

ONSHORE DISPOSAL RISK ASSESSMENT

The original Public Environmental Review (PER) for the Mardie Project (Preston, 22 June 2020), proposed an onshore disposal method for dredge spoil. This involved placing spoil into containers on hopper barges, transporting them to the trestle jetty, and then transferring the containers by crane onto trucks. The trucks would then transport the spoil to a bunded containment cell near the stockyard and decant water from the cell to be treated through a series of settling ponds before being discharged into the intertidal zone.

However, the previous tender process undertaken to implement this proposal (as detailed in Section 5.1.1 (page 50) of the Preliminary Documentation) identified numerous technical difficulties with the onshore disposal methodology, most notably that the shallow marine environment restricts the transportation options for the dredge spoil to the onshore disposal location. The only feasible option to transport dredge spoil to shore that was presented in tender submissions was via 4-9 km of slurry pipeline (diameter of the pipe would be approximately 1.5m). The slurry pipeline could not be situated within the approved Development Envelope for the Project due to the high risks associated with simultaneous operational (SIMOPS) interactions between the dredger and the pipeline. It was also noted that pumping the dredge spoil slurry back to shore over such a long distance would require up to six diesel powered booster pumps anchored to the seabed. Further, the design and operation of the slurry pipeline does not allow for sections to be isolated in the event of a leak or rupture. If a pipeline leak or failure occurs; the procedure would involve shutting down dredging vessel and draining the pipeline before sections can be replaced or repaired. Additional concerns around the adequacy of the size of the land disposal area, efficacy of onshore bunding, possibility of weather events re-mobilising sediments from the onshore spoil ground, and impacts to groundwater from dredge dewater were also noted during the previous tender process. Subsequent discussions with the Department of Climate Change, Energy, the Environment and Water (DCCEE) during the ongoing assessment process for the Mardie project have also highlighted the potential significance of impacts to terrestrial habitats resulting from onshore disposal.

The following risk assessment aims to address each of these issues and identifies relevant MNES that may potentially be affected by each direct or indirect impact from onshore disposal of dredge spoil. The risk assessment is based on the risk criteria description provided in Section 6.1.1.(page 69) of the Preliminary Documentation. The risk assessment for offshore disposal of dredge spoil is located within Section 6.1 of the Preliminary Documentation (page 62-68), and a summary and comparison of potential impacts to MNES associated with onshore and offshore disposal of dredge spoil is presented in Attachment 23 of the Preliminary Documentation.

Table 1: Potential Impacts to MNES (marine and terrestrial) associated with Onshore Disposal of Dredge Spoil for Capital and Maintenance Dredge Events for the Life of the Project

Potential Impact	Relevant MNES	Assessment of Impacts
Direct impacts		
Impacts to MNES resulting from the loss of MNES terrestrial habitat via the disturbance footprint for the construction and operation of the onshore disposal site	Benthic Communities and Habitat (BCH) Grey Falcon Migratory Shorebirds habitat Pilbara Leaf-nosed Bat Pilbara Olive Python Triodia grassland habitat	<p>Nature and extent of impact:</p> <p>The construction and operation of the onshore dredge disposal area would have a 62.35 ha footprint for the temporary and/or permanent infrastructure (e.g. onshore pipelines, ponds, haul roads, containment bund walls, etc.) (refer to Figure 1 below). This disturbance footprint comprises 62 ha of “Good to Excellent” condition native vegetation and includes the following MNES habitat:</p> <ul style="list-style-type: none"> - 62 ha Grey Falcon foraging - 45.9 ha Pilbara Leaf-nosed Bat / Triodia grassland habitat - 16 ha Coastal Samphire - 12.4 ha Migratory Shorebird - 0.07 ha Pilbara Olive Python

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		<p>Unknown, unpredictable or irreversible impacts:</p> <p>The construction and operation of the onshore dredge disposal area will result in irreversible loss of up to 62 ha of “Good to Excellent” condition native vegetation which includes MNES terrestrial habitat.:</p> <p>No unknown or unpredictable impacts are predicted from this direct disturbance of habitat.</p> <p>Significance of impacts:</p> <ul style="list-style-type: none"> - Pilbara Leaf-nosed Bat and Triodia grasslands: include both spinifex grassland and shrubland over spinifex grassland. Spinifex grassland principally occurs on the upland areas along the eastern side of the intertidal zone, as well as on islands within the mudflats / saltflats and near the coast. Given the broad extent of this habitat type in the region, this impact is not considered to be extensive, however, it does hold some value as foraging habitat for the Pilbara Leaf-nosed Bat. - Pilbara Olive Python: given the small area of potential clearing, this impact is not considered to be extensive, however it does hold some value for the Pilbara Olive Python. - Grey Falcon: Given the broad extent of foraging habitat for this species in the region, this impact is not considered to be extensive, however, it does hold some value for the Grey Falcon. A direct disturbance of 62 ha of good to excellent quality foraging habitat may be considered significant in a local context. - Migratory Shorebird / Coastal Samphire: This habitat type is well represented throughout the terrestrial fauna survey area, however, it represents high-value habitat for a number of significant bird species. A direct disturbance of an additional 16 ha of coastal samphire habitat is considered to be a significant residual impact. <p>Inherent Risk Rating:</p> <p>The likelihood of the impact occurring has been given a rating of ‘<u>Highly Likely</u>’, and a consequence of impact rating of ‘<u>High</u>’, resulting in a risk rating of ‘<u>High</u>’.</p> <p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Minimise footprint for clearing to undertake construction and operation of the onshore disposal site - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Benthic Communities and Habitat Monitoring and Management Plan (Rev D, dated 24 October 2024) available via: https://www.bciminerals.com.au/images/files/1.%2023ENV226%20Mardie%20BCHMMP%20RevD%20DCCEEW%20Updates%20FINAL.pdf - Implementation of the Migratory Shorebird Monitoring and Management Plan (Rev 3, dated 19 August 2024) available via: https://www.bciminerals.com.au/images/files/MigratoryShorebird_MMP_Rev3_clean.pdf - Scheduling of dredging works outside of key ecological window of significant marine fauna species (i.e. during April to September (inclusive)) <p>Residual Risk Rating:</p> <p>Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of ‘<u>Highly Likely</u>’, and a consequence of ‘<u>Moderate</u>’, resulting in a risk rating of ‘<u>High</u>’.</p> <p>Additional Technical Data – refer to the Optimised Mardie Project Supplementary Report (Preston, 30 Aug 2022) available via: https://www.epa.wa.gov.au/sites/default/files/PER_documentation2/220831%20BCI%20Optimised%20Mardie%20Project%20Supplementary%20Report%20Rev1%20FINAL.pdf</p> <ul style="list-style-type: none"> - Section 8.3.2 provides details regarding Grey Falcon; Triodia grassland habitat - Section 8.5.2 provides further detail regarding the assessment of significance of the potential impacts for Grey Falcon - Section 8.5.7 provides further detail regarding the assessment of significance of the potential impacts for Triodia grassland habitat - Phoenix (2021b; Appendix 7.1) provides further technical information regarding Triodia grassland habitat, available via: https://www.epa.wa.gov.au/sites/default/files/PER_documentation2/7.1%20Phoenix%20Environmental%20Sciences%20%282021b%29%20Basic%20%28Level%201%29%20terrestrial%20fauna%20survey.pdf
Impacts to MNES resulting from the decline in health and /or loss of MNES marine and terrestrial	Australian Bottlenosed Dolphin	<p>Nature and extent of impact:</p> <p>The pumping distance for the slurry pipeline to reach the onshore disposal site ranges from 4 km to 9 km. The presence of clay (and at many places interlaced with gravel /cobbles) and especially the conglomerate / Calcarene in the material to be dredged, can form clay balls that may increase abrasion rates, damage/block</p>

