the berth pocket as well as during the period of 1st – 6th of September 2022, during seabed levelling and dredging of the channel entrance onboard the vessel Pelagic.

During the period of 15th – 26th of August 2022, two Marine Fauna Observers (MFOs) were located on the Ship Loader Platform, when possible, during the seabed levelling of the berth pocket, to conduct visual observations and mitigation procedures. The MFOs on the Ship Loader Platform commenced visual observations once operations of seabed levelling in the berth pocket was already underway.

During the period of 1st – 6th of September 2022, two Marine Fauna Observers (MFOs) were located on the vessel Pelagic during the seabed levelling and dredging of the channel entrance, when possible, to conduct visual observations and assist with mitigation procedures.

During the period of 15th – 26th of August 2022, seabed levelling vessel EDI conducted seabed levelling operations of the berth pocket. Onboard seabed levelling vessel EDI, one BMT MFO trained crew member conducted visual observations during daylight operational hours. Communication between seabed levelling vessel EDI and the MFOs on the Ship Loader Platform was established through channel 12 VHF. Weather conditions delayed seabed levelling operations on numerous occasions.

During the period of 2nd – 12th of September 2022, seabed levelling vessel EDI conducted seabed levelling operations of the entrance of the channel. On the 9th of September2022, seabed levelling vessel EDI did not conduct operations and held at anchorage for superintendent directive. Onboard seabed levelling vessel EDI, one BMT MFO trained crew member conducted visual observations during daylight operational hours. Whilst the MFOs onboard vessel Pelagic communicated primarily with dredging vessel Modi R, seabed levelling vessel EDI was also on channel 10 VHF and acknowledged relayed information when such information was relevant.

During the period of 1st – 7th of September 2022, dredging vessel Modi-R conducted dredging operations of the entrance of the channel. Onboard dredging vessel Modi R, one BMT MFO trained crew member conducted visual observations during daylight operational hours. Communication between dredging vessel Modi R and the MFOs onboard vessel Pelagic was established through channel 10 VHF. MFOs onboard Pelagic maintained communication and assisted with visual observations and mitigation but did not conduct mitigation shutdowns, that responsibility was performed by the trained MFO onboard dredging vessel Modi R.

The MFOs that observed onboard the vessel Pelagic boarded dredging vessel Modi R prior to the commencement of dredging on the 1st of September 2022 but was not present when the operations first began. Whilst MFOs on the vessel Pelagic were on shift within the channel entrance operational area, both dredging vessel Modi R and seabed levelling vessel EDI were present. MFOs onboard the vessel Pelagic maintained a closer distance from dredging vessel Modi R whilst dredging operations occurred and during transit to and from the disposal site. MFOs onboard the vessel Pelagic transited within the vicinity of Modi R.

Please see Table 1 and 1.2 below for brief report overviews and refer to Appendix 1 for the Seabed Levelling of the berth pocket and Appendix 1.2 for the Dredging of the channel entrance for observer effort data.

Table 1: Shark Bay Resources Seabed Levelling Overview

MFO ON THE SHIP LOADER REPORT OVERVIEW FOR SEABED LEVELLING OF THE BERTH POCKET PROJECT PERIOD
There were 12 observational days beginning the 15th August 2022 to 26th the August 2022.
Visual observation time totalled 109:04.
There were 32 visual observations of mitigation species within the Operational Area.
There were 21 mitigation actions required for this project period.
There were 0 non-compliance issues.

Table 1.2: Shark Bay Resources Dredging Overview

MFO ON THE VESSEL PELAGIC REPORT OVERVIEW FOR DREDGING OF THE CHANNEL ENTRANCE PROJECT PERIOD
There were 6 observational days beginning the 1st September 2022 to the 6th September 2022.
Visual observation time totalled 41:40.
There were 18 visual observations of mitigation species within the Operational Area.
There were 2 mitigation actions required for this project period.
There were 0 non-compliance issues.

MFO MONITORING EFFORT BY MFO ON THE SHIP LOADER AND THE VESSEL PELAGIC

During the Seabed Levelling of the berth pocket, the period 15th – 26th of August 2022, the MFOs maintained watch from the Ship Loader Platform where a 360-degree view of the observational and shutdown zones was best achieved. Visual observations for mitigating species were conducted during daylight shift hours with observations commencing before sunrise or when the weather permitted operations to commence.

During the dredging of the channel entrance, the period 1st – 6th of September 2022, the MFOs maintained watch from vessel Pelagic where a 360-degree view of the observational and shutdown zones was best achieved. MFOs maintained an appropriate distance from dredging vessel Modi R whilst dredging and dumping operations were conducted. Visual observations for mitigating species were conducted during daylight shift hours with observations commencing once transit to the dredging operational area was completed when the weather permitted.

These efforts are recorded in the Observer Effort forms, see Appendix 1 for the Seabed Levelling of the berth pocket and Appendix 1.2 for the dredging of the channel entrance.

MFO's maintained observations during daylight shift hours which varied throughout the project due to weather delays and transit times.

MFO's used marine 7 x 50 range finding binoculars. Effort and sighting data were recorded in BMTs' observation and interaction reports as well as additional recording methods for backup and incorporation into reports.

MARINE FAUNA SIGHTINGS DURING THE SEABED LEVELLING OF THE BERTH POCKET PROJECT PERIOD AS RECORDED BY MFO ON THE SHIP LOADER

Thirty-two marine megafauna sightings occurred within the Seabed Levelling Berth Pocket Operational Area during the project period of the 15th August 2022 to the 26th August 2022. Species identification was with reference to both observer experience and the Field Guide to Marine Mammals (Shirihai, 2006).

Sighting C1 occurred at 16:05hr on the 16th of August. Whilst seabed levelling two Common Bottlenose dolphins, one being a juvenile, were sighted 491m from the sound source travelling in a southerly direction, then changing direction and travelling north. Surface activity followed by dorsal fins was sighted. Mitigation action was implemented and the seabed levelling operation was shut down. The closest approach to the sound source was 188m. The last sighting occurred at 16:07hr. 30 minutes passed with no further sightings and an 'all clear' to restart operations was given at 16:37hr. At 16:37hr a 20-minute soft start was conducted. At 16:57hr seabed levelling recommenced.

Sighting C2 occurred at 07:24hr on the 17th of August. Whilst seabed levelling, MFO sighted two unidentifiable dolphins dorsal fins 149m from the sound source, travelling in a southerly direction. Mitigation action was implemented and the seabed levelling operation was shut down. The closest approach was 149m.

Sighting C3 occurred at 08:00hr on the 17th of August. Whilst shutdown, dolphins were sighted leaving the shutdown zone travelling north, 572m from the sound source towards three more dolphins that were swimming in the same direction at a further distance from the sound source.

Sighting S1 occurred at 07:36hr on the 17th of August. Whilst shutdown a dugong was sighted surfacing, taking a breath and diving 80m from the sound source. The closest approach was 80m. 30 minutes passed with no further sightings and an "all clear" to restart operations was given at 08:06hr. At 08:06hr a 20-minute soft start was conducted. At 08:26hr seabed levelling recommenced.

Sighting C4 occurred at 07:28hr on the 18th of August. Whilst seabed levelling, MFO sighted four Common bottlenose dolphins dorsal fins 203m from the sound source, travelling in a northerly direction. Mitigation action was implemented and the seabed levelling operation was shut down. The closest approach was 203m. At 07:34hr the dolphins were resighted 750m from the sound source still travelling north. An "all clear" to restart operations was given at 07:34hr. At 07:34hr a 20-minute soft start was conducted. At 07:54hr seabed levelling recommenced.

Sighting C5 occurred at 15:30hr on the 18th of August. Whilst seabed levelling, MFO five Common bottlenose dolphins were sighted travelling south 512m away from the sound source, about to enter the 500m shutdown zone. Mitigation action was implemented and the seabed levelling operations were shutdown. At 15:32hr the dolphins were sighted 346m from the sound source and at closest approach were 122m. At 15:40hr the dolphins were sighted 512m from the sound source continuing to travel south outside the shutdown zone. An 'all clear' to restart operations was given at 15:40hr. At 15:40hr a 20-minute soft start was conducted. At 16:00hr seabed levelling recommenced.

Sighting C6 occurred at 16:18hr on the 18th of August. MFO onboard EDI radioed that they had sighted dolphins 200m south east of the sound source. MFO ship loader sighted approximately eight dolphins, one being a juvenile, 322m from the sound source. The dolphins were seen feeding, breaching and slow swimming within the shutdown zone. The closest approach to the sound source was 158m. At 17:33hr the dolphins were sighted 625m from the sound source, swimming away in a northerly direction. An 'all clear' was given at 17:33hr, the captain radioed for end of seabed levelling operations for the day.

Sighting C7 occurred at 17:05hr on the 19th of August. Whilst seabed levelling, MFO sighted approximately five Common bottlenose dolphins porpoising 454m from the sound source, travelling in a southerly direction. Mitigation action was implemented and the seabed levelling operation was shut down. The closest approach was 172m. At 17:13hr the dolphins were resighted 577m from the sound source still travelling south. An "all clear" to restart operations was given at 07:13hr. At 17:13hr a 20-minute soft start was being conducted. At 17:15hr the dolphins were resighted making their way back into the shutdown zone where they proceeded to dive and slow swim 477m from the sound source. Mitigation action was implemented once again and the seabed levelling operation was shut down. At 17:28hr the dolphins were

sighted 639m from the sound source travelling in a south westerly direction. An "all clear" to restart operations was given at 17:28hr. At 17:28hr a 20-minute soft start was conducted.

Sighting T1 occurred at 10:45hr on the 20th of August. Whilst seabed levelling, MFO sighted a Loggerhead turtle resting and surface swimming 292m from the sound source travelling in a southern direction. Mitigation action was implemented and the seabed levelling operation was shut down. The turtle swam outside of the shutdown zone and proceeded to dive, 339m from the sound source. An "all clear" to restart operations was given at 10:50hr. At 10:50hr a 20-minute soft start was conducted. At 11:10hr seabed levelling recommenced.

Sighting T2 occurred at 13:05hr on the 20th of August. Whilst seabed levelling, MFO sighted a Loggerhead turtle surface, then dive 381m from the sound source. No mitigation action was required as the turtle was outside the shutdown zone.

Sighting C8 occurred at 14:15hr on the 20th of August. Whilst seabed levelling, MFO sighted two juvenile Common bottlenose dolphins swimming 226m from the sound source. Mitigation action was implemented and the seabed levelling operation was shut down. The last sighting was at 14:19hr, observer sighted one dolphin diving. 30 minutes passed with no further sightings and an 'all clear' to restart operations was given at 14:49hr. At 14:49hr a 20-minute soft start was conducted. At 15:09hr seabed levelling recommenced.

Sighting C9 occurred at 17:15hr on the 20th of August. Whilst seabed levelling, MFO sighted six Common bottlenose dolphins swimming 413m from the sound source in a northerly direction. Mitigation action was implemented and the seabed levelling operation was shut down. Dolphins were observed slow swimming in different directions within the shutdown zone and after approximately five minutes started swimming south westerly. The closest approach was 413m. At 17:22hr the dolphins were resighted 648m from the sound source outside of the shutdown zone. An "all clear" to restart operations was given at 17:25hr. At 17:25hr a 20-minute soft start was conducted. At 17:45hr seabed levelling recommenced.

Sighting C10 occurred at 10:45hr on the 21st of August. Whilst seabed levelling, MFO sighted two Common bottlenose dolphins surface swimming and resting 574m from the sound source. No mitigation was required as the sighting was outside the 500m shutdown zone. Observation was maintained and the dolphins were last sighted at 10:52hr.

Sighting C11 occurred at 14:55hr on the 21st of August. At 14:55hr whilst seabed levelling, MFO sighted three Common bottlenose dolphins, two of them being juveniles, slow swimming 310m from the sound source. Mitigation action was implemented and the seabed levelling operation was shut down. The dolphins were observed swimming north within the shutdown zone in a "zigzag" pattern, before turning around and swimming back towards south. The closest approach was 310m. The last sighting was at 15:10hr, the dolphins were sighted 640m from the sound source. An "all clear" to restart operations was given at 15:10hr. At 15:10hr a 20-minute soft start was conducted. At 15:30hr seabed levelling recommenced.

Sighting C12 occurred at 17:14hr on the 22nd of August. Whilst seabed levelling, MFO sighted two dorsal fins 714m from the sound source travelling south towards the shutdown zone. At 17:20hr MFO sighted two Common bottlenose dolphins, slow swimming 318m from the sound source. Mitigation action was implemented and the seabed levelling operation was shut down. The closest approach was 189m. There was no resighting of the dolphins after the MFO last observed them diving.

Sighting C13 occurred at 10:45hr on the 24th of August. Whilst seabed levelling, three Common bottlenose dolphins, one being a calf staying in an echelon position, were sighted 165m from the sound source. Mitigation action was implemented and the seabed levelling operation was shutdown. The closest approach was 89m from the sound source. They were observed swimming around the pilings then occasionally diving. MFO noticed the pigmentation of the calf's tail stock and underside of the fluke to be distinctly paler grey. The dolphins proceeded to swim out to dolphin no. 1 and continued in a northerly direction within the glare. The last sighting was 310m from the sound source at 11:10hr. 30 minutes passed with no further sightings and an "all clear" to restart operations was given at 11:40hr. At 11:40hr a 20-minute soft start was conducted. At 12:00hr seabed levelling recommenced.

Sighting C14 occurred at 14:18hr on the 24th of August. Whilst seabed levelling, three Common bottlenose dolphins were sighted 392m from the sound source. Mitigation action was implemented and the seabed levelling operation was shutdown. The dolphins were observed slow swimming in a northerly direction. The closest approach was 392m. At

14:25hr the dolphins were sighted 614m from the sound source. An “all clear” to restart operations was given at 14:25hr. At 14:25hr a 20-minute soft start was conducted. At 14:45hr seabed levelling recommenced.

Sighting SH1 occurred at 15:00hr on the 24th of August. Whilst seabed levelling, an unidentifiable shark that was approximately 1.5m in length with a light grey colouring was observed resting 20m away, alongside the western pilings for approximately an hour before moving away.

Sighting C15 occurred at 15:15hr on the 24th of August. Whilst seabed levelling, two Common bottlenose dolphins were sighted 312m from the sound source. Mitigation action was implemented and the seabed levelling operation was shutdown. The dolphins were observed slow swimming in a south westerly direction. The closest approach was 312m. At 15:25hr the dolphins were sighted 891m from the sound source. An “all clear” to restart operations was given at 15:25hr. At 15:25hr a 20-minute soft start was conducted. At 15:45hr seabed levelling recommenced. At 15:39hr the dolphins were sighted again 890m from the sound source and once more at 15:51hr approximately 1km from the sound source travelling southwest.

Sighting C16 occurred at 16:50hr on the 24th of August. Whilst seabed levelling, three Common bottlenose dolphins were sighted 417m from the sound source. Mitigation action was implemented and the seabed levelling operation was shutdown. The dolphins were observed fast swimming in a south easterly direction. The closest approach was 409m. At 17:00hr the dolphins were sighted 631m from the sound source. An “all clear” to restart operations was given at 17:00hr. At 17:00hr a 20-minute soft start was conducted. At 17:20hr seabed levelling recommenced.

Sighting C17 occurred at 07:20hr on the 25th of August. Whilst seabed levelling, six Common bottlenose dolphins were sighted 271m from the sound source. Mitigation action was implemented and the seabed levelling operation was shutdown. The dolphins were observed slow swimming in a southerly direction through the western pilings and out towards the yellow buoy, before continuing south. The closest approach was 271m. At 07:35hr the dolphins were sighted 615m from the sound source. An “all clear” to restart operations was given at 07:35hr. At 07:35hr a 20-minute soft start was conducted. At 07:55hr seabed levelling recommenced.

Sighting SH2 occurred at 08:57hr on the 25th of August. Whilst seabed levelling, a 1.5m unidentifiable shark, possibly a Bull shark was observed 90m away from the sound source swimming alongside the northern pilings before moving away at 09:00hr.

Sighting T3 occurred at 09:55hr on the 25th of August. Whilst seabed levelling a Loggerhead turtle was sighted 111m from the sound source. Mitigation action was implemented and the seabed levelling operation was shutdown. The turtle was sighted at the surface for less than one minute before diving. The closest approach and last sighting was 111m from the sound source at 09:55hr. 30 minutes passed with no further sightings and an “all clear” to restart operations was given at 10:25hr. At 10:29hr a 20-minute soft start was conducted. At 10:49hr seabed levelling recommenced.

Sighting C18 occurred at 11:43hr on the 25th of August. Whilst seabed levelling MFO, sighted six Common bottlenose dolphins slow swimming and diving 890m from the sound source. MFO observed as the dolphins travelled in a southerly direction towards the shutdown zone. At 12:00hr the six Common bottlenose dolphins were sighted 493m from the sound source continuing to travelling through the pilings south. Mitigation action was implemented and the seabed levelling operation was shutdown. The closest approach was 260m. At 12:11hr the dolphins were sighted 596m from the sound source. An “all clear” to restart operations was given at 12:11hr. At 12:11hr a 20-minute soft start was conducted. At 12:31hr seabed levelling recommenced.

Sighting SH3 occurred at 14:46hr on the 25th of August. Whilst seabed levelling a 1.5m unidentifiable shark, possibly a Bull shark was observed 93m, at closest approach, away from the sound source. Swimming on the northside of the ship loader. The last sighting was at 14:46hr.

Sighting C19 occurred at 15:35hr on the 25th of August. Whilst seabed levelling, MFO onboard EDI radioed MFO ship loader that they had sighted dolphins within the mitigation zone and shutdown. MFO ship loader sighted seven Common bottlenose dolphins 243m from the sound source slow swimming north. The closest approach was 280m. At 15:40hr the dolphins were sighted 520m from the sound source still travelling north. An “all clear” to restart operations was given at 15:41hr. At 15:41hr a 20-minute soft start was conducted. At 16:01hr seabed levelling recommenced.

Sighting SH4 occurred at 15:41hr on the 25th of August. Whilst on soft start a 1.5m Tiger shark was observed 137m, at closest approach, away from the sound source. Swimming on the northside of the ship loader. The last sighting was at 15:41hr.

Sighting C20 occurred at 07:30hr on the 26th of August. Whilst seabed levelling, three Common bottlenose dolphins were sighted within the 3km observation zone, slow swimming in a northerly direction, 584m from the sound source. No mitigation action was required as the dolphins were not within the shutdown zone. Seabed levelling operation continued. The closest approach was 578m. At 07:37hr the dolphins were last sighted travelling north 602m from the sound source.

Sighting T4 occurred at 09:30hr on the 26th of August. Whilst seabed levelling, a Green turtle was sighted 91m from the sound source, surfacing for a few minutes, before diving. Mitigation action was implemented and the seabed levelling operation was shutdown. At 09:54hr the turtle resurfaced 111m from the sound source, 20m northwest from the previous sighting position, momentarily before diving again. The last sighting was 111m from the sound source at 09:54hr. 30 minutes passed with no further sightings and an "all clear" to restart operations was given at 10:24hr. At 10:24hr a 20-minute soft start was conducted. At 10:44hr seabed levelling recommenced. At 11:14hr the Green turtle was resighted surfacing 115m from the sound source, just slightly northwest from the last time the turtle was sighted. The turtle was observed surfacing, before diving out of sight. Mitigation action was implemented and the seabed levelling operation was shutdown. At 11:39hr the turtle was sighted again, surfacing momentarily then diving once again. EDI proceeded to travelled southeast away from the turtle sighting whilst maintaining a shutdown of operations. At 12:01hr whilst still shutdown, the turtle was sighted once more, now 312m from the sound source, surfacing and then diving once again. During this sighting, dolphins were still inside the shutdown zone. At 13:10hr whilst seabed levelling the Green turtle was resighted once more surfacing then diving, 334m from the sound source. No mitigation action was required as the turtle was outside the shutdown zone.

Sighting C21 occurred at 11:57hr on the 26th of August. Whilst still shutdown, four Common bottlenose dolphins were sighted 190m from the sound source, swimming in a southerly direction. One was observed spinning whilst passing through the pilings. The closest approach was 180m. The dolphins continued travelling in a southerly direction and at 12:10hr and were sighted leaving the shutdown zone 539m from the sound source. An "all clear" to restart operations was given at 12:10hr. At 12:10hr a 20-minute soft start was conducted. At 12:30hr seabed levelling recommenced.

Sighting C22 occurred at 16:55hr on the 26th of August. Whilst seabed levelling, one Common bottlenose dolphin was sighted porpoising in a southerly direction 195m from the sound source. Mitigation action was implemented and the seabed levelling operation was shutdown. At 17:00hr the dolphin was sighted 544m from the sound source continuing to travel south. An "all clear" to restart operations was given at 17:00hr. At 17:00hr a 20-minute soft start was conducted. At 12:20hr seabed levelling recommenced.

Sighting T5 occurred at 17:00hr on the 26th of August. Whilst on soft start, a Green turtle was sighted 396m from the sound source surfacing then diving. No mitigation action was required as the turtle was not within the shutdown zone.

MARINE FAUNA SIGHTINGS DURING THE DREDGING OF THE CHANNEL ENTRANCE AND DREDGE DISPOSAL OPERATIONAL AREA AS RECORDED BY MFO ONBOARD PELAGIC

Eighteen marine megafauna sightings occurred within the dredging of the Channel Entrance and Dredge Disposal Operational Area during the project period of the 1st September 2022 to the 6th September 2022. Species identification was with reference to both observer experience and the Field Guide to Marine Mammals (Shirihai, 2006).

Sighting C1 occurred at 11:03hr on the 1st of September. Whilst in transit, MFO observed four Common bottlenose dolphins, no interaction log was necessary as the sighting was outside of the observational zone.

Sighting T1 occurred at 13:15hr on the 2nd of September. Whilst in transit to the operational area, MFO sighted one green turtle. The turtle was sighted at the surface of the water. No interaction log was necessary as the sighting was outside of the observational area.

Sighting C2 occurred at 09:34hr on the 3rd of September. Whilst dredging MFO sighted three Common bottlenose dolphins 700m from the sound source. The dolphins were observed slow swimming and diving in a south easterly direction. The closest approach was 700m. No mitigation action was required as the dolphins were not within shutdown zone.

Sighting T2 occurred at 15:43hr on the 3rd of September. Whilst dredging MFO sighted a Loggerhead turtle 500m from the sound source. The turtle surfaced momentarily before diving. The closest approach was 500m. No mitigation action was required as the dolphins were not within shutdown zone.

Sighting T3 occurred at 07:04hr on the 4th of September. Whilst in transit to the operational area, MFO sighted one green turtle. The turtle was sighted at the surface of the water, 10m from the boat. No interaction log was necessary as the sighting was outside of the observational area.

Sighting C3 occurred at 07:31hr on the 4th of September. Whilst in transit to the operational area, MFO sighted two common bottlenose dolphins. The dolphins were sighted swimming, 80m from the boat. No interaction log was necessary as the sighting was outside of the observational area.

Sighting C4 occurred at 08:37hr on the 4th of September. Whilst dredging MFO sighted two Common bottlenose dolphins 800m from the sound source. The dolphins were observed slow swimming and diving. The closest approach was 800m. No mitigation action was required as the dolphins were not within shutdown zone.

Sighting C5 occurred at 12:11hr on the 4th of September. Whilst dredging MFO sighted three Common bottlenose dolphins 550m from the sound source. The dolphins were observed slow swimming and diving. The closest approach was 550m. No mitigation action was required as the dolphins were not within shutdown zone.

Sighting T4 occurred at 07:27hr on the 5th of September. Whilst in transit to the operational area, MFO sighted one green turtle. The turtle was sighted at the surface of the water, 15m from the boat. No interaction log was necessary as the sighting was outside of the observational area.

Sighting T5 occurred at 08:00hr on the 5th of September. Whilst in transit to the operational area, MFO sighted one green turtle. The turtle was sighted at the surface of the water, 30m from the boat. No interaction log was necessary as the sighting was outside of the observational area.

Sighting C6 occurred at 08:33hr on the 5th of September. Whilst transiting to the disposal site, MFO sighted two Humpback whales 1.5km from the sound source. The whales were observed pectoral and fluke slapping and breaching, travelling in a south westerly direction. The closest approach was 1.5km. No mitigation action was required as the whales were not within shutdown zone.

Sighting C7 occurred at 10:32hr on the 5th of September. Whilst transiting to the disposal site, MFO sighted two Humpback whales 1.65km from the sound source. The whales were observed pectoral and fluke slapping and breaching, travelling in a north westerly direction. The closest approach was 1.65km. No mitigation action was required as the whales were not within shutdown zone.

Sighting C8 occurred at 11:06hr on the 5th of September. Whilst transiting from the disposal site, MFO sighted one Humpback whale 1.25km from the sound source. The whale was observed travelling in a northerly direction, occasionally spyhopping. The closest approach was 1.25km. No mitigation action was required as the sound source was not active.

Sighting C9 occurred at 12:53hr on the 5th of September. Whilst transiting to the disposal site, MFO sighted one Humpback whale 700m from the sound source. A dorsal fin was sighted before the whale was observed fluking and not resurfacing. MFO radioed Modi R with information of sighting. Modi R delayed dumping operations for 30 minutes due to no resighting of whale. The closest approach was 700m.

Sighting C10 occurred at 08:36hr on the 6th of September. Whilst dredging, MFO sighted one Humpback whale 2km from the sound source. The whale was slow swimming, travelling in a south westerly direction. The closest approach was 2km. No mitigation action was required as the whales were not within shutdown zone.

Sighting C11 occurred at 08:55hr on the 6th of September. Whilst transiting to the disposal site, MFO sighted one Common bottlenose dolphin 550m from the sound source. The dolphin was observed riding the bow of Pelagic before diving. The closest approach was 550m. No mitigation action was required as the dolphin was not within shutdown zone.

Sighting C12 occurred at 09:02hr on the 6th of September. Whilst at the disposal site, MFO sighted two Humpback whales 300m from the sound source. Blows and dorsal fins were observed travelling in a westerly direction. MFO radioed Modi R with information of the sighting and Modi R waited 30 minutes from their last sighting of the whales before recommencing operations. The closest approach was 300m.