Potential Impact	Relevant MNES	Assessment of Impacts
fauna habitat via smothering by dredge spoil / sediment due to leakage and/or rupture of up to 9km of the slurry pipeline	Australian Humpback Dolphin Australian Snubfin Dolphin BCH Blue Whale Dugong Dwarf Sawfish Flatback Turtle Giant Manta Ray Green Sawfish Green Turtle Grey Falcon Grey Nurse Shark Hawksbill Turtle Humpback Whale Leaf-scaled Sea Snake Leatherback turtle Loggerhead Turtle Migratory Shorebirds habitat Narrow Sawfish Pilbara Leaf-nosed Bat Pilbara Olive Python Reef Manta Ray Short-nosed Sea Snake Triodia grassland habitat Whale Shark White Shark	<p>pipelines, and necessitate booster pumps to move the dredge slurry along the pipeline to the onshore disposal location. Procurement of specialist pumps may potentially be from overseas which increases the operational timeframes should maintenance or replacement be required. In the event there is a leak or rupture of the slurry pipeline, dredging would cease immediately. However, dredge spoil within the pipeline would be discharged to the marine environment, as it is not possible to isolate portions of the pipeline. Due to SIMOPs (simultaneous operations) requirements, the slurry pipeline would be located outside of the approved Development Envelope. Based on the dynamic nature of the marine environment (i.e. waves, tides and currents) it is likely the loss of dredge spoil would be dispersed over a large area.</p> <p>Unknown, unpredictable or irreversible impacts:</p> <p>The extent of the impacts is unknown and unpredictable based on the dynamic nature of the marine environment (i.e. waves, tides and currents). The impacts may be irreversible.</p> <p>Significance of impacts:</p> <p>The impact is likely to extend beyond the approved Mardie Project Development Envelope and Disturbance Footprint, as it would not be possible to contain the sediment within the boundaries of the Development Envelope. The significance of the impact would be dependent on the volume of sediment dispersed into the marine environment and area where the sediments are transported/deposited to as to whether there would be an impact to marine fauna habitat and the quality of the habitat potentially impacted.</p> <p>Inherent Risk Rating:</p> <p>The likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>Critical</u>', resulting in a risk rating of '<u>Severe</u>'.</p> <p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the approved Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bciminerals.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf - Implementation of the Marine Environmental Quality Monitoring and Management Plan (Rev 6 ,dated 23 November 2022) available via: https://www.bciminerals.com.au/images/files/R190108_Mardie_MEQMMP_Rev6_FINAL_20221205.pdf - Daily pre-start inspection of dredging / disposal equipment - Leak detection system installed on the slurry pipeline - Regular inspections and maintenance of equipment during the course of the dredging program - Deployment of containment barriers (i.e. floating booms) to contain the sediment plume associated with a pipeline leak and/or rupture - Use of skimmers/suction devices to physically remove the lost slurry material from the water surface or seabed - Scheduling of dredging works outside of key ecological window of significant marine fauna species (i.e. during April to September (inclusive)) <p>Residual Risk Rating:</p> <p>Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Unlikely</u>', and a consequence of impact rating of '<u>Major</u>', resulting in a risk rating of '<u>High</u>'.</p> <p>Additional Technical Data:</p> <p>There is no additional technical data.</p>
Impacts to MNES resulting from the alteration to marine environmental quality via increased sediment due to leakage and/or rupture of up to 9km of the slurry pipeline	Australian Bottlenosed Dolphin Australian Humpback Dolphin Australian Snubfin Dolphin BCH Blue Whale	<p>Nature and extent of impact:</p> <p>The pumping distance for the slurry pipeline to reach the onshore disposal site ranges from 4 km to 9 km. The presence of clay (interlaced with gravel /cobbles) and especially the conglomerate / Calcareenite in the material to be dredged, along with sand and gravel, can form clay balls that may increase abrasion rates, damage/block pipelines, and necessitate booster pumps to move the dredge slurry along the pipeline to the onshore disposal location. Procurement of specialist pumps may potentially be from overseas which increases the operational timeframes should maintenance or replacement be required. In the event there is a leak or rupture of the slurry pipeline, dredging would cease immediately. However, all of the dredge spoil within the pipeline would be discharged to the onshore and/or marine environment, as it is not possible to isolate portions of the pipeline to action repairs/replacements. Due to SIMOP requirements the slurry pipeline would be located outside of the approved</p>

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	Dugong Dwarf Sawfish Flatback Turtle Giant Manta Ray Green Sawfish Green Turtle Grey Nurse Shark Hawksbill Turtle Humpback Whale Leaf-scaled Sea Snake Leatherback turtle Loggerhead Turtle Narrow Sawfish Reef Manta Ray Short-nosed Sea Snake Whale Shark White Shark	<p>Development Envelope. Based on the dynamic nature of the marine environment (i.e. waves, tides and currents) it is likely the loss of dredge spoil would be dispersed over a large area.</p> <p>Unknown, unpredictable or irreversible impacts:</p> <p>The extent of the impacts is unknown and unpredictable based on the dynamic nature of the marine environment (i.e. waves, tides and currents). The impacts may be irreversible.</p> <p>Significance of impacts:</p> <p>The impact is likely to extend beyond the Mardie Project Development Envelope and approved Disturbance Footprint, as it would not be possible to contain the sediment. The significance of the impact would be dependent on the volume of sediment dispersed into the marine environment and area where the sediments are transported/deposited to as to whether there would be an impact to marine fauna habitat and the quality of the habitat potentially impacted.</p> <p>Inherent Risk Rating:</p> <p>The likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>Critical</u>', resulting in a risk rating of '<u>Severe</u>'.</p> <p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bciminerals.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf - Implementation of the Marine Environmental Quality Monitoring and Management Plan (Rev 6, dated 23 November 2022) available via: https://www.bciminerals.com.au/images/files/R190108_Mardie_MEQMMP_Rev6_FINAL_20221205.pdf - Daily pre-start inspection of equipment - Leak detection system installed on the pipeline - Regular inspections and maintenance of equipment during the course of the dredge program - Deployment of containment barriers (i.e. floating booms) to contain the sediment plume associated with a pipeline leak and/or rupture - Use of skimmers/suction devices to physically remove the lost slurry material from the water surface or seabed - Scheduling of dredging works outside of key ecological window of significant marine fauna species (i.e. during April to September (inclusive)) <p>Residual Risk Rating:</p> <p>Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Unlikely</u>', and a consequence of '<u>Major</u>', resulting in a risk rating of '<u>High</u>'.</p> <p>Additional Technical Data:</p> <p>There is no additional technical data.</p>
Impacts to MNES resulting from the alteration to marine environmental quality via hydrocarbon spills during refuelling of pumps for the slurry pipeline	Australian Bottlenosed Dolphin Australian Humpback Dolphin Australian Snubfin Dolphin BCH Blue Whale Dugong Dwarf Sawfish Flatback Turtle Giant Manta Ray	<p>Nature and extent of impact:</p> <p>The pumping distance for the slurry pipeline to reach the onshore disposal site ranges from 4 km to 9 km. This will require the connection of multiple (up to 6) booster pumps in series to the slurry pipeline. Sufficient pumping power is required to be balanced with correct dredge methodology to ensure that adequate flow velocity and correct slurry mixture composition is maintained to avoid pipeline blockage, which could result in a pipeline rupture. It is estimated that 160L of diesel per pump per hour would be required. Refuelling the booster pumps in tidal areas near the shore will be challenging requiring niche amphibious equipment sourced from overseas or built specifically for the project. Alternatively, refuelling will be dependent on tidal access availability, which would impact the productivity for the dredge program. For the booster pumps located in the deeper marine water, a separate vessel would be deployed to facilitate the refuelling.</p>

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	Green Sawfish Green Turtle Grey Nurse Shark Hawksbill Turtle Humpback Whale Leaf-scaled Sea Snake Leatherback turtle Loggerhead Turtle Narrow Sawfish Reef Manta Ray Short-nosed Sea Snake Whale Shark White Shark	<p>Unknown, unpredictable or irreversible impacts:</p> <p>The extent of the impacts is unknown (as it would depend on the volume of hydrocarbons lost) and unpredictable given the dynamic nature of the marine environment (i.e. waves, tides and currents). The impacts may be irreversible.</p> <p>Significance of impacts:</p> <p>The impact is likely to extend beyond the approved Mardie Project Development Envelope and Disturbance Footprint. The significance of the impact would be dependent on the volume of hydrocarbon(s) dispersed into the marine environment and area where the hydrocarbon(s) are transported/deposited to as to whether there would be an impact to marine fauna habitat and the quality of the habitat potentially impacted.</p> <p>Inherent Risk Rating:</p> <p>The likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>Critical</u>', resulting in a risk rating of '<u>Severe</u>'.</p> <p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Spill Response Procedure [Rev 0, dated November 2021] - Implementation of the Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bciminerals.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf - Implementation of the Marine Environmental Quality Monitoring and Management Plan (Rev 6, dated 23 November 2022) available via: https://www.bciminerals.com.au/images/files/R190108_Mardie_MEQMMP_Rev6_FINAL_20221205.pdf - Scheduling of dredging works outside of key ecological window of significant marine fauna species (i.e. during April to September (inclusive)) <p>Residual Risk Rating:</p> <p>Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Unlikely</u>', and a consequence of '<u>Major</u>', resulting in a risk rating of '<u>High</u>'</p> <p>Additional Technical Data:</p> <p>There is no additional technical data.</p>
Impacts to MNES resulting from the decline in health and /or loss of MNES marine and terrestrial fauna habitat via hydrocarbon spills during refuelling of pumps for the slurry pipeline	Australian Bottlenosed Dolphin Australian Humpback Dolphin Australian Snubfin Dolphin BCH Blue Whale Dugong Dwarf Sawfish Flatback Turtle Giant Manta Ray Green Sawfish Green Turtle Grey Falcon Grey Nurse Shark Hawksbill Turtle Humpback Whale	<p>Nature and extent of impact:</p> <p>Pumping distance to reach the onshore disposal site ranges from 4 km to 9 km. This will require the contractor to connect multiple (up to 6) booster pumps in series to the slurry pipeline. Sufficient pumping power is required to be balanced with correct dredge methodology to ensure that adequate flow velocity and correct slurry mixture composition is maintained to avoid pipeline blockage, which could result in a pipeline rupture. It is estimated that 160L of diesel per pump per hour would be required. Fuelling the booster pumps in tidal areas near the shore will be challenging requiring niche amphibious equipment sourced from overseas or built specifically for the project. Alternatively, fuelling will be dependent on tidal access availability.</p>

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	Leaf-scaled Sea Snake Leatherback turtle Loggerhead Turtle Migratory Shorebird habitat Narrow Sawfish Pilbara Leaf-nosed Bat Pilbara Olive Python Reef Manta Ray Short-nosed Sea Snake Triodia grassland Whale Shark White Shark	<p>Unknown, unpredictable or irreversible impacts:</p> <p>The extent of the impacts is unknown (as it would depend on the volume of hydrocarbons lost) and unpredictable given the dynamic nature of the marine environment (i.e. waves, tides and currents). The impacts may be irreversible.</p> <p>Significance of impacts:</p> <p>The impact is likely to extend beyond the Mardie Project Development Envelope and approved Disturbance Footprint. The significance of the impact would be dependent on the volume of hydrocarbon(s) dispersed into the marine environment and area where the hydrocarbon(s) are transported/deposited to as to whether there would be an impact to marine fauna habitat and the quality of the habitat potentially impacted.</p> <p>Inherent Risk Rating:</p> <p>The likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>Critical</u>', resulting in a risk rating of '<u>Severe</u>'.</p> <p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Spill Response Procedure [BCI-ENV-PRO-007 Rev 0] - Implementation of the Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bciminerals.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf - Implementation of the Marine Environmental Quality Monitoring and Management Plan (Rev 6, dated 23 November 2022) available via: https://www.bciminerals.com.au/images/files/R190108_Mardie_MEQMMP_Rev6_FINAL_20221205.pdf - Scheduling of dredging works outside of key ecological window of significant marine fauna species (i.e. during April to September (inclusive)) <p>Residual Risk Rating:</p> <p>Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of '<u>Major</u>', resulting in a risk rating of '<u>High</u>'</p> <p>Additional Technical Data:</p> <p>There is no additional technical data.</p>
Impacts to MNES resulting from loss of MNES marine fauna habitat from the physical disturbance of the anchors installations required for the slurry pipeline and booster pumps	BCH Dugong Dwarf Sawfish Flatback Turtle Giant Manta Ray Green Sawfish Green Turtle Hawksbill Turtle Leaf-scaled Sea Snake Leatherback turtle Loggerhead Turtle Migratory Shorebird habitat Narrow Sawfish Reef Manta Ray Short-nosed Sea Snake	<p>Nature and extent of impact:</p> <p>Direct loss of BCH habitat associated with the deployment of anchorage points required for the slurry pipeline and booster pumps. The anchor points are likely to be required at regular intervals (possibly every 100m along the 4km to 9km pipeline) which may be via concrete blocks of approximately 1m x 1m which would directly impact BCH. As noted above the slurry pipeline may need to be located outside of the Development Envelope at certain times due to SIMOP requirements.</p> <p>Unknown, unpredictable or irreversible impacts:</p> <p>No unknown or unpredictable impacts are predicted from this direct disturbance of habitat.</p> <p>Significance of impacts:</p> <p>The BCH survey completed for the Mardie Project identified the presence of the following BCH within and surrounding the approved Development Envelope (refer to Figure 2 attached):</p> <ul style="list-style-type: none"> - dense coral/macroalgae - moderate coral/macroalgae - sand, bare substrate - foreshore mudflat /tidal creeks - low coverage filter feeder/macroalgae/seagrass. <p>The area surrounding the approved Development Envelope is comprised of habitats that are unlikely to represent particular regional or conservation significance compared to other areas within the Pilbara region, where higher covers and diversities are observed.</p> <p>Inherent Risk Rating:</p> <p>The likelihood of the impact occurring has been given a rating of '<u>Highly Likely</u>', and a consequence of impact rating of '<u>Moderate</u>', resulting in a risk rating of '<u>High</u>'.</p>