Sighting C13 occurred at 11:50hr on the 6th of September. Whilst dredging, MFO sighted three Common bottlenose dolphins 750m from the sound source. The dolphins were sighted slow swimming and diving in a south easterly direction. The closest approach was 750m. No mitigation action was required as the dolphins were not within shutdown zone.

Please refer to Table 2 as well as Appendices 2, 3 and 4 for further details on visual fauna sightings during the seabed levelling of the berth pocket.

Please refer to Table 2.1 as well as Appendices 2.1 and 3.1 for further details on visual fauna sightings during the dredging of the channel entrance and dredge disposal site.

Table 2: Visual Sighting Data during the Seabed Levelling of the Berth Pocket

Detection Number for Berth Pocket	Common Name	Species	Total Number	Date	Time	Source Activity at Initial Detection	Closest Approach to Source (m)	Mitigation Action	Duration of Mitigation Action (HH:MM)
C1	Common Bottlenose dolphin	*Tursiops truncatus*	2	16/08/22	16:05	Seabed levelling	188m	Shutdown	00:32
C2	Unidentifiable dolphins	*N/A*	2	17/08/22	07:24	Seabed levelling	149m	Shutdown	00:36
S1	Dugong	*Dugong dugon*	1	17/08/22	07:36	Shutdown	80m	Maintain Shutdown	00:30
C3	Unidentifiable dolphins	*N/A*	3	17/08/22	08:00	Shutdown	572m	None	00:00
C4	Common bottlenose dolphin	*Tursiops truncatus*	4	18/08/22	07:28	Seabed levelling	203m	Shutdown	00:06
C5	Common bottlenose dolphin	*Tursiops truncatus*	5	18/08/22	15:30	Seabed levelling	122m	Shutdown	00:10
C6	Common bottlenose dolphin	*Tursiops truncatus*	8	18/08/22	16:18	Seabed levelling	158m	Shutdown	01:15
C7	Common bottlenose dolphin	*Tursiops truncatus*	5	19/08/22	17:05	Seabed levelling	172m	Shutdown	00:22
T1	Loggerhead turtle	*Caretta caretta*	1	20/08/22	10:45	Seabed levelling	292m	Shutdown	00:05
T2	Loggerhead turtle	*Caretta caretta*	1	20/08/22	13:05	Seabed levelling	381m	None	00:00
C8	Common bottlenose dolphin	*Tursiops truncatus*	2	20/08/22	14:15	Seabed levelling	226m	Shutdown	00:34
C9	Common bottlenose dolphin	*Tursiops truncatus*	6	20/08/22	17:15	Seabed levelling	413m	Shutdown	00:10
C10	Common bottlenose dolphin	*Tursiops truncatus*	2	21/08/22	10:45	Seabed levelling	574m	None	00:00

C11	Common bottlenose dolphin	*Tursiops truncatus*	3	21/08/22	14:55	Seabed levelling	310m	Shutdown	00:15
C12	Common bottlenose dolphin	*Tursiops truncatus*	2	22/08/22	17:20	Seabed levelling	189m	Shutdown	00:20
C13	Common bottlenose dolphin	*Tursiops truncatus*	3	24/08/22	10:45	Seabed levelling	89m	Shutdown	00:55
C14	Common bottlenose dolphin	*Tursiops truncatus*	3	24/08/22	14:18	Seabed levelling	312m	Shutdown	00:07
SH1	Shark sp.	*N/A*	1	24/08/22	15:00	Seabed levelling	20m	None	00:00
C15	Common bottlenose dolphin	*Tursiops truncatus*	2	24/08/22	15:15	Seabed levelling	390m	Shutdown	00:10
C16	Common bottlenose dolphin	*Tursiops truncatus*	3	24/08/22	16:50	Seabed levelling	417m	Shutdown	00:10
C17	Common bottlenose dolphin	*Tursiops truncatus*	6	25/08/22	07:20	Seabed levelling	271m	Shutdown	00:15
SH2	Shark sp. possible Bull shark	*N/A*	1	25/08/22	08:57	Seabed levelling	90m	None	00:00
T3	Loggerhead turtle	*Caretta caretta*	1	25/08/22	09:55	Seabed levelling	111m	Shutdown	00:30
C18	Common bottlenose dolphin	*Tursiops truncatus*	6	25/08/22	12:00	Seabed levelling	260m	Shutdown	00:11
SH3	Shark sp. possible Bull shark	*N/A*	1	25/08/22	14:46	Seabed levelling	93m	None	00:00
C19	Common bottlenose dolphin	*Tursiops truncatus*	7	25/08/22	15:35	Seabed levelling	280m	Shutdown	00:06
SH4	Tiger shark	*N/A*	1	25/08/22	15:41	Seabed levelling	137m	None	00:00
C20	Common bottlenose dolphin	*Tursiops truncatus*	3	26/08/22	07:31	Seabed levelling	584m	None	00:00
T4	Green turtle	*Chelonia mydas*	1	26/08/22	09:30	Seabed levelling	91m	Shutdown	00:54
T4	Green turtle	*Chelonia mydas*	1	26/08/22	11:14	Seabed levelling	115m	Shutdown	00:47
C21	Common bottlenose dolphin	*Tursiops truncatus*	4	26/08/22	11:57	Seabed levelling	180m	Extend shutdown	00:09
C22	Common bottlenose dolphin	*Tursiops truncatus*	1	26/08/22	16:55	Seabed levelling	195m	Shutdown	00:05
T5	Green turtle	*Chelonia mydas*	1	26/08/22	17:00	Soft start	396m	None	00:00

Table 2.1: Visual Sighting Data during the Dredging of the Channel Entrance and Dredge Disposal Site

Detection Number For Channel Entrance	Common Name	Species	Total Number	Date	Time	Source Activity at Initial Detection	Closest Approach to Source (m)	Mitigation Action	Duration of Mitigation Action (HH:MM)
C1	Common bottlenose dolphin	*Tursiops truncatus*	4	01/09/22	11:03	N/A Vessel in transit	N/A	None	00:00
T1	Green turtle	*Chelonia mydas*	1	02/09/22	13:15	N/A Vessel in transit	N/A	N/A	00:00
C2	Common bottlenose dolphin	*Tursiops truncatus*	3	03/09/22	09:34	Dredging	700m	None	00:00

T2	Loggerhead turtle	*Caretta caretta*	1	03/09/22	15:43	Dredging	500m	None	00:00
T3	Green turtle	*Chelonia mydas*	1	04/09/22	07:04	N/A Vessel in transit	N/A	N/A	00:00
C3	Common bottlenose dolphin	*Tursiops truncatus*	2	04/09/22	07:31	N/A Vessel in transit	N/A	N/A	00:00
C4	Common bottlenose dolphin	*Tursiops truncatus*	2	04/09/22	09:34	Dredging	800m	None	00:00
C5	Common bottlenose dolphin	*Tursiops truncatus*	3	04/09/22	15:43	Dredging	550m	None	00:00
T4	Green turtle	*Chelonia mydas*	1	05/09/22	07:27	N/A Vessel in transit	N/A	N/A	00:00
T5	Green turtle	*Chelonia mydas*	1	05/09/22	08:00	N/A Vessel in transit	N/A	N/A	00:00
C6	Humpback whale	*Megaptera novaeangliae*	2	05/09/22	08:33	Transit to dumping grounds	1.5km	None	00:00
C7	Humpback whale	*Megaptera novaeangliae*	2	05/09/22	10:32	Transit to dumping grounds	1.2km	None	00:00
C8	Humpback whale	*Megaptera novaeangliae*	1	05/09/22	11:06	Transit from dumping grounds	1.25km	None	00:00
C9	Humpback whale	*Megaptera novaeangliae*	1	05/09/22	12:53	Transit to dumping grounds	700m	Delay in dumping operations	00:30
C10	Humpback whale	*Megaptera novaeangliae*	1	06/09/22	08:36	Dredging	2km	None	00:00
C11	Common bottlenose dolphin	*Tursiops truncatus*	1	06/09/22	08:55	Transit to dumping grounds	550m	None	00:00
C12	Humpback whale	*Megaptera novaeangliae*	2	06/09/22	09:02	Dumping grounds	300m	Delay in dumping operations	00:30
C13	Common bottlenose dolphin	*Tursiops truncatus*	3	06/09/22	11:50	Dredging	300m	None	00:00

MITIGATION ACTION DURING SEABED LEVELLING OF THE BERTH POCKET PROJECT PERIOD AS RECORDED BY MFO ON THE SHIP LOADER

There were twenty-five mitigation actions during the duration of seabed levelling of the berth pocket whilst MFOs observed:

Sighting C1 occurred at 16:05hr on the 16th of August. Whilst seabed levelling two Common Bottlenose dolphins, one being a juvenile, were sighted 491m from the sound source travelling in a southerly direction, then changing direction and travelling north. Surface activity followed by dorsal fins was sighted. Mitigation action was implemented and the seabed levelling operation was shut down. The closest approach to the sound source was 188m. The last sighting occurred at 16:07hr. 30 minutes passed with no further sightings and an 'all clear' to restart operations was given at 16:37hr. At 16:37hr a 20-minute soft start was conducted. At 16:57hr seabed levelling recommenced.

Sighting C2 occurred at 07:24hr on the 17th of August. Whilst seabed levelling, MFO sighted two unidentifiable dolphins dorsal fins 149m from the sound source, travelling in a southerly direction. Mitigation action was implemented and the seabed levelling operation was shut down. The closest approach was 149m.

Sighting S1 occurred at 07:36hr on the 17th of August. Whilst shutdown a dugong was sighted surfacing, taking a breath and diving 80m from the sound source. The closest approach was 80m. 30 minutes passed with no further sightings and an "all clear" to restart operations was given at 08:06hr. At 08:06hr a 20-minute soft start was conducted. At 08:26hr seabed levelling recommenced.

Sighting C4 occurred at 07:28hr on the 18th of August. Whilst seabed levelling, MFO sighted four Common bottlenose dolphins dorsal fins 203m from the sound source, travelling in a northerly direction. Mitigation action was implemented and the seabed levelling operation was shut down. The closest approach was 203m. At 07:34hr the dolphins were resighted 750m from the sound source still travelling north. An “all clear” to restart operations was given at 07:34hr. At 07:34hr a 20-minute soft start was conducted. At 07:54hr seabed levelling recommenced.

Sighting C5 occurred at 15:30hr on the 18th of August. Whilst seabed levelling, MFO five Common bottlenose dolphins were sighted travelling south 512m away from the sound source, about to enter the 500m shutdown zone. Mitigation action was implemented and the seabed levelling operations were shutdown. At 15:32hr the dolphins were sighted 346m from the sound source and at closest approach were 122m. At 15:40hr the dolphins were sighted 512m from the sound source continuing to travel south outside the shutdown zone. An 'all clear' to restart operations was given at 15:40hr. At 15:40hr a 20-minute soft start was conducted. At 16:00hr seabed levelling recommenced.

Sighting C6 occurred at 16:18hr on the 18th of August. MFO onboard EDI radioed that they had sighted dolphins 200m south east of the sound source. MFO ship loader sighted approximately eight dolphins, one being a juvenile, 322m from the sound source. The dolphins were seen feeding, breaching and slow swimming within the shutdown zone. The closest approach to the sound source was 158m. At 17:33hr the dolphins were sighted 625m from the sound source, swimming away in a northerly direction. An 'all clear' was given at 17:33hr, the captain radioed for end of seabed levelling operations for the day.

Sighting C7 occurred at 17:05hr on the 19th of August. Whilst seabed levelling, MFO sighted approximately five Common bottlenose dolphins porpoising 454m from the sound source, travelling in a southerly direction. Mitigation action was implemented and the seabed levelling operation was shut down. The closest approach was 172m. At 17:13hr the dolphins were resighted 577m from the sound source still travelling south. An “all clear” to restart operations was given at 07:13hr. At 17:13hr a 20-minute soft start was being conducted. At 17:15hr the dolphins were resighted making their way back into the shutdown zone where they proceeded to dive and slow swim 477m from the sound source. Mitigation action was implemented once again and the seabed levelling operation was shut down. At 17:28hr the dolphins were sighted 639m from the sound source travelling in a south westerly direction. An “all clear” to restart operations was given at 17:28hr. At 17:28hr a 20-minute soft start was conducted.

Sighting T1 occurred at 10:45hr on the 20th of August. Whilst seabed levelling, MFO sighted a Loggerhead turtle resting and surface swimming 292m from the sound source travelling in a southern direction. Mitigation action was implemented and the seabed levelling operation was shut down. The turtle swam outside of the shutdown zone and proceeded to dive, 339m from the sound source. An “all clear” to restart operations was given at 10:50hr. At 10:50hr a 20-minute soft start was conducted. At 11:10hr seabed levelling recommenced.

Sighting C8 occurred at 14:15hr on the 20th of August. Whilst seabed levelling, MFO sighted two juvenile Common bottlenose dolphins swimming 226m from the sound source. Mitigation action was implemented and the seabed levelling operation was shut down. The last sighting was at 14:19hr, observer sighted one dolphin diving. 30 minutes passed with no further sightings and an ‘all clear’ to restart operations was given at 14:49hr. At 14:49hr a 20-minute soft start was conducted. At 15:09hr seabed levelling recommenced.