Potential Impact	Relevant MNES	Assessment of Impacts
		<p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bciminerals.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf - Implementation of the Marine Environmental Quality Monitoring and Management Plan (Rev 6, dated 23 November 2022) available via: https://www.bciminerals.com.au/images/files/R190108_Mardie_MEQMMP_Rev6_FINAL_20221205.pdf - Scheduling of dredging works outside of key ecological window of significant marine fauna species (i.e. during April to September (inclusive)) <p>Residual Risk Rating: Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Highly Likely</u>', and a consequence of impact rating of '<u>Minor</u>', resulting in a risk rating of '<u>Medium</u>'.</p> <p>Additional Technical Data: There is no additional technical data.</p>
Disturbance, injury or death to MNES marine fauna during dredging works via vessel strike	Australian Humpback Dolphin Australian Snubfin Dolphin Blue Whale Dugong Dwarf Sawfish Flatback Turtle Giant Manta Ray Green Sawfish Green Turtle Grey Nurse Shark Hawksbill Turtle Humpback Whale Leatherback Turtle Loggerhead Turtle Narrow Sawfish Reef Manta Ray Spotted Bottlenose Dolphin Whale Shark White Shark	<p>Nature and extent of impact: The operation of the dredger and could increase the risk of disturbance, injury or death to marine MNES fauna if they are in the vicinity of the dredge barge during operations.</p> <p>Unknown, unpredictable or irreversible impacts: No impacts would be considered unknown. This impact is generally unpredictable, as the presence of fauna beneath the dredge is likely to be extremely rare and may not occur at all. No irreversible impacts are predicted.</p> <p>Significance of impacts: This potential impact is unlikely to occur but could result in the loss of individuals on very rare occasions. Therefore, the risk to an MNES population is considered low.</p> <p>Inherent Risk Rating: The likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>Moderate</u>', resulting in a risk rating of '<u>Medium</u>'.</p> <p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bciminerals.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf - Implementation of the Marine Environmental Quality Monitoring and Management Plan (Rev 6, dated 23 November 2022) available via: https://www.bciminerals.com.au/images/files/R190108_Mardie_MEQMMP_Rev6_FINAL_20221205.pdf - Scheduling of dredging works outside of key ecological window of significant marine fauna species (i.e. during April to September (inclusive)) - Report large marine fauna sightings to vessels. <p>Residual Risk Rating: Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Unlikely</u>', and a consequence of impact rating of '<u>Moderate</u>', resulting in a risk rating of '<u>Low</u>'.</p> <p>Additional Technical Data:</p> <ul style="list-style-type: none"> - Section Error! Reference source not found. of the Preliminary Documentation provides detail regarding marine MNES fauna that may utilise the habitat within DMPA4. - Section Error! Reference source not found. of the Preliminary Documentation provides detail regarding the impacts to marine MNES fauna.

Potential Impact	Relevant MNES	Assessment of Impacts
Injury and/or death of MNES marine fauna via entanglement with slurry pipeline and / or anchor points for the booster pumps	Australian Bottlenosed Dolphin Australian Humpback Dolphin Australian Snubfin Dolphin Blue Whale Dugong Dwarf Sawfish Flatback Turtle Giant Manta Ray Green Sawfish Green Turtle Grey Nurse Shark Hawksbill Turtle Humpback Whale Leaf-scaled Sea Snake Leatherback turtle Loggerhead Turtle Narrow Sawfish Reef Manta Ray Short-nosed Sea Snake Whale Shark White Shark	<p>Nature and extent of impact:</p> <p>The shallow marine environment restricts the method of transportation of dredge spoil onshore. In order to pump the dredge spoil slurry back to shore - over a long distance (between 4 km to 9 km) - the pipeline (diameter of approximately 1.5m) would require a number of booster pumps, located along the length of the pipeline), each of which would need to be anchored to the seabed. There is the possibility the pipeline and the tethering of the anchorages could lead to entanglement of MNES marine fauna.</p> <p>Unknown, unpredictable or irreversible impacts:</p> <p>This impact is generally unpredictable, as the presence of marine fauna beneath the pipeline and anchorage points is likely to be extremely rare and may not occur at all. Irreversible impacts could include the death of a MNES marine fauna species.</p> <p>Significance of impacts:</p> <p>This potential impact is unlikely to occur but could result in the loss of individuals on very rare occasions. Therefore, the risk to an MNES population is considered low.</p> <p>Inherent Risk Rating:</p> <p>The likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>High</u>', resulting in a risk rating of '<u>Medium</u>'.</p> <p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bcimineral.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bcimineral.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf - Implementation of the Marine Environmental Quality Monitoring and Management Plan (Rev 6, dated 23 November 2022) available via: https://www.bcimineral.com.au/images/files/R190108_Mardie_MEQMMP_Rev6_FINAL_20221205.pdf - Scheduling of dredging works outside of key ecological window of significant marine fauna species (i.e. during April to September (inclusive)) - Report large marine fauna sightings to vessels. <p>Residual Risk Rating:</p> <p>Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Unlikely</u>', and a consequence of impact rating of '<u>Moderate</u>', resulting in a risk rating of '<u>Low</u>'.</p> <p>Additional Technical Data:</p> <p>There is no additional technical data.</p>
Injury and/or alteration to marine MNES fauna behaviour via noise from the operation of the dredger, pumps required for the slurry pipeline and the vessel required to refuel the pumps	Australian Bottlenosed Dolphin Australian Humpback Dolphin Australian Snubfin Dolphin Blue Whale Dugong Dwarf Sawfish Flatback Turtle Giant Manta Ray Green Sawfish Green Turtle Grey Nurse Shark	<p>Nature and extent of impact:</p> <p>The onshore disposal of dredge spoil will produce marine noise from the dredger vessel movements, pumps required for the dredge spoil slurry pipeline, and vessels required to refuel to the pumps, which could lead to the injury or alteration of marine MNES fauna behaviour. The noise sources are not permanent and limited to the duration of the capital dredge event and each maintenance dredge event.</p> <p>Unknown, unpredictable or irreversible impacts:</p> <p>Marine noise impacts are known, and a risk assessment was undertaken to predict these impacts.</p> <p>No irreversible impacts are predicted from this direct impact.</p> <p>Significance of impacts:</p> <p>The inherent risk to the marine MNES fauna from the noise of the dredger, booster pumps for the slurry pipeline and refuelling vessels, is considered low.</p> <p>The probability of marine megafauna being within the vicinity of the Project dredge area for sufficient time periods to accumulate the requisite length of exposure to noise at damaging levels and the mitigating potential of the recommended management measures, further reduce risk profiles.</p> <p>Inherent Risk Rating:</p> <p>The likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>Moderate</u>', resulting in a risk rating of '<u>Medium</u>'.</p>