Sighting C9 occurred at 17:15hr on the 20th of August. Whilst seabed levelling, MFO sighted six Common bottlenose dolphins swimming 413m from the sound source in a northerly direction. Mitigation action was implemented and the seabed levelling operation was shut down. Dolphins were observed slow swimming in different directions within the shutdown zone and after approximately five minutes started swimming south westerly. The closest approach was 413m. At 17:22hr the dolphins were resighted 648m from the sound source outside of the shutdown zone. An “all clear” to restart operations was given at 17:25hr. At 17:25hr a 20-minute soft start was conducted. At 17:45hr seabed levelling recommenced.

Sighting C11 occurred at 14:55hr on the 21st of August. At 14:55hr whilst seabed levelling, MFO sighted three Common bottlenose dolphins, two of them being juveniles, slow swimming 310m from the sound source. Mitigation action was implemented and the seabed levelling operation was shut down. The dolphins were observed swimming north within the shutdown zone in a “zigzag” pattern, before turning around and swimming back towards south. The closest approach was 310m. The last sighting was at 15:10hr, the dolphins were sighted 640m from the sound source. An “all

clear" to restart operations was given at 15:10hr. At 15:10hr a 20-minute soft start was conducted. At 15:30hr seabed levelling recommenced.

Sighting C12 occurred at 17:14hr on the 22nd of August. Whilst seabed levelling, MFO sighted two dorsal fins 714m from the sound source travelling south towards the shutdown zone. At 17:20hr MFO sighted two Common bottlenose dolphins, slow swimming 318m from the sound source. Mitigation action was implemented and the seabed levelling operation was shut down. The closest approach was 189m. There was no resighting of the dolphins after the MFO last observed them diving.

Sighting C13 occurred at 10:45hr on the 24th of August. Whilst seabed levelling, three Common bottlenose dolphins, one being a calf staying in an echelon position, were sighted 165m from the sound source. Mitigation action was implemented and the seabed levelling operation was shutdown. The closest approach was 89m from the sound source. They were observed swimming around the pilings then occasionally diving. MFO noticed the pigmentation of the calf's tail stock and underside of the fluke to be distinctly paler grey. The dolphins proceeded to swim out to dolphin no. 1 and continued in a northerly direction within the glare. The last sighting was 310m from the sound source at 11:10hr. 30 minutes passed with no further sightings and an "all clear" to restart operations was given at 11:40hr. At 11:40hr a 20-minute soft start was conducted. At 12:00hr seabed levelling recommenced.

Sighting C14 occurred at 14:18hr on the 24th of August. Whilst seabed levelling, three Common bottlenose dolphins were sighted 392m from the sound source. Mitigation action was implemented and the seabed levelling operation was shutdown. The dolphins were observed slow swimming in a northerly direction. The closest approach was 392m. At 14:25hr the dolphins were sighted 614m from the sound source. An "all clear" to restart operations was given at 14:25hr. At 14:25hr a 20-minute soft start was conducted. At 14:45hr seabed levelling recommenced.

Sighting C15 occurred at 15:15hr on the 24th of August. Whilst seabed levelling, two Common bottlenose dolphins were sighted 312m from the sound source. Mitigation action was implemented and the seabed levelling operation was shutdown. The dolphins were observed slow swimming in a south westerly direction. The closest approach was 312m. At 15:25hr the dolphins were sighted 891m from the sound source. An "all clear" to restart operations was given at 15:25hr. At 15:25hr a 20-minute soft start was conducted. At 15:45hr seabed levelling recommenced. At 15:39hr the dolphins were sighted again 890m from the sound source and once more at 15:51hr approximately 1km from the sound source travelling southwest.

Sighting C16 occurred at 16:50hr on the 24th of August. Whilst seabed levelling, three Common bottlenose dolphins were sighted 417m from the sound source. Mitigation action was implemented and the seabed levelling operation was shutdown. The dolphins were observed fast swimming in a south easterly direction. The closest approach was 409m. At 17:00hr the dolphins were sighted 631m from the sound source. An "all clear" to restart operations was given at 17:00hr. At 17:00hr a 20-minute soft start was conducted. At 17:20hr seabed levelling recommenced.

Sighting C17 occurred at 07:20hr on the 25th of August. Whilst seabed levelling, six Common bottlenose dolphins were sighted 271m from the sound source. Mitigation action was implemented and the seabed levelling operation was shutdown. The dolphins were observed slow swimming in a southerly direction through the western pilings and out towards the yellow buoy, before continuing south. The closest approach was 271m. At 07:35hr the dolphins were sighted 615m from the sound source. An "all clear" to restart operations was given at 07:35hr. At 07:35hr a 20-minute soft start was conducted. At 07:55hr seabed levelling recommenced.

Sighting T3 occurred at 09:55hr on the 25th of August. Whilst seabed levelling a Loggerhead turtle was sighted 111m from the sound source. Mitigation action was implemented and the seabed levelling operation was shutdown. The turtle was sighted at the surface for less than one minute before diving. The closest approach and last sighting was 111m from the sound source at 09:55hr. 30 minutes passed with no further sightings and an "all clear" to restart operations was given at 10:25hr. At 10:29hr a 20-minute soft start was conducted. At 10:49hr seabed levelling recommenced.

Sighting C18 occurred at 11:43hr on the 25th of August. Whilst seabed levelling MFO, sighted six Common bottlenose dolphins slow swimming and diving 890m from the sound source. MFO observed as the dolphins travelled in a southerly direction towards the shutdown zone. At 12:00hr the six Common bottlenose dolphins were sighted 493m from the sound source continuing to travelling through the pilings south. Mitigation action was implemented and the seabed levelling operation was shutdown. The closest approach was 260m. At 12:11hr the dolphins were sighted 596m from

the sound source. An "all clear" to restart operations was given at 12:11hr. At 12:11hr a 20-minute soft start was conducted. At 12:31hr seabed levelling recommenced.

Sighting C19 occurred at 15:35hr on the 25th of August. Whilst seabed levelling, MFO onboard EDI radioed MFO ship loader that they had sighted dolphins within the mitigation zone and shutdown. MFO ship loader sighted seven Common bottlenose dolphins 243m from the sound source slow swimming north. The closest approach was 280m. At 15:40hr the dolphins were sighted 520m from the sound source still travelling north. An "all clear" to restart operations was given at 15:41hr. At 15:41hr a 20-minute soft start was conducted. At 16:01hr seabed levelling recommenced.

Sighting T4 occurred at 09:30hr on the 26th of August. Whilst seabed levelling, a Green turtle was sighted 91m from the sound source, surfacing for a few minutes, before diving. Mitigation action was implemented and the seabed levelling operation was shutdown. At 09:54hr the turtle resurfaced 111m from the sound source, 20m northwest from the previous sighting position, momentarily before diving again. The last sighting was 111m from the sound source at 09:54hr. 30 minutes passed with no further sightings and an "all clear" to restart operations was given at 10:24hr. At 10:24hr a 20-minute soft start was conducted. At 10:44hr seabed levelling recommenced. At 11:14hr the Green turtle was resighted surfacing 115m from the sound source, just slightly northwest from the last time the turtle was sighted. The turtle was observed surfacing, before diving out of sight. Mitigation action was implemented and the seabed levelling operation was shutdown. At 11:39hr the turtle was sighted again, surfacing momentarily then diving once again. EDI proceeded to travelled southeast away from the turtle sighting whilst maintaining a shutdown of operations. At 12:01hr whilst still shutdown, the turtle was sighted once more, now 312m from the sound source, surfacing and then diving once again. During this sighting, dolphins were still inside the shutdown zone. At 13:10hr whilst seabed levelling the Green turtle was resighted once more surfacing then diving, 334m from the sound source. No mitigation action was required as the turtle was outside the shutdown zone.

Sighting C21 occurred at 11:57hr on the 26th of August. Whilst still shutdown, four Common bottlenose dolphins were sighted 190m from the sound source, swimming in a southerly direction. One was observed spinning whilst passing through the pilings. The closest approach was 180m. The dolphins continued travelling in a southerly direction and at 12:10hr and were sighted leaving the shutdown zone 539m from the sound source. An "all clear" to restart operations was given at 12:10hr. At 12:10hr a 20-minute soft start was conducted. At 12:30hr seabed levelling recommenced.

Sighting C22 occurred at 16:55hr on the 26th of August. Whilst seabed levelling, one Common bottlenose dolphin was sighted porpoising in a southerly direction 195m from the sound source. Mitigation action was implemented and the seabed levelling operation was shutdown. At 17:00hr the dolphin was sighted 544m from the sound source continuing to travel south. An "all clear" to restart operations was given at 17:00hr. At 17:00hr a 20-minute soft start was conducted. At 12:20hr seabed levelling recommenced.

MITIGATION ACTION DURING DREDGING OF THE CHANNEL ENTRANCE AS RECORDED BY MFO ONBOARD PELAGIC

There were two mitigation actions during the duration of dredging of the channel entrance whilst MFOs observed:

Sighting C9 occurred at 12:53hr on the 5th of September. Whilst transiting to the disposal site, MFO sighted one Humpback whale 700m from the sound source. A dorsal fin was sighted before the whale was observed fluking and not resurfacing. MFO radioed Modi R with information of sighting. Modi R delayed dumping operations for 30 minutes due to no resighting of whale. The closest approach was 700m.

Sighting C12 occurred at 09:02hr on the 6th of September. Whilst at the disposal site, MFO sighted two Humpback whales 300m from the sound source. Blows and dorsal fins were observed travelling in a westerly direction. MFO radioed Modi R with information of the sighting and Modi R waited 30 minutes from their last sighting of the whales before recommencing operations. The closest approach was 300m.

SUMMARY OF MFO OBSERVATIONS DURING THE SEABED LEVELLING OF THE BERTH POCKET AND SEABED LEVELLING AND DREDGING OF THE ENTRANCE OF THE CHANNEL ENTRANCE

During the period of 1st – 6th of September 2022, two Marine Fauna Observers (MFOs) were located on the vessel Pelagic during the seabed levelling and dredging of the channel entrance, when possible, to conduct visual observations and assist with mitigation procedures. During the period of 7th – 12th of September MFO Elizabeth Dean was on call in Useless Loop as mobilisation difficulties to and from Useless Loop hampered the ability to observe from the entrance to the channel and MFO Elizabeth Dean could not conduct visual observations but maintained communication with crew members of BMT and Shark Bay Resources.

During the period of 15th – 26th of August 2022, seabed levelling vessel EDI conducted seabed levelling operations of the berth pocket. During the period of 2nd – 12th of September 2022, seabed levelling vessel EDI conducted seabed levelling operations of the channel entrance. On the 9th of September 2022, seabed levelling vessel EDI did not conduct operations and held at anchorage for superintendent directive. Onboard seabed levelling vessel EDI, one BMT MFO trained crew member conducted visual observations and mitigation procedures during operational hours as referred to in the BMT "Marine Fauna Observation Log Assessment" reports.

During the period of 1st – 7th September 2022, dredging vessel Modi R conducted dredging operations. Onboard dredging vessel Modi R, one BMT MFO trained crew member conducted visual observations and mitigation procedures during operational hours as referred to in the BMT "Marine Fauna Observation Log Assessment" reports.

MFO ONBOARD EDI MARINE FAUNA SIGHTINGS AND MITIGATION ACTION AS RECORDED BY THE MFO ONBOARD EDI

This data is taken from the seabed levelling vessel EDI "BMT Marine Fauna Observation Log Assessment" reports and a direct transcript of marine fauna sightings and mitigation action. "Detection Number for Berth Pocket as Recorded by Ship Loader MFO" column has been included to correlate sighting information between both MFOs data.

Table 3: Direct Transcript of Visual Sighting Data from EDIs BMT "Marine Fauna Observation Log Assessment" reports during the Seabed Levelling of the Berth Pocket

Detection Number for Berth Pocket as Recorded by Ship Loader MFO for Correlation Reference	Common Name	Species	Total Number	Date	Time	Source Activity at Initial Detection and comments	Closest Approach to Source (m)	Mitigation Action	Duration of Mitigation Action (HH:MM)
C1	Dolphin	*N/A*	N/A	16/08/22	16:05	Sweeping "Stopped as MFO on ship loader spotted dolphins"	N/A	Shutdown	00:35
C2 (S1 was also sighted during this time)	Dolphin	*N/A*	N/A	17/08/22	07:25	Sweeping "MFO ship loader spotted dolphins, shutdown"	N/A	Shutdown	00:45
C4	Dolphin	*N/A*	N/A	18/08/22	07:30	Sweeping "MFO ship loader spotted dolphins – stopped"	N/A	Shutdown	00:05
C5	Dolphin	*N/A*	N/A	18/08/22	15:30	Sweeping "MFO ship loader spotted dolphins – shutdown"	N/A	Shutdown	00:10

C6	Dolphin	*N/A*	N/A	18/08/22	16:18	Sweeping "Spotted dolphins swimming south"	200m	Shutdown	01:17
C7	Dolphin	*N/A*	N/A	19/08/22	17:05	Sweeping "MFO ship loader spotted dolphins" "Dolphins left shutdown zone" Dolphins re-entered shutdown zone" "MFO ship loader said all clear – restarted"	N/A	Shutdown	00:24
T1	Turtle	*N/A*	N/A	20/08/22	10:45	Sweeping "MFO ship loader spotted turtle" "MFO ship loader said all clear to start"	N/A	Delay Start	00:03
C8	Dolphin	*N/A*	N/A	20/08/22	14:17	Sweeping "MFO ship loader spotted dolphins - shutdown" "MFO ship loader said all clear to restart"	N/A	Shutdown	00:33
C9	Dolphin	*N/A*	N/A	20/08/22	17:13	Sweeping "MFO ship loader spotted dolphins – shutdown" "MFO said all clear to restart"	N/A	Shutdown	00:12
C11	Dolphin	*N/A*	N/A	21/08/22	14:55	Sweeping "MFO ship0 loaded spotted dolphins – shutdown" "MFO ship loader said all clear"	N/A	Shutdown	00:15
C12	Dolphin	*N/A*	N/A	22/08/22	17:20	Sweeping "MFO ship loader spotted dolphin – shutdown"	N/A	Shutdown	N/A
C13	Dolphin	*N/A*	N/A	24/08/22	10:45	Sweeping "MFO spotted dolphins – shutdown" "MFO ship loader said all clear – restart"	N/A	Shutdown	00:55
C14	Dolphin	*N/A*	N/A	24/08/22	14:20	Sweeping "MFO ship loaded spotted dolphins – shutdown" "MFO ship loader said all clear – restart"	N/A	Shutdown	00:05
C15	Dolphin	*N/A*	N/A	24/08/22	15:15	Sweeping "MFO ship loader spotted	N/A	Shutdown	00:20

						dolphins – shutdown" "MFO ship loader said al clear – restart"			
C16	Dolphin	*N/A*	N/A	24/08/22	16:50	Sweeping "MFO ship loader spotted dolphins – shutdown" "MFO ship loader said all clear – restart"	N/A	Shutdown	00:10
C17	Dolphin	*N/A*	N/A	25/08/22	07:20	Sweeping "MFO ship loader spotted dolphins" "MFO ship loader said all clear"	N/A	Shutdown	00:15
T3	Turtle	*N/A*	N/A	25/08/22	09:54	Sweeping "MFO ship loader spotted turtle" "Re started"	N/A	Shutdown	00:36
C18	Dolphin	*N/A*	N/A	25/08/22	12:00	Sweeping "MFO ship loader spotted dolphins" "MFO ship loader said all clear"	N/A	Shutdown	00:10
C19	Dolphin	*N/A*	N/A	25/08/22	15:35	Sweeping "Spotted dolphins swimming, shutdown" "MFO ship loader said all clear"	N/A	Shutdown	00:06
T4 (C21 was also sighted during this time)	Turtle	*N/A*	N/A	26/08/22	09:30	Sweeping "MFO ship loader spotted turtle in shutdown zone" "Turtle still present" "MFO ship loader said all clear"	N/A	Shutdown	00:55
C22	Dolphin	*N/A*	N/A	26/08/22	16:55	Sweeping "MFO ship loader spotted dolphins" "MFO ship loader said all clear"	N/A	Shutdown	00:05

There were twenty one mitigation actions during the duration of seabed levelling of the berth pocket whilst MFO onboard EDI observed. Mitigation information is contained within table 3 as a direct transcript from the vessel EDI BMT "Marine Fauna Observation Log Assessment" reports. Detection numbers have been included when relevant to correlate sighting information between ship loader MFO and EDI MFO data.

This data is taken from the seabed levelling vessel EDI BMT "Marine Fauna Observation Log Assessment" reports and a direct transcript of marine fauna sightings and mitigation action. "Detection Number for Channel Entrance as Recorded by Pelagic MFO" column has been included to correlate sighting information between both MFOs data.

Table 3.1: Direct Transcript of Visual Sighting Data from EDIs BMT "Marine Fauna Observation Log Assessment" report during the Seabed Levelling of the Channel Entrance

Detection Number For Channel Entrance as Recorded by Pelagic MFO for Correlation Reference	Common Name	Species	Total Number	Date	Time	Source Activity at Initial Detection and comments	Closest Approach to Source (m)	Mitigation Action	Duration of Mitigation Action (HH:MM)
N/A	Whale	*N/A*	1	05/09/22	06:40	Sweeping "Pectoral fin slapping"	5.5km (3nm)	None	00:00
N/A	Whale	*N/A*	1	05/09/22	07:30	Sweeping "FS heading more east" "Swam out of range to NE"	7.4km (4nm)	None	00:00
N/A	Humpback Whale	*Megaptera novaeangliae*	1	06/09/22	06:50	Sweeping "Shutdown ops – Humpback in SDZ" "Start ops – humpback left SDZ" "Sweeping - Humpback leaving OZ"	350m	Shutdown	00:20
N/A	Humpback Whale	*Megaptera novaeangliae*	2	07/09/22	08:40	Sweeping "Shutdown - HB in SDZ" "start up sweeping – HB seen leaving SDZ"	600m	Shutdown	00:25
N/A	Humpback Whale	*Megaptera novaeangliae*	2	07/09/22	12:10	Sweeping "Shutdown HB in SDZ" "Start up HB left SDZ"	800m	Shutdown	00:20
N/A	Humpback Whale	*Megaptera novaeangliae*	2	11/09/22	12:00	Sweeping "Stop work sighting, not moving milling, left shutdown zone resume sweeping"	800m	Shutdown	00:55
N/A	Humpback Whale	*Megaptera novaeangliae*	2	11/09/22	14:05	Sweeping "Pod of 2, northbound, stopped work"	1km	Shutdown	00:15
N/A	Whale	*N/A*	2	12/09/22	09:40	Sweeping "Whales heading north, shutdown"	900m	Shutdown	00:35

There were six mitigation actions during the duration of seabed levelling of the channel entrance whilst MFO onboard EDI observed. Mitigation information is contained within table 3.1 as a direct transcript from the vessel EDI BMT "Marine Fauna Observation Log Assessment" reports. Detection numbers have been included when relevant to correlate sighting information between Pelagic MFO and EDI MFO data.

MFO ONBOARD MODI R MARINE FAUNA SIGHTINGS AND MITIGATION ACTION AS RECORDED BY THE MFO ONBOARD MODI R

This data is taken from the dredging vessel Modi R BMT "Marine Fauna Observation Log Assessment" reports and a direct transcript of marine fauna sightings and mitigation action. "Detection Number for Channel Entrance as Recorded by Pelagic MFO" column has been included to correlate sighting information between both MFOs data.

Table 4: Direct Transcript of Visual Sighting Data from Modi R BMT "Marine Fauna Observation Log Assessment" reports during the Dredging of the Channel Entrance and Dredge Disposal Site

Detection Number For Channel Entrance as Recorded by Pelagic MFO for Correlation Reference	Common Name	Species	Total Number	Date	Time	Source Activity at Initial Detection and comments	Closest Approach to Source (m)	Mitigation Action	Duration of Mitigation Action (HH:MM)
N/A	Stingray	*N/A*	10	02/09/22	01:30	Dredging	15m	None	00:00
N/A	Dolphin	*N/A*	10	04/09/22	00:04	Dumping grounds	20m	None	00:00
C6	Humpback Whale	*Megaptera novaeangliae*	1	05/09/22	08:35	Transit to dumping grounds "MFO spotted whale during transit Modi reduce speed"	N/A	None	00:00
C9	Whale	*N/A*	1	05/09/22	12:53	Transit to dumping grounds "White boat spot whale, we don't see"	300m	Delay in dumping operations	00:30
N/A	Whale	*N/A*	N/A	06/09/22	06:56	In transit from dumping grounds	300m	None	00:00
C12	Whale	*N/A*	2	06/09/22	09:02	Dumping grounds "MFO spot whale dumping area, waiting, we see 09:06"	300m	Delay in dumping operations	00:30
N/A	Whale	*N/A*	1	07/09/22	07:56	Dumping grounds "See whale before dump"	800m	Delay in dumping operations	00:30
N/A	Whale	*N/A*	1	07/09/22	08:38	"Stop for whale close to vessel, look before dump, no see"	100m	Delay in dumping operations	N/A

There were four mitigation actions during the duration of dredging of the channel entrance whilst MFO onboard Modi R observed. Mitigation information is contained within table 4 as a direct transcript from the vessel Modi R BMT "Marine Fauna Observation Log Assessment." Detection numbers have been included when relevant to correlate sighting information between Pelagic MFO and Modi R MFO data.

OTHER WILDLIFE

Throughout this project period several non-mitigating fauna species were observed including fish, sharks and birds.

Bull, Tiger and other shark species were observed slow swimming and resting on the bottom of the seabed next to pilings under the Ship Loader Platform during tidal changes. Fish species present around the Ship Loader Platform included Pink Snapper, Mullet and Cod. Fish species were seen in schools swimming between pilings.

Avifauna observed from the ship loader included Silver Gulls, Australian Pied Cormorant, Crested Bellbird, Australian Pelican and Osprey. Two Osprey were observed everyday flying between the ship loader and a man-made nesting structure located at the northern end of the dolphins.

See Appendix 4 for the Record of Shark Sightings Seabed Levelling. Although not officially reported, see Appendix 5 and 5.1 for the Record of Other Fauna Seabed Levelling and Record of Other Fauna Dredging.

WEATHER CONDITIONS

During the project period, observations were carried out in predominantly average weather conditions. Winds ranged from 2.1kts to 20.5kts, on average they were approximately 10kts. Swell height was typically around the 0.3m mark with consistently changing tides. Sea state throughout the reporting period ranged from Beaufort 1 to Beaufort 4.

Visibility overall was between 1-5km with observations being hampered during periods of rainfall. On some occasions visibility was hampered during the day due to high sea state.