Potential Impact	Relevant MNES	Assessment of Impacts
	Hawksbill Turtle Humpback Whale Leaf-scaled Sea Snake Leatherback turtle Loggerhead Turtle Narrow Sawfish Reef Manta Ray Short-nosed Sea Snake Whale Shark White Shark	<p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bciminerals.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf - Implementation of the Marine Environmental Quality Monitoring and Management Plan (Rev 6, dated 23 November 2022) available via: https://www.bciminerals.com.au/images/files/R190108_Mardie_MEQMMP_Rev6_FINAL_20221205.pdf - Scheduling of dredging works outside of key ecological window of significant marine fauna species (i.e. during April to September (inclusive)) - Report large marine fauna sightings to vessels - Utilise low noise equipment where available and suitable. <p>Residual Risk Rating: Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Unlikely</u>', and a consequence of impact rating of '<u>Minor</u>', resulting in a risk rating of '<u>Low</u>'.</p> <p>Additional Technical Data: There is no additional technical data.</p>
Alteration to MNES marine fauna behaviour via artificial light spill to the marine environment	Flatback Turtle Green Turtle Hawksbill Turtle Leatherback Turtle Loggerhead Turtle	<p>Nature and extent of impact: The onshore disposal of dredge spoil will require lighting on dredge vessels and booster pumps for the slurry pipeline between the dredge channel and onshore disposal location, which may result in the alteration of marine MNES fauna behaviour.</p> <p>Unknown, unpredictable or irreversible impacts: No irreversible impacts are predicted from this direct impact.</p> <p>Significance of impacts: While exact light emissions are unable to be predicted, it is understood that the lighting will not be permanent but will include lighting on vessels and the booster pumps at night. The slurry pipeline route will traverse over the Mardie Marine Turtle beach. Through the implementation of the Marie Marine Turtle Monitoring Program (Rev 4), no marine turtle nesting has been recorded on this beach. No dredge spoil disposal will occur during the 1 October to 31 March environmental blackout period, during which turtle nesting takes place.</p> <p>Inherent Risk Rating: The likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>Moderate</u>', resulting in a risk rating of '<u>Medium</u>'.</p> <p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Illumination Plan (Rev 7, dated 1 May 2024) available via: https://www.bciminerals.com.au/images/files/Mardie%20Illumination%20Plan%20-%20Rev%207_Optimized.pdf - Implementation of the Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bciminerals.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf - Implementation of the Marie Marine Turtle Monitoring Program (Rev 4, dated July 2023) available via: https://www.bciminerals.com.au/images/files/BCI_MarineTurtleMonitoringProgram_Rev4_06072023.pdf - Scheduling of dredging works outside of key ecological window of significant marine fauna species (i.e. during April to September (inclusive)) - Consider design recommendations provided in the National Light Pollution Guidelines for Wildlife (DCCEEW 2023a) in order to ensure that lighting impacts are as low as practicable. - Monitoring and management of marine fauna as per the observation and exclusion zones.

Potential Impact	Relevant MNES	Assessment of Impacts
		<p>Residual Risk Rating:</p> <p>Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Unlikely</u>', and a consequence of impact rating of '<u>Moderate</u>', resulting in a risk rating of '<u>Low</u>'.</p> <p>Additional Technical Data:</p> <ul style="list-style-type: none"> - Section Error! Reference source not found. of the Preliminary Documentation provides detail regarding marine turtles and their habitat identified in proximity to the Proposed Action. - Section Error! Reference source not found. of the Preliminary Documentation provides detail regarding the impacts to marine MNES fauna. - Section Error! Reference source not found. of the Preliminary Documentation provides detail regarding impacts from artificial light. - Attachment 10 (Att10_Marine Turtle Monitoring Program 2023), Attachment 11 (Att11_Marine Turtle Survey Report 2024), and Attachment 12 (Att12_Marine Turtle Survey Report 2025) provide further technical information regarding marine turtles in the Approved Proposal area and surrounds.
Indirect Impacts		
Impact to MNES resulting from the declined health and/or loss of MNES fauna habitat via dust impacts from airborne dust from the dewatered dredge spoil stockpile	BCH Grey Falcon Migratory Shorebirds habitat Pilbara Leaf-nosed Bat Pilbara Olive Python Triodia grassland habitat	<p>Nature and extent of impact:</p> <p>The airborne dispersion of dredge spoil from the stockpile could impact the nearshore BCH (mangroves and algal mats), migratory shorebird habitat and grey falcon foraging habitat (refer to Figure 3 below, which assumes a 200m zone of impact from the onshore dredge spoil location).</p> <p>Unknown, unpredictable or irreversible impacts:</p> <p>The extent of the impacts is unknown and unpredictable based on the weather conditions and nature of the dredge spoil material (i.e. temperature, wind and timeframes for dredge spoil to dewater). The impacts may be irreversible and extend beyond the approved Project Development Envelope.</p> <p>Significance of impacts:</p> <p>While the exact extent of the impacts is not known it is likely that over the life of the Project, there will be some airborne dust from the dredge spoil stockpile that could impact adjacent MNES habitat.</p> <p>Indicative potential impacts to the MNES based on a 200m zone of impact (refer to Figure 3 below) are as follows:</p> <ul style="list-style-type: none"> - Up to 0.6 ha of algal mats - Up to 33.6 ha of Grey Falcon foraging - Up to 17.6 ha of migratory shorebird habitat - Up to 15.1 ha of coastal samphire (BCH) - Up to 2.2 ha of mangroves (BCH). <p>Inherent Risk Rating:</p> <p>The likelihood of the impact occurring has been given a rating of '<u>Likely</u>', and a consequence of impact rating of '<u>Major</u>', resulting in a risk rating of '<u>High</u>'</p> <p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bciminerals.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf - Application of dust suppression agent on the dewatered stockpile to reduce windborne dust <p>Residual Risk Rating:</p> <p>Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>Moderate</u>', resulting in a risk rating of '<u>Medium</u>'.</p>

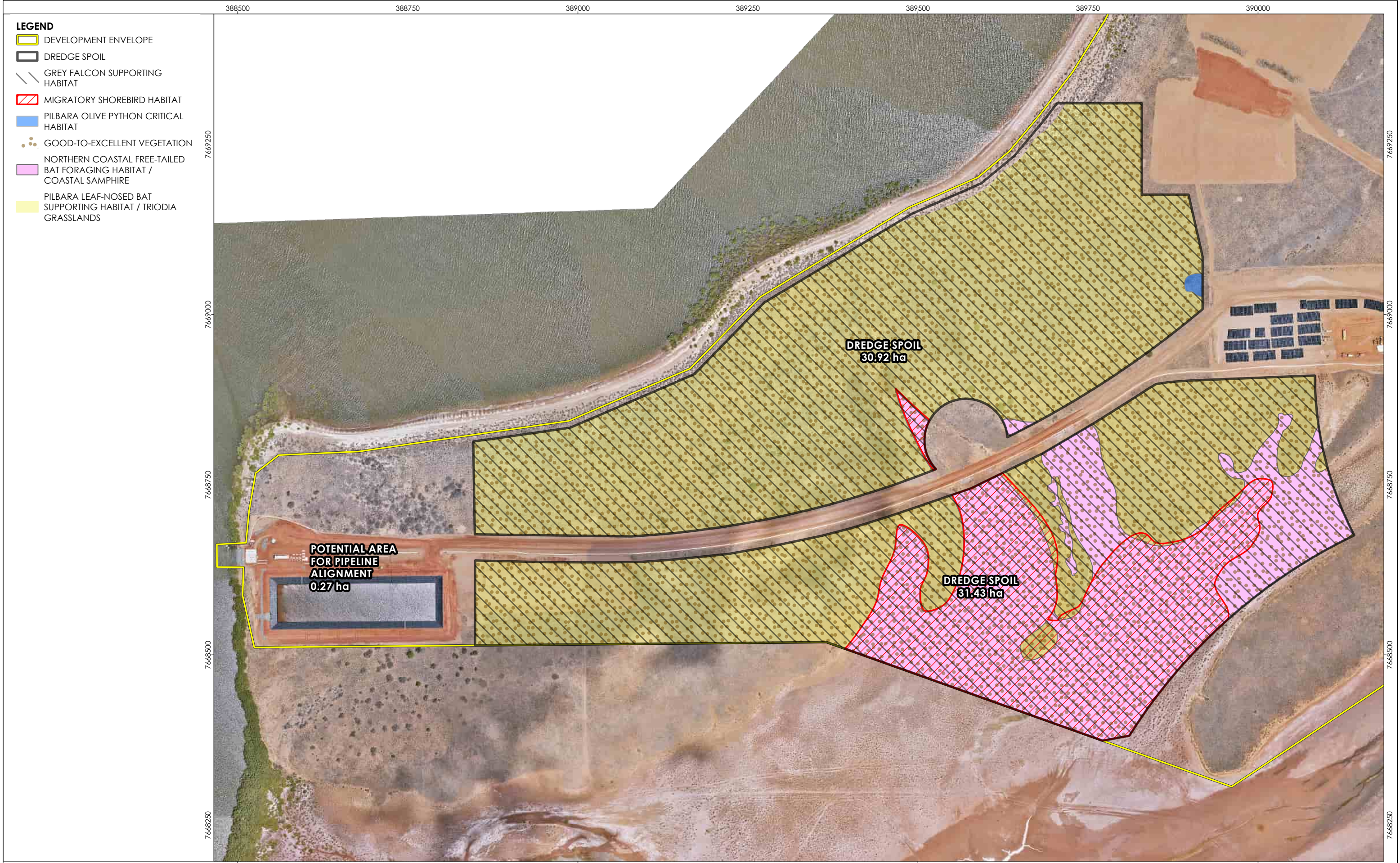
Potential Impact	Relevant MNES	Assessment of Impacts
		<p>Additional Technical Data:</p> <p>The Project is located in the southern Pilbara region, which has a tropical monsoon climate with distinct wet and dry seasons. The Pilbara coast is the most prone area along the Australian coastline, with the cyclone season running from mid-December to April, peaking in February- March.</p> <p>The dry season extends from May to October and is characterised by warm to hot temperatures, easterly to south-easterly winds from the continental landmass, clear and stable conditions, as the subtropical high-pressure ridge migrates over this area. In the afternoons, the winds generally shift to north-westerly, particularly later in the dry season, associated with the onset of the land sea breeze as the temperature difference between the continent and the ocean increases throughout the day. In the wet season the wind climate is dominated by westerly and north-westerly winds. Wind rose plots for the Dry Season months (May to October) and Wet Season months (November to April) based on analysis of the measured wind records from Mardie Airport over the period 2011 - 2018.</p> <p>Maximum daily temperatures at Mardie average 33.9 °C throughout the year, peaking at 38.0 °C in January and falling to 27.7 °C in July. The Pilbara is influenced by northern rainfall systems of tropical origin. These systems are responsible for heavy falls during the summer months, while the southern low-pressure systems sometimes bring limited winter rains. The annual average rainfall is only 128 mm, and the mean monthly rainfall has a bimodal distribution, peaking in January to March and also May to June, with very little rainfall from July to December. Daily rainfall can reach over 300 mm during extreme events that may occur one to two times per decade. Evaporation rates in the region are high, estimated to exceed by ten times the annual rainfall.</p>
Impact to MNES resulting from the declined health and/or loss of MNES terrestrial fauna habitat via altered groundwater quality from the seepage of water from the dredge spoil stockpile	BCH Grey Falcon Migratory Shorebirds habitat Pilbara Leaf-nosed Bat Pilbara Olive Python Triodia grassland habitat	<p>Nature and extent of impact:</p> <p>Seepage of contaminants from the dredge stockpile could impact the nearshore BCH (mangroves and algal mats), migratory shorebird habitat and grey falcon foraging habitat (refer to Figure 3 below, which assumes a 200m zone of impact from the onshore dredge spoil location) via alteration of the groundwater quality. All sediment samples collected within the dredge footprint recorded no potential acid sulfate soils (PASS) (O2 Marine, 2019a). Therefore, baseline sediment results indicate that dredge sediments reflect natural background conditions and are suitable for onshore disposal.</p> <p>Unknown, unpredictable or irreversible impacts:</p> <p>The extent of the impacts is unknown and unpredictable based on the dynamic nature of the groundwater movement and tidal interactions within the Project area. The impacts may be irreversible and extend beyond the approved Project Development Envelope.</p> <p>Significance of impacts:</p> <p>The exact extent and significance of the impact are not known.</p> <p>Inherent Risk Rating:</p> <p>The likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>High</u>', resulting in a risk rating of '<u>Medium</u>'</p> <p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bciminerals.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf <p>Residual Risk Rating:</p> <p>Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Unlikely</u>', and a consequence of impact rating of '<u>Moderate</u>', resulting in a risk rating of '<u>Low</u>'.</p> <p>Additional Technical Data:</p> <p>There is no additional technical data.</p>

Potential Impact	Relevant MNES	Assessment of Impacts
Impact to MNES resulting from the declined health and/or loss of MNES marine and terrestrial fauna habitat via smothering of dredge spoil material due to structural failure of the containment bund	Australian Bottlenosed Dolphin Australian Humpback Dolphin Australian Snubfin Dolphin BCH Blue Whale Dugong Dwarf Sawfish Flatback Turtle Giant Manta Ray Green Sawfish Green Turtle Grey Flacon Grey Nurse Shark Hawksbill Turtle Humpback Whale Leaf-scaled Sea Snake Leatherback turtle Loggerhead Turtle Migratory Shorebird habitat Narrow Sawfish Pilbara Leaf-nosed Bat Pilbara Olive Python Reef Manta Ray Short-nosed Sea Snake Triodia grassland Whale Shark White Shark	<p>Nature and extent of impact:</p> <p>Dispersion of dredge spoil from the stockpile could impact the nearshore BCH (mangroves and algal mats), migratory shorebirds habitat and grey falcon foraging habitat (refer to Figure 3 below, which assumes a 200m zone of impact from the onshore dredge spoil location).</p> <p>Unknown, unpredictable or irreversible impacts:</p> <p>The extent of the impacts is unknown and unpredictable based on the possible volume of dredge spoil contained within the onshore disposal area (i.e. capital dredge and unknown number of maintenance dredge events).</p> <p>Significance of impacts:</p> <p>The impacts may be irreversible and extend beyond the approved Development Envelope for the Mardie Project. Indicative potential impacts to the MNES based on a 200m zone of impact (refer to Figure 3) are as follows:</p> <ul style="list-style-type: none"> - Up to 0.6 ha of algal mats - Up to 33.6 ha of Grey Falcon foraging - Up to 17.6 ha of migratory shorebird habitat - Up to 15.1 ha of coastal samphire (BCH) - Up to 2.2 ha of mangroves (BCH). <p>Inherent Risk Rating:</p> <p>The likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>Critical</u>', resulting in a risk rating of '<u>Severe</u>'.</p> <p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bciminerals.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf <p>Residual Risk Rating:</p> <p>Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>Major</u>', resulting in a risk rating of '<u>High</u>'.</p> <p>Additional Technical Data:</p> <p>The Project is located in the southern Pilbara region, which has a tropical monsoon climate with distinct wet and dry seasons. The Pilbara coast is the most prone area along the Australian coastline, with the cyclone season running from mid-December to April, peaking in February to March.</p> <p>The dry season extends from May to October and is characterised by warm to hot temperatures, easterly to south-easterly winds from the continental landmass, clear and stable conditions, as the subtropical high-pressure ridge migrates over this area. In the afternoons, the winds generally shift to north-westerly, particularly later in the dry season, associated with the onset of the land sea breeze as the temperature difference between the continent and the ocean increases throughout the day. In the wet season the wind climate is dominated by westerly and north-westerly winds. Wind rose plots for the Dry Season months (May to October) and Wet Season months (November to April) based on analysis of the measured wind records from Mardie Airport over the period 2011 - 2018.</p> <p>Maximum daily temperatures at Mardie average 33.9 °C throughout the year, peaking at 38.0 °C in January and falling to 27.7 °C in July. The Pilbara is influenced by northern rainfall systems of tropical origin. These systems are responsible for heavy falls during the summer months, while the southern low-pressure systems sometimes bring limited winter rains. The annual average rainfall is only 128 mm, and the mean monthly rainfall has a bimodal distribution, peaking in January to March and also May to June, with very little rainfall from July to December. Daily rainfall can reach over 300 mm during extreme events that may occur one to two times per decade. Evaporation rates in the region are high, estimated to exceed by ten times the annual rainfall.</p> <p>The Australian cyclone season extends from November through to April with an average of 10 cyclones per year, although not all make landfall. Tropical cyclone winds can generate extreme coastal water levels through storm surge and these systems are frequently associated with heavy rainfall that can cause significant flooding. The Pilbara region of Western Australia has a high exposure to tropical cyclone events, with a typical cyclone track recurving and making landfall on the coastline between Broome and Exmouth. The season typically runs from mid-December to April, peaking in February and March. The Karratha to Onslow coastline is the most-cyclone prone section of the Australian coast, typically experiencing one landfalling event every two years. Historical events of significance impacting between Karratha and Onslow include: Trixie 1975, Chloe 1984, Orson 1989, Olivia 1996, John 1999, Monty 2004, Clare 2006 and Glenda 2006. In late March 2019, the passage of TC</p>