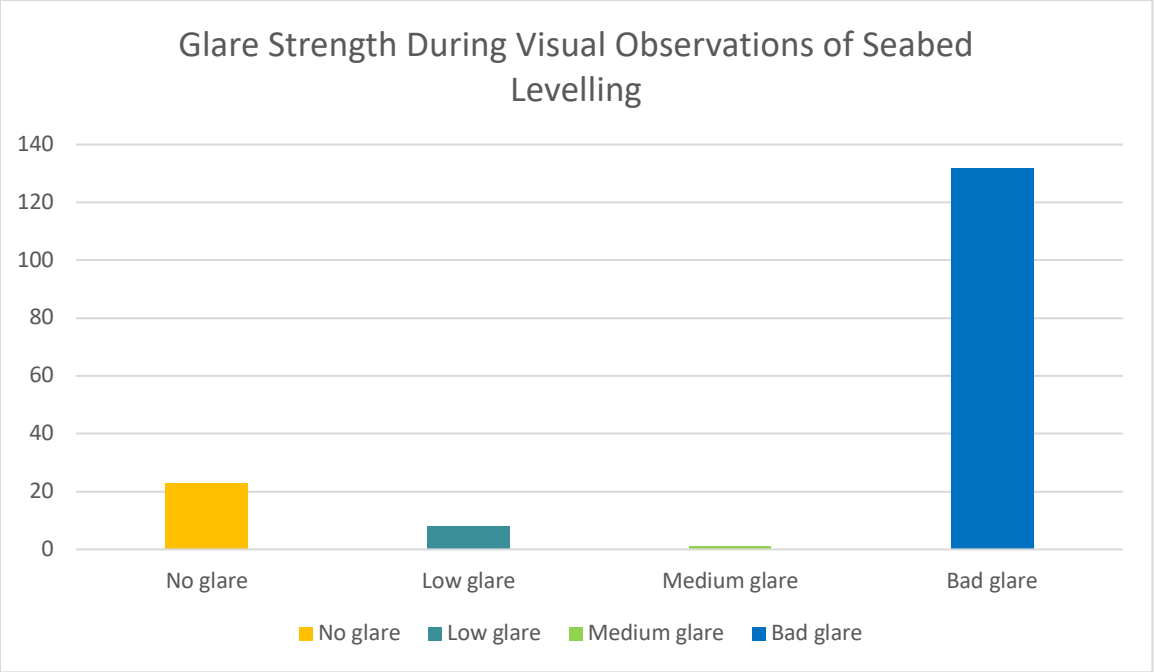

Figure 1: Glare Strength During Visual Observations of Seabed Levelling

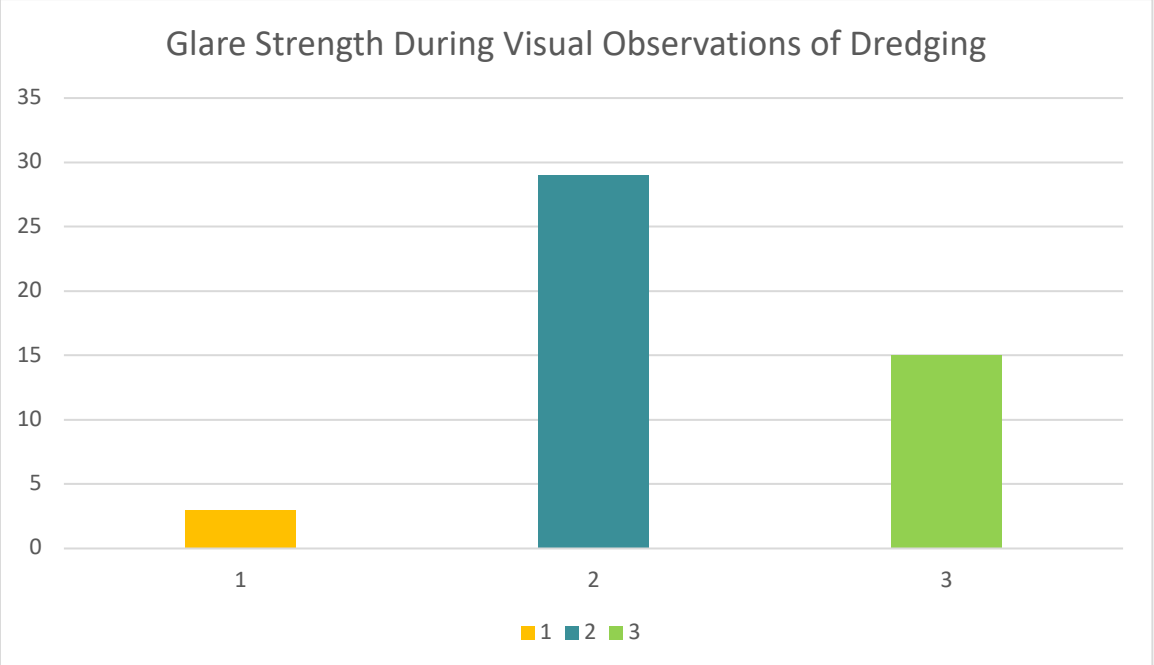

Figure 2: Glare Strength During Visual Observations of Dredging

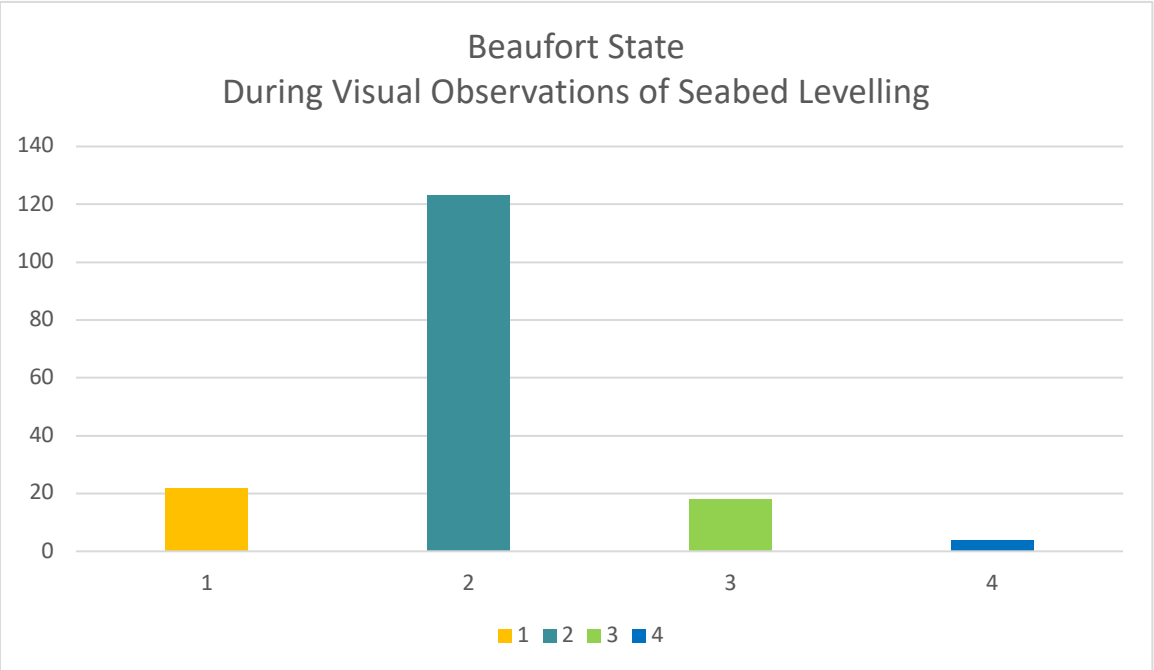

Figure 3: Beaufort State During Visual Observations of Seabed Levelling

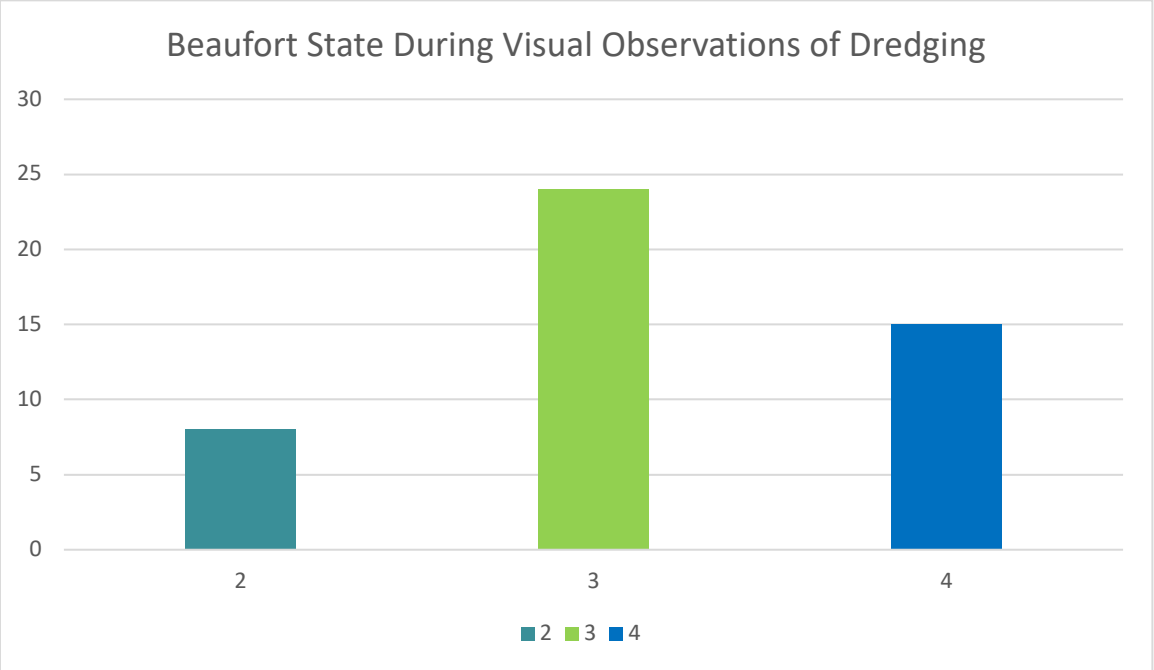

Figure 4: Beaufort State During Visual Observations of Dredging

Figure 5: Photograph of the "Sea Turtle Deflector" attached to Modi R draghead

CITATIONS

DEWHA (2008). EPBC Act Policy Statement 2.1. Interactions between offshore seismic exploration and whales, September 2008. Australian Government Department of the Environment, Water, Heritage and the Arts. Canberra.

Shirihai, H., and Jarrett, B (2006). Whales, Dolphins and Seals – A Field Guide to the Marine Mammals of the World, A&C Black Publishers Ltd, London, ISBN: 978-0-7136-7037-0.

EDI BMT "Marine Fauna Observation Log Assessment" reports from the period of 15th – 26th of August 2022 and the period of 2nd – 12th of September 2022.

Modi R BMT "Marine Fauna Observation Log Assessment" reports from the period of 1st – 7th of September 2022.

APPENDICES

Appendix 1. Observer Effort Data Seabed Levelling of the berth pocket

Refer to attached file *"Observer Effort Seabed Levelling.xlsx"*

Appendix 1.2. Observer Effort Data Dredging of the channel entrance

Refer to attached file *"Observer Effort Dredging.xlsx"*

Appendix 2. Record of Cetacean Sightings Seabed Levelling

Refer to attached file *"Record of Cetacean Sightings Seabed Levelling.xlsx"*

Appendix 3. Record of Turtle Sightings Seabed Levelling
Refer to attached file *"Record of Turtle Sightings Seabed Levelling.xlsx"*

Appendix 4. Record of Sirenians Sightings Seabed Levelling
Refer to attached file *"Record of Sirenians Sightings Seabed Levelling.xlsx"*

Appendix 2.1. Record of Cetacean Sightings Dredging
Refer to attached file *"Record of Cetacean Sightings Dredging.xlsx"*

Appendix 3.1. Record of Turtle Sightings Dredging
Refer to attached file *"Record of Turtle Sightings Dredging.xlsx"*

Appendix 5. Record of Shark Sightings Seabed Levelling
Refer to attached file *"Record of Shark Sightings Seabed Levelling.xlsx"*

Appendix 6. Record of Other Fauna Seabed Levelling
Refer to attached file *"Record of Other Fauna Seabed Levelling.xlsx"*

Appendix 6.1. Record of Other Fauna Dredging
Refer to attached file *"Record of Other Fauna Dredging.xlsx"*

BMT Commercial Australia Pty Ltd
Level 4, 20 Parkland Road,
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ABN: 54 010 830 421

Technical note

Project	Shark Bay Resources – Maintenance Dredging		
From:	Ashley Lemmon		
Date:	18 July 2022	To:	Andrew Bohnen
Doc Ref:	Tn-1588_00-7		William Jones
Subject:	Additional ground truthing survey report		

1 Introduction

1.1 Background

Shark Bay Resources Pty Ltd (SBR) are completing maintenance dredging to redistribute an estimated volume of 10,000 m^3 from the berth pocket and 68,200 m^3 from entrance channel to remove sediment accretion and restore historical depths (hereafter; the Project).

In July 2019 and February 2020, towed video data were collected to investigate the spatial extent of benthic communities and habitat (BCH) assemblages in the vicinity of the berth pocket, entrance channel and disposal area (Project Area; Figure 1.1). Subsequently, a habitat map was developed to support the environmental referral of the Project by informing the Environmental Impact Assessment (EIA, BMT 2020a) and Dredging Environmental Management Plan (DEMP, BMT 2021).

The Project was referred and approved under the *Environmental Protection Act 1986* (State) (the EP Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (the EPBC Act), subject to conditions in Ministerial Statement 1173 and Controlled Action EPBC 2020/8717, respectively. Furthermore, the Project was referred under the *Environment Protection (Sea Dumping) Act 1981* (the SD Act) and is subject to conditions in the Sea Dumping Permit, SD2020/3993 to load and dispose of material at sea, approved.

In accordance with the approval conditions and DEMP (BMT 2021), an additional ground truthing survey was undertaken in June 2022 to investigate the BCH in the Project Area and validate the habitat map prepared to support the EIA, ~eight weeks prior to the scheduled Project commencement.

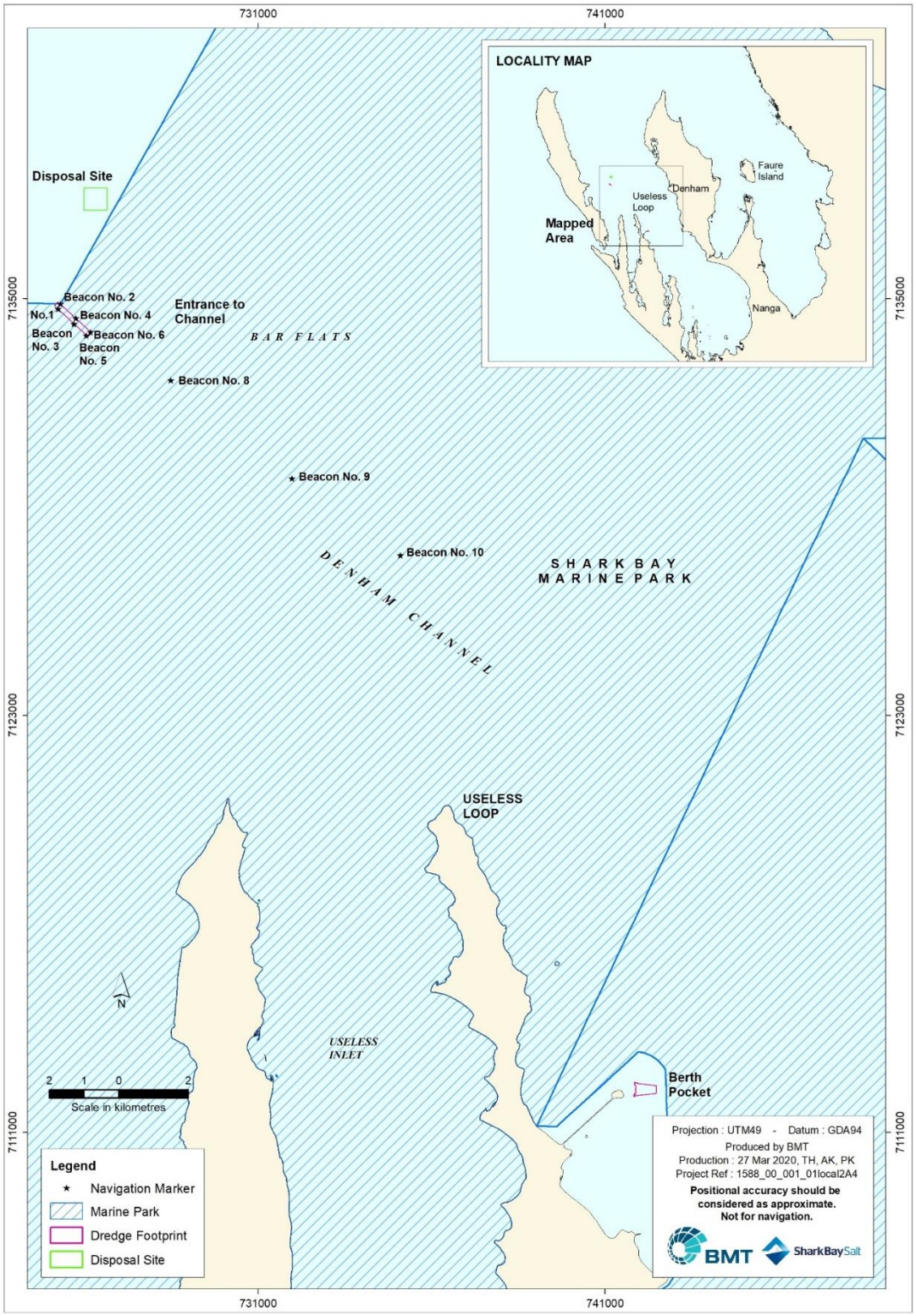


Figure 1.1 Locality map of the Shark Bay Resources berth pocket and entrance channel dredge areas, disposal area and Marine Park boundary

1.2 Purpose of this document

This document provides the results of the additional ground truthing survey completed in June 2022 and a comparative overview of the results with the existing extent and distribution described and mapped in the EIA (BMT 2020b).