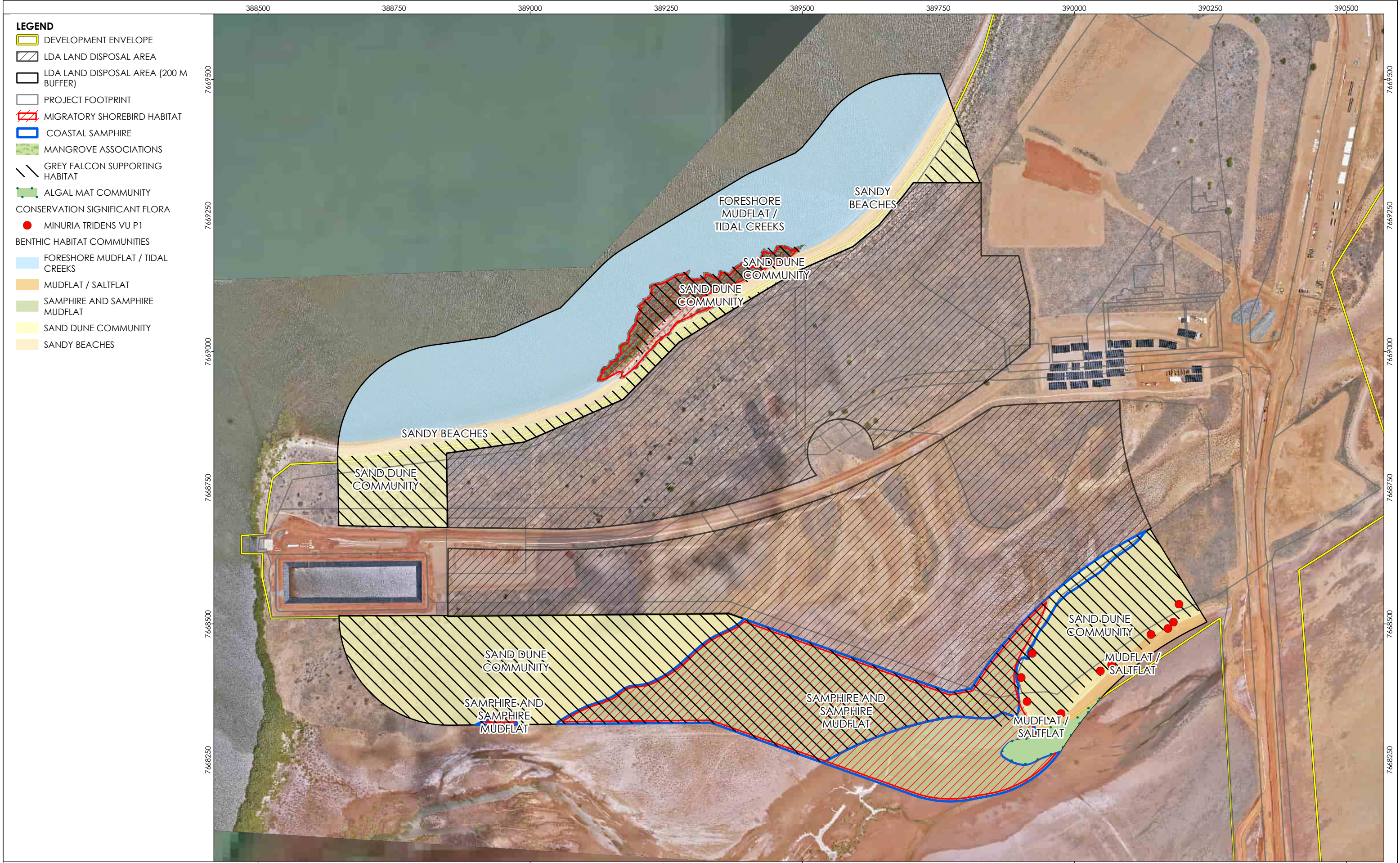
Potential Impact	Relevant MNES	Assessment of Impacts
		<p>Veronica tracked west over the region from offshore of Karratha losing intensity as it continued west offshore of Mardie as a tropical low system. In January and February 2025, TC Shaun and TC Zelia impacted the Mardie Project site and surrounding coastline.</p> <p>The northwestern coastline of Western Australia is highly vulnerable to the occurrence of storm surge. This is due to the frequency of tropical cyclones, the wide continental shelf and relatively shallow ocean floor over the North West Shelf, as well as the low-lying nature of much of the coastline. In addition, tropical cyclone events are strongly associated with flooding due to widespread heavy rainfall.</p>
Impact to MNES resulting from the decline in health and/or loss of MNES marine fauna habitat via introduced marine pests (IMP)	Australian Bottlenosed Dolphin Australian Humpback Dolphin Australian Snubfin Dolphin BCH Blue Whale Dugong Dwarf Sawfish Flatback Turtle Giant Manta Ray Green Sawfish Green Turtle Grey Flacon Grey Nurse Shark Hawksbill Turtle Humpback Whale Leaf-scaled Sea Snake Leatherback turtle Loggerhead Turtle Migratory Shorebird habitat Narrow Sawfish Pilbara Leaf-nosed Bat Pilbara Olive Python Reef Manta Ray Short-nosed Sea Snake Triodia grassland Whale Shark White Shark	<p>Nature and extent of impact: The dredging activities will require the use of vessels, pipelines and booster pumps, which may be brought to site from areas with high IMP risks, potentially resulting in IMP translocation.</p> <p>Unknown, unpredictable or irreversible impacts: No impacts would be considered unknown. The impacts of IMPs is understood. It is impossible to predict whether this impact would occur. If an IMP was to become fully established the impacts could potentially be irreversible.</p> <p>Significance of impacts: Vectors are the mechanism by which a potential marine pest can be translocated from donor to receiving node. Primary vectors of concern include biofouling on vessel hulls and other surfaces, ballast water, or other internal water or sediment carried by a vessel or marine equipment.</p> <p>Inherent Risk Rating: The likelihood of the impact occurring has been given a rating of '<u>Unlikely</u>', and a consequence of impact rating of '<u>High</u>', resulting in a risk rating of '<u>Medium</u>'.</p> <p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bciminerals.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf - Implementation of the Marine Pest Management Procedure (Rev 1, dated September 2022) available via: https://www.bciminerals.com.au/images/files/T210234_20211215_BCI_Marine_Pest_Management_Procedures_Rev1_dated.pdf <p>Residual Risk Rating: Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Rare</u>', and a consequence of impact rating of '<u>High</u>', resulting in a risk rating of '<u>Low</u>'.</p> <p>Additional Technical Data: There is no additional technical data.</p>