2 Benthic Mapping

2.1 Description of existing habitat map

The habitat map developed from the 2019 and 2020 surveys, which informed the EIA and DEMP (BMT 2020b, 2021), is shown in Figure 2.1. The total survey area was characterised by 65% seagrass cover of variable density (with dense, moderate and sparse classifications applied). The remaining area was largely unvegetated and comprised sand and rock rubble (34%) and a small area of sparse filter feeders (1%) (Figure 2.1; BMT 2020b).

BMT 2020b describes the berth pocket characterised by recolonised relatively dense seagrass meadows comprising *Posidonia australis* and *Amphibolis antarctica*, as well as sparse mixed seagrass meadows dominated by *Halophila spinulosa* and patches of bare sand and rocky rubble. The BCH in deeper water (~12 m) adjacent to the entrance channel dredge area consisted of sparse to moderate cover of *H. spinulosa* with sparse occurrences of *Posidonia spp.*, and bare sand/rocky rubble, while the shallow banks (~5 m) adjacent to the entrance channel were characterised by dense *Posidonia spp.* meadows (BMT 2021). Habitats within the disposal area consisted of bare sand and rocky rubble, with some sparse seagrass occurring adjacent to the south west of the disposal area (Figure 2.1; BMT 2020b).

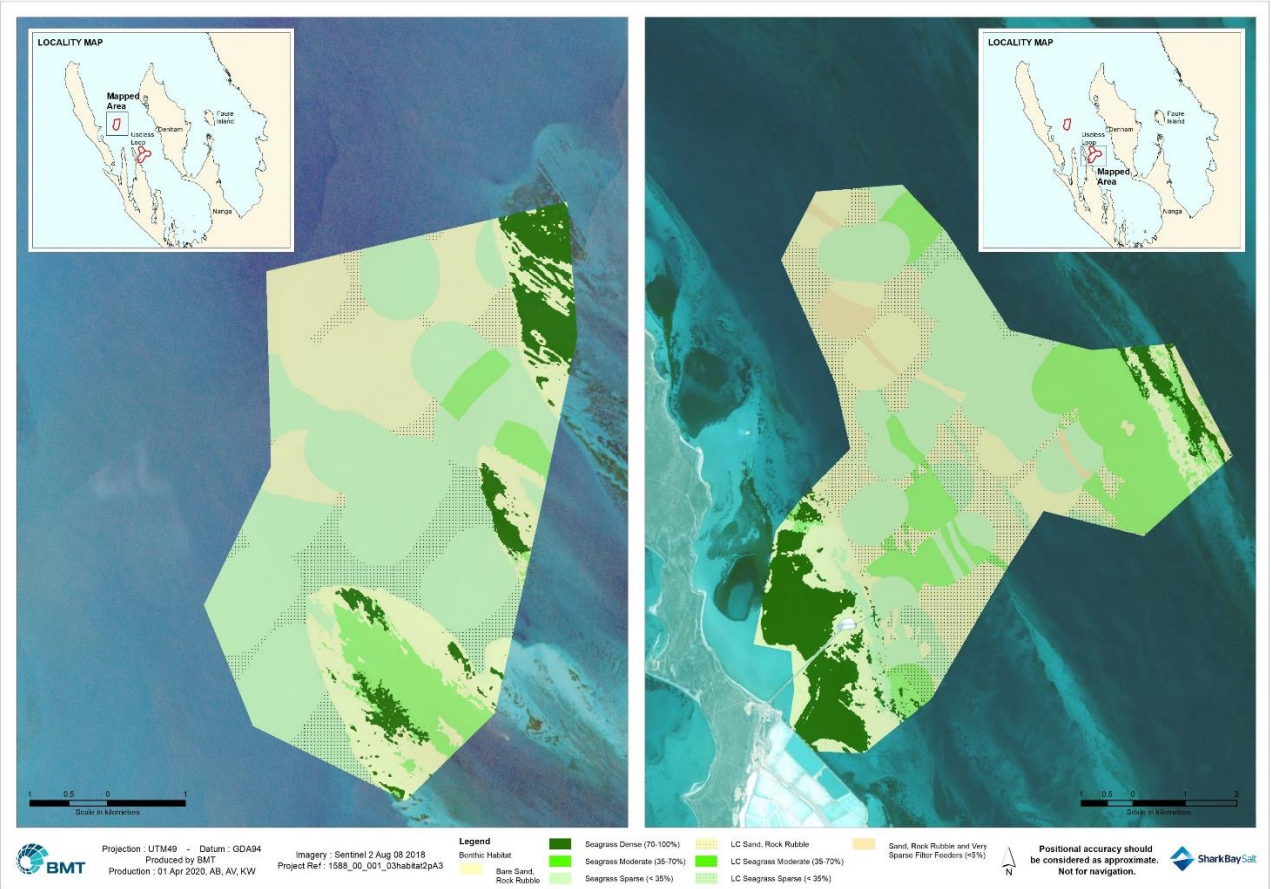


Figure 2.1 Extent and distribution of benthic communities and habitats in the vicinity of the berth pocket, entrance channel and disposal area

2.2 Habitat map validation methods

Prior to conducting the field survey, BMT collated available marine spatial data including contemporary satellite imagery (Sentinel-2 image, captured on 04 May 2022 [ESA 2022]) and existing nearshore habitat mapping information at Shark Bay, and overlayed all layers in ArcGIS 10.2.1 and QGIS 2.14.3 for assessment of the Project Area in a high resolution.

A sampling and analysis plan (SAP) was developed (see BMT 2022) to implement the BCH ground truthing validation survey of the Project Area consistent with previous habitat investigation surveys (e.g. BMT 2020b) and to meet the objectives of the various Project environmental approvals' conditions.

Two BMT marine scientists executed a field survey to collect towed video ground truth data 11−14 June 2022 using methods consistent with BMT 2020b. Video footage was analysed and classified by a marine scientist using the methods consistent with BMT 2020b. Video footage was analysed and classified by a marine scientist using the categories listed in Table 2.1 and TransectMeasure software (SeaGIS 2013). The software allows a single benthic habitat type to be assigned to each frame of video footage. Benthic habitat was classified by identifying the dominant substrate and presence or absence of biota in each frame of the video. A percent cover (hereafter, cover) category was also applied to each frame of the video during classification of habitat, ranging from very sparse to dense (Table 2.1). The cover classification is cumulative of all biota present within a frame, including mixed assemblages. At least 10 % of classified habitat data was checked by a second marine scientist to ensure accuracy and provide quality assurance to the process.

Table 2.1 Preliminary benthic habitat categories

Biota (major category)	Biota (minor species category)	Biota (minor category description)	Percent cover (per frame)
Seagrass	*Halophila* spp.	Commonly dominated by *H. spinulosa* but includes *H. ovalis* and *H. spinulosa*	Very sparse (<5%) Sparse (5–35%) Moderate (36–75%) Dense (76–100%)
	Posidonia spp.	Dominated by *Posidonia australis*. but including *P. australis, P. coriacea and P. sinuosa*	
	Amphibolis sp.	Dominated by *A. antarctica*	
	Other	Dominated by other ephemeral seagrass species, including *Cymodocea* sp. and *Halodule uninervis*	
Filter feeders	Filter feeders	Typically, a sparse distribution of sponges, and hydroids growing on rocky substrate with sparse *H. spinulosa* also present	
Sand	Bare sand	n/a	
Rock substrate	Bare rock reef/rubble	n/a	

2.3 Data analysis and results

High-definition video footage was collected along 60 transects of variable length throughout the Project Area. Of the 60 transects, 41 were analysed, creating a total of 2665 classified habitat point data (Table 2.2). The remaining 19 transects were of poor video quality, predominantly due to poor visibility, in areas where sufficient video footage was captured. Bare sand, rock rubble was the dominant habitat (58.6 %), followed by seagrass of various densities (38.7 %, Table 2.2). A very small amount of macroalgae and filter feeder habitat was also classified from video footage (<2 %, Table 2.2).

Table 2.2 Classified habitat point data

Habitat	Classified points	Proportion (%)
Bare sand, rock rubble	1562	58.6
Seagrass (Dense to Very sparse)	1061	38.7
Filter Feeder (Moderate to Very sparse)	40	1.5
Macroalgae (Very sparse)	8	0.3
Unknown	24	0.9
TOTAL	2665	100

Note:

1. Unknown = Points that could not be attributed due to obstruction or poor visibility / image quality

The distribution of dominant habitats (sand, rock rubble and seagrasses) was predominantly well aligned with the existing habitat map in the Project Area though there is some variability between the existing habitat map and the additional ground truth data (Figure 2.2; Figure 2.3). Where towed video was undertaken at the berth pocket area variance in classified habitat between surveys occurs to the north of

the Zone of High Impact (ZoHI) where a number of points are classified as sand habitat that were previously classified (and mapped) as sparse seagrass (Figure 2.2). The remaining classified point data, adjacent west, south and south west of the berth pocket ZoHI appears to align well with the existing habitat map (Figure 2.2).

Habitat point data from transects conducted in the Zone of Moderate Impact (ZoMI), surrounding the disposal area align well with the existing habitat map. The area is largely devoid of vegetated habitat (seagrass) and dominated by bare sand, with the exception of sparse seagrass meadows present to the east and south east of the ZoMI (Figure 2.3). The sparse seagrass habitat observed in the towed video footage from transects conducted at the disposal area were comprised of predominantly *Halophila spp.*

The BCH adjacent to the entrance channel ZoHI were the most disparate between the additional ground truth survey and the 2019/20 surveys and existing habitat map. Classified point data from transects conducted to the north, north west and north east of the channel ZoHI align reasonably well (Figure 2.3). The disparity between the existing habitat map and the additional ground truth data from this survey occurs over the expansive area of moderate seagrass habitat aligning with, and to the south east of the channel. Survey effort was extensive in this area during the additional ground truth survey owing to the observation of predominantly bare sandy substrate adjacent to the ZoHI, which was subsequently confirmed through analysis of the video footage (Figure 2.3).

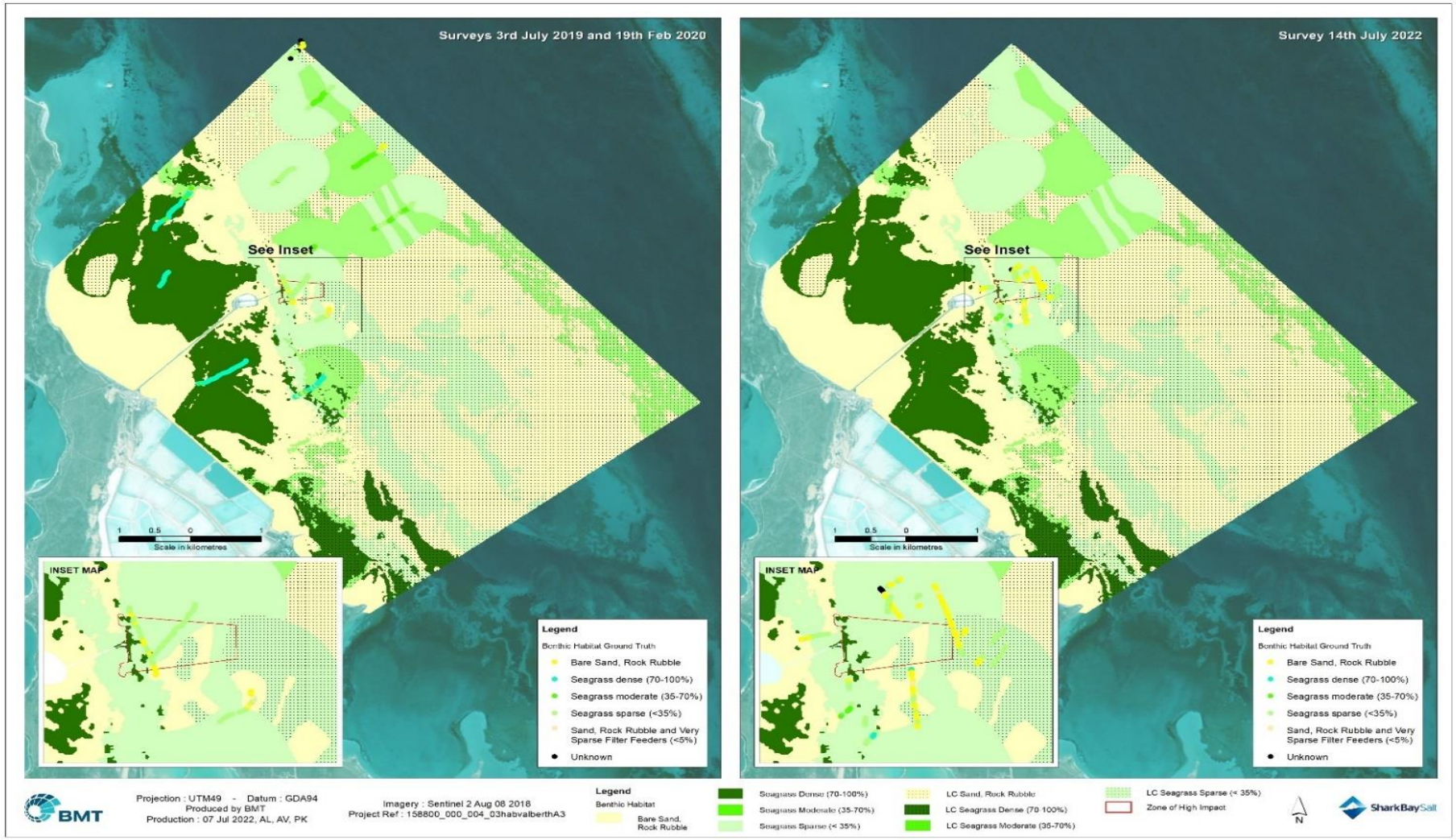


Figure 2.2 Classified point data represented as benthic habitat categories from ground truth surveys in 2019, 2020 and 2022 overlaid on the benthic habitat map at the berth pocket

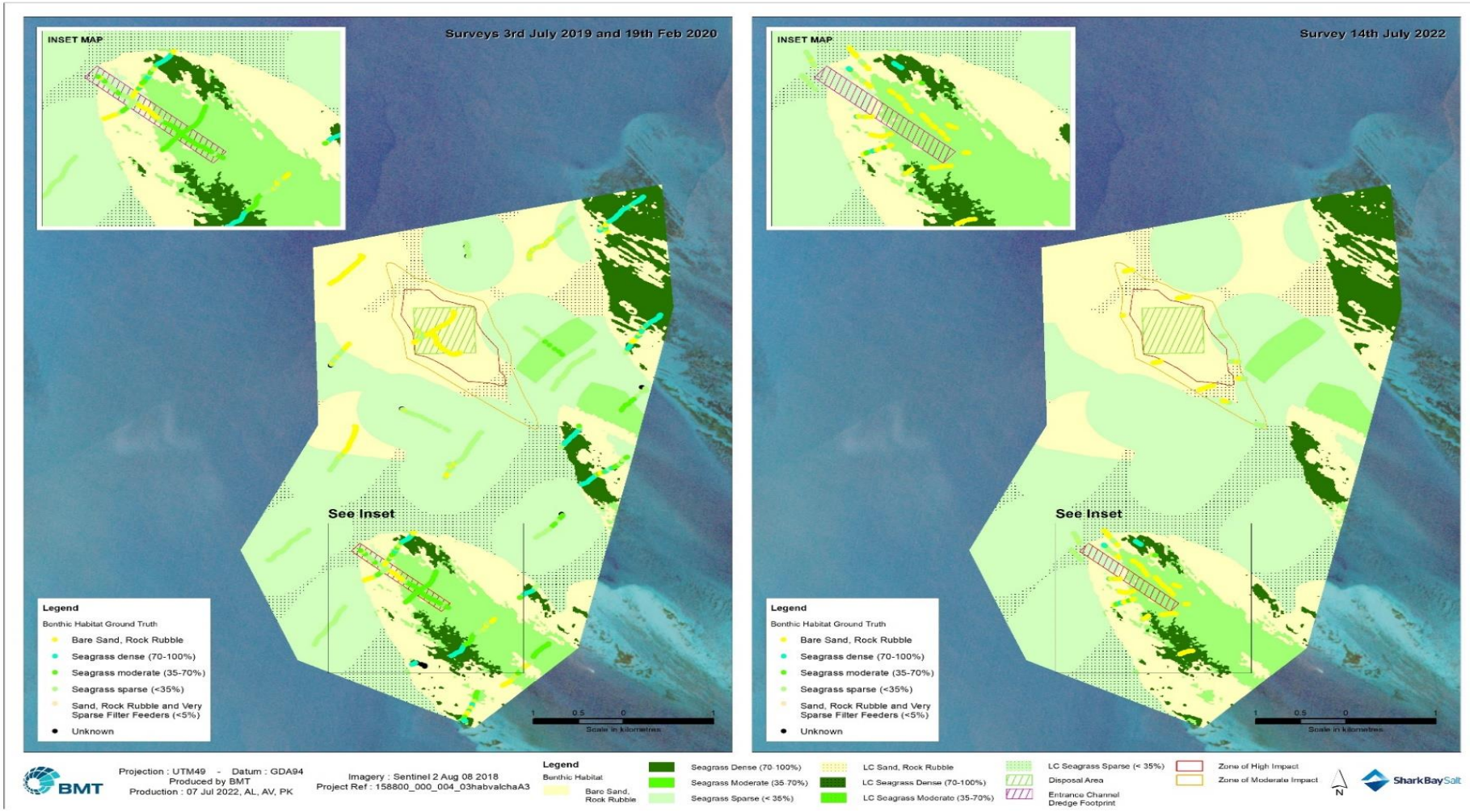


Figure 2.3 Classified point data from ground truth surveys in 2019, 2020 and 2022 overlaid on the benthic habitat map at the entrance channel and disposal areas

3 Discussion

The extent and distribution of vegetative habitat (seagrasses) identified from the additional ground truthing survey are typical of the Shark Bay environment, which has one the largest and most diverse seagrass assemblages in the world. Shallow waters, generally <5 m deep, support higher densities of perennial seagrasses such as *A.antarctica* and *P.australis* (Oceanica 2009, Burkholder et al. 2013, Strydom et al. 2020). Meadows such as those were recorded in ground truth data from 2019, 2020 and 2022, particularly in the shallow nearshore waters adjacent to the berth pocket and the shallow banks around Bar Flats near the entrance channel.

Ephemeral species such as *H. spinulosa*, *H. ovalis*, *Cymodocea spp*. and *Halodule uninervis* were also commonly observed but in lower densities confined to deeper waters, generally >5 m, which is consistent with previous studies (CALM 1996, Anderson 1994, 1998, McCluskey 2008, Burkholder et al. 2013).

Majority of the classified habitat point data from the June 2022 is well aligned with the existing habitat map, which is considered characteristic of the Shark Bay marine environment. However, variability between the 2019/20 and 2022 habitat data was observed in two areas: 1) north of the berth pocket ZoHI and, 2) south east of the entrance channel ZoHI. The differences observed in the data is considered to be representative of natural temporal and spatial variability of seagrasses present among survey years and areas.

For instance, at the berth pocket the dominant habitat type in the existing habitat map is sparse seagrass interspersed with large expanses of bare sand (BMT 2020b). It is therefore conceivable that this meadow may not be persistent perennial, but instead ephemeral displaying temporal variability between surveys. Survey data in 2022 suggests a very similar trend, albeit with a higher proportion of sand observed. Therefore, the variability observed in towed video footage is to be expected over this habitat.

Temporal and spatial variability of vegetative cover is common in areas where ephemeral species, such as *Halophila spp.* occur (Vanderklift et al. 2016). BMT 2020b describes the deeper waters of the Project Area, including those east of the entrance channel as being dominated by *H. spinulosa*. The dynamic patterns of these ephemeral meadows can be described as ‘boom and bust’, where a dense, vegetated meadow can develop in a relatively short period from a seedbank within the sandy sediment and abruptly disappear following senescence of the leaves and shoots. *Halophila spp.* (including *H. spinulosa*) are known to experience continued growth (increasing abundance and percent cover) for periods spanning multiple years, only to be entirely absent shortly thereafter (Vanderklift et al. 2016). An assessment by visual observation at discrete temporal instances would score the substrate at two extremes: bare sand or dense seagrass, when in fact the seedbank may simply remain dormant until the environmental conditions become conducive for growth to occur. It is likely that the inconsistency in classification near the entrance channel between ground truthing surveys reflects an ephemeral *Halophila spp.* meadow that is characteristic of deeper waters (>5 m) in the Shark Bay area.

The extent and distribution of BCH in the Project Area is well understood from survey efforts completed from 2019–2022. The additional ground truthing survey implemented in June 2022 provides further confidence in the habitat map used to inform the EIA (BMT 2020a) and develop the DEMP (BMT 2021), and that it is contemporary and accurately reflects the BCH that typify the Project Area. Robust environmental monitoring will be undertaken during maintenance dredging to monitor potential impacts to BCH and allow for implementation of early management should management thresholds trigger as outlined in the DEMP (BMT 2021).

4 References

Anderson PK (1994) Dugong distribution, the seagrass Halophila spinulosa, and thermal environment in winter in deeper waters of eastern Shark Bay, Western Australia. Wildlife Research 21:381–388

Anderson PK (1998) Shark Bay dugongs (*Dugong dugon*) in summer. II: Foragers in a Halodule-dominated community. Mammalia 62:409–425

BMT (2020a) Shark Bay Resources: Dredging Environmental Impact Assessment. Prepared for Shark Bay Resources by BMT Commercial Australia Pty Ltd, Report No. R-1588_00-2, Perth, Western Australia, June 2020

BMT (2020b) Shark Bay Resources Dredging: Benthic Habitat Mapping Report. Prepared for Shark Bay Resources Pty Ltd by BMT Commercial Australia Pty Ltd, Report No. R-1588_00-3 Rev 0, Perth, Western Australia, June 2020

BMT (2021) Shark Bay Resources: Dredging Environmental Management Plan. Prepared for Shark Bay Resources Pty Ltd by BMT Commercial Australia Pty Ltd. Report No. R-1588_00-7 Rev 5, June 2021

BMT (2022) Shark Bay Resources – DEMP Benthic Habitat Survey 2022 Sampling and Analysis Plan. Prepared for Shark Bay Resources Pty Ltd by BMT Commercial Australia Pty Ltd, Report No R-1588_00-9 Rev 0, Perth, Western Australia, June 2022

Burkholder DA, Fourqurean JW, Heithaus MR (2013) Spatial pattern in seagrass stoichiometry indicates both N-limited and P-limited regions of an iconic P-limited subtropical bay. Marine Ecology Progress Series 472:101–15

CALM (1996) Shark Bay Marine Reserves–Management Plan 1996–2006. Management Plan No 34, Department of Conservation and Land Management, Perth, Western Australia, August 1996

ESA (2022) Sentinel Online. European Space Agency, Rome, Italy. Available at <https://scihub.copernicus.eu/dhus/#/home> [Accessed May 2022]

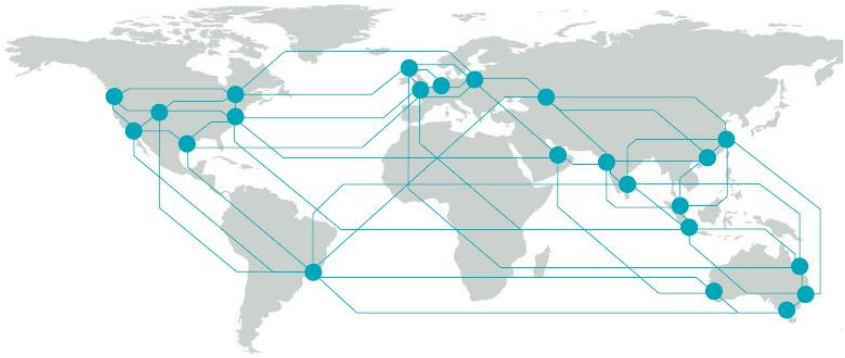
McCluskey P (2008) Shark Bay World Heritage Property – Strategic Plan 2008–2020. Prepared for Department of Environment and Conservation and Department of the Environment, Water, Heritage and the Arts, Perth, Western Australia

Oceanica (2009) Useless Loop Port Maintenance Works and Infrastructure Upgrade, Shark Bay – Works Approval Application / Environmental Referral. Prepared for Shark Bay Resources by Oceanica Consulting Pty Ltd, Report No. 762_001/1, Perth, Western Australia, February 2009

SeaGIS (2013) TransectMeasure – single camera biological analysis tool. SeaGIS Pty Ltd, Melbourne, Victoria. Available at < http://www.seagis.com.au/transect.html>

Strydom S, Murray K, Wilson S, Huntley B, Rule M, Heithaus M, Bessey C, Kendrick GA, Burkholder D, Holmes T, Fraser MW (2020) Too hot to handle: unprecedented seagrass death driven by marine heatwave in a World Heritage Area. Global Change Biology doi:10.1111/gcb.15065

Vanderklift, M, Bearham D, Haywood M, Lozano-Montes H, Mccallum R, McLaughlin J, Mcmahon K, Mortimer N, Lavery P (2016). Natural Dynamics: understanding natural dynamics of seagrasses in north-western Australia WAMSI Dredging Science Node Report.



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