Potential Impact	Relevant MNES	Assessment of Impacts
Impact to MNES resulting from the increased emissions from fuel burning for the booster pumps on the slurry pipeline and for the boat required to refuel the booster pumps	Australian Bottlenosed Dolphin Australian Humpback Dolphin Australian Snubfin Dolphin BCH Blue Whale Dugong Dwarf Sawfish Flatback Turtle Giant Manta Ray Green Sawfish Green Turtle Grey Falcon Grey Nurse Shark Hawksbill Turtle Humpback Whale Leaf-scaled Sea Snake Leatherback turtle Loggerhead Turtle Migratory Shorebirds habitat Narrow Sawfish Pilbara Leaf-nosed Bat Pilbara Olive Python Reef Manta Ray Short-nosed Sea Snake Triodia grassland habitat Whale Shark White Shark	<p>Nature and extent of impact: Increased greenhouse gas emissions from burning of fuel for the operation of the booster pumps for the dredge spoil slurry pipeline.</p> <p>Unknown, unpredictable or irreversible impacts: No impacts would be considered unknown, unpredictable or irreversible.</p> <p>Significance of impacts: Localised alteration of air quality would be short-term for the duration of the dredge program.</p> <p>Inherent Risk Rating: The likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>Moderate</u>', resulting in a risk rating of '<u>Medium</u>'.</p> <p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bciminerals.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf <p>Residual Risk Rating: Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>Moderate</u>', resulting in a risk rating of '<u>Medium</u>'.</p> <p>Additional Technical Data: There is no additional technical data.</p>

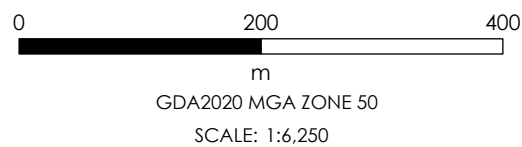
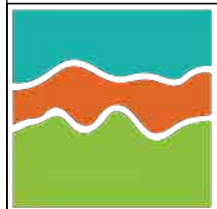
Potential Impact	Relevant MNES	Assessment of Impacts
Impact to MNES resulting from the decline and/or loss of MNES marine and terrestrial fauna habitat due to mobilisation of dredge spoil sediments into tidal creeks and sensitive nearshore environments during severe weather events (e.g. cyclones)	Australian Bottlenosed Dolphin Australian Humpback Dolphin Australian Snubfin Dolphin BCH Blue Whale Dugong Dwarf Sawfish Flatback Turtle Giant Manta Ray Green Sawfish Green Turtle Grey Nurse Shark Hawksbill Turtle Humpback Whale Leaf-scaled Sea Snake Leatherback turtle Loggerhead Turtle Migratory Shorebirds habitat Narrow Sawfish Reef Manta Ray Short-nosed Sea Snake Whale Shark White Shark	<p>Nature and extent of impact:</p> <p>Reduction in marine MNES fauna use of the water column. The size of impacted areas will vary depending on hydrodynamic conditions at the time. Some impacts may occur if beyond the approved Mardie Development Envelope.</p> <p>Unknown, unpredictable or irreversible impacts:</p> <p>The size of the impacted areas will vary, depending on the volume of sediment mobilised, hydrodynamic condition and frequency of weather events.</p> <p>Significance of impacts:</p> <p>Mobilisation of spoil sediments into the nearshore environment have the potential to change water quality indirectly impacting marine MNES fauna behaviour by reducing light penetration through the water column. The sediment plumes are likely to spike for short periods immediately following a severe weather event. The extent of the impacts may extend beyond the approved Project Development Envelope.</p> <p>Inherent Risk Rating:</p> <p>The likelihood of the impact occurring has been given a rating of '<u>Likely</u>', and a consequence of impact rating of '<u>Major</u>', resulting in a risk rating of '<u>High</u>'.</p> <p>Avoidance and Mitigation Measures:</p> <ul style="list-style-type: none"> - Implementation of the Construction Environmental Management Plan (Rev 2c, dated June 2024) available via: https://www.bciminerals.com.au/images/files/CONSTRUCTION_ENVIRONMENTAL_MANAGEMENT_Rev_2c.pdf - Implementation of the Mardie Project Dredge Management Plan (Rev 7, dated May 2023) available via: https://www.bciminerals.com.au/images/files/10.%20Dredge%20Management%20Plan%20-%20%20Rev%207%20-%20O2%20Marine%202023.pdf <p>Residual Risk Rating:</p> <p>Following the application of the above avoidance and mitigation measures, the likelihood of the impact occurring has been given a rating of '<u>Possible</u>', and a consequence of impact rating of '<u>Moderate</u>', resulting in a risk rating of '<u>Medium</u>'.</p> <p>Additional Technical Data:</p> <p>The Project is located in the southern Pilbara region, which has a tropical monsoon climate with distinct wet and dry seasons, and is prone to cyclones. The Australian cyclone season extends from November through to April with an average of 10 cyclones per year, although not all make landfall. Tropical cyclone winds can generate extreme coastal water levels through storm surge and these systems are frequently associated with heavy rainfall that can cause significant flooding. The Pilbara region of Western Australia has a high exposure to tropical cyclone events, with a typical cyclone track recurving and making landfall on the coastline between Broome and Exmouth. The season typically runs from mid-December to April, peaking in February and March. The Karratha to Onslow coastline is the most-cyclone prone section of the Australian coast, typically experiencing one landfalling event every two years. Historical events of significance impacting between Karratha and Onslow include Trixie 1975, Chloe 1984, Orson 1989, Olivia 1996, John 1999, Monty 2004, Clare 2006 and Glenda 2006. In late March 2019 the passage of TC Veronica tracked west over the region from offshore of Karratha losing intensity as it continued west offshore of Mardie as a tropical low system. In January and February 2025, TC Shaun and TC Zelia impacted the Mardie Project site and surrounding coastline.</p> <p>The northwestern coastline of Western Australia is highly vulnerable to the occurrence of storm surge. This is due to the frequency of tropical cyclones, the wide continental shelf and relatively shallow ocean floor over the North West Shelf, as well as the low-lying nature of much of the coastline. In addition, tropical cyclone events are strongly associated with flooding due to widespread heavy rainfall.</p>







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MARDIE PROJECT ONSHORE SPOIL DISPOSAL POTENTIAL IMPACTS TO MNES CONTAINMENT BUND FAILURE

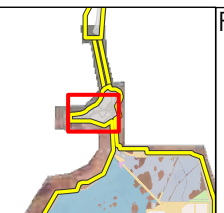


FIGURE:

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