

Attachment 4

Aspects	Potential Impacts as Assessed within SAR	Current Conceptual Port Facility Layout	Conclusion
Tidal Regimes, Wave Climate, Current and Hydrodynamics			
Site disturbance/ excavation	<p>Section 2.1.3 Part 3 The SAR recognises that the BLNG Precinct marine infrastructure has the potential to cause both direct and indirect impacts on physical factors through changes to the seabed.</p> <p>Hydrodynamic modelling is not presented in the SAR, as a conceptual port design had not been developed at the time of submission. However, based on a Coastal Processes Sediment Transport Study (DHI, 2010) it is determined that the change to the local wave and current climate will be minor relative to the semi-diurnal inundations and oscillations naturally experienced in the James Price Point coastal area.</p>	Given that the SAR determines that any changes to the local wave and current climate will be minor relative to naturally occurring conditions, it is highly unlikely that moving the marine/coastal interface of the IMF further inland by several hundred metres would have different outcome with respect to currents and waves as that determined in the SAR.	Impacts as assessed in SAR

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Physical presence	<p>Section 2.1.3 Part 3</p> <p>The SAR determines that potential impacts on coastal processes associated with the physical presence of the BLNG Precinct, include:</p> <ul style="list-style-type: none"> • the impoundment of sediment against shore-crossing structures; • modification of inshore tidal currents and sediment transport pathways; and • changes to the transportation of sediment along the James Price Point coastal area. <p>Sediment transport modelling is not presented in the SAR, as a conceptual port design had not been developed at the time of submission. However, based on a Coastal Processes Sediment Transport Study (DHI, 2011) it is determined that potential impacts to coastal processes are likely to be localised due to the weak alongshore drift and minor in comparison to existing natural processes such as the movement of sediment by tidal forces and tropical cyclones.</p> <p>Following development of the conceptual Port infrastructure design, coastal processes were modelled, and the results made publically available in Section 5 of Part 7 of the SAR.</p> <p>The supplementary coastal process report finds that the existing coastal sediment transport regime will be relatively unaffected along the coastline outside the immediate area sheltered by the Precinct. Nonetheless, the port will act as a “sediment sink” and this will result in sediment starvation of local beaches within approximately 2-3 km north and south of the port in the short to medium term. It is expected that the predicted impacts to the local coastal geomorphology can be successfully mitigated by the application of best practice management and design measures, consistent with the commitments outlined in the SAR.</p>	<p>A review of the implications of the footprint of current conceptual layout of the IMF would shift the southern boundary of the cell north, resulting in a smaller cell. The area of accretion would shift north, remaining immediately adjacent to the revised Port facilities, within the sheltered area. The area of accretion may be slightly smaller due to decreased volume of sediment (smaller cell) and decreased area of shelter. The area of erosion may also become slightly smaller, with the shift of structures and the area of accretion northward.</p>	<p>Minor reduction in accretion footprint</p>

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Marine Sediment Quality			
Marine site disturbance and excavation	<p>Section 2.3.3.1 of Part 3</p> <p>The SAR predicts the greatest impacts to marine sediment quality from marine site disturbance and excavation to be changes in the sediment structure and particle size distribution at disturbed sites, mobilisation of bioavailable contaminants (only likely to occur during maintenance dredging), de-oxygenation of sediments and a reduction in sediment infauna and epifauna at the spoil disposal sites.</p> <p>The SAR determines that de-oxygenation impacts would be highly localised and likely to be temporary and as such considered to be minor. Impacts to infauna and epifauna are likely to be temporary (< 5 years) and localised to the dredged spoil disposal ground.</p>	<p>The IMF, which is a component of the Precinct Port, will be constructed using a combination of on-land excavation and marine dredging methods. Suitable soils collected during from the land-based excavation will be used for construction. Remaining removed material will be disposed of in offshore spoil grounds which are located beyond the 3 nm state limit.</p> <p>Changes in sediment structure and particle size distribution, and the mobilisation of bioavailable contaminants, due to marine dredging for the IMF, including small vessel harbour and tug pens would be as described in the SAR.</p> <p>De-oxygenation of sediments and a reduction in sediment infauna and epifauna due to disposal of excavated material being disposed off the offshore spoil grounds at the spoil disposal sites would be addressed through the Commonwealth Sea Dumping permit.</p>	Impacts as assessed in SAR
Sediment deposition and turbidity	<p>Section 2.3.3.2 of Part 3</p> <p>The SAR identifies that sediment deposition would potentially impact marine sediment quality via changes to deposition regimes, particle size distribution and the diversity and abundance of benthic infauna and epifauna. In addition, contaminants accumulated over then operational life of the BLNG Precinct may be disturbed during maintenance and deposited within the extent of the dredge plume.</p> <p>The impacts would be localised and short term given the natural coastal processes. The significance of the residual impact from the BLNG Precinct on sediment quality is assessed to be low because of the localised and short-term nature of the impacts.</p>	The current estimated dredging required for the establishment of the Port (including the IMF) of 21 Mm ³ includes any marine dredging associated with the IMF. Therefore, any impacts due to sediment deposition and turbidity generated from dredging associated with the IMF are as described in the SAR.	Impacts as assessed in SAR

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Marine Water Quality			
Marine site disturbance and excavation	<p>Section 2.2.4.1 of Part 3</p> <p>The SAR identifies a reduction in water quality due to an increase in turbidity (i.e. total suspended sediments) and a reduction in benthic light availability (i.e. increased light attenuation) as being potential impacts due to marine site disturbance and excavation.</p>	<p>The current estimated dredging required for the establishment of the Port (including the IMF) of 21 Mm³ includes any marine dredging associated with the IMF. Therefore, any impacts due to sediment deposition and turbidity generated from dredging associated with the IMF are as described in the SAR.</p>	<p>Impacts as assessed in SAR</p>
Benthic Primary Producers			
Marine site disturbance and excavation	<p>Section 2.4.3.1 of Part 3</p> <p>The SAR identifies the main impacts on Benthic Primary Producers due to marine site disturbance and excavation to be the permanent direct removal of sub-tidal primary producers and habitats due to dredging and the smothering mortality of sub-tidal benthic producers and habitats due to dredge spoil disposal.</p> <p>The SAR defines the lethal affect on benthos (with recovery within 5 years being unlikely) to be the area beneath the dredge footprint and for approximately 1 km surrounding nearshore marine infrastructure. While acknowledging that the eventual area occupied by marine infrastructure is likely to only encompass a subset of the broader Precinct Part area, the SAR assumes that the excavation and removal of substrate will directly impact the entire BLNG Precinct Port.</p>	<p>Given that the SAR assumes that the excavation and removal of substrate will directly impact the entire BLNG Precinct Port, any impacts on benthic primary producers due to marine site disturbance and excavation associated with the IMF are as described in the SAR.</p>	<p>Impacts as assessed in SAR</p>
Sediment deposition and turbidity	<p>Section 2.4.3.2 of Part 3</p> <p>Dredging will result in both fine and coarse sediments being suspended within the water column which will lead to a reduction in benthic light availability. Light reduction will cause an indirect effect of reduced productivity from photosynthetic BPPS. While the effect may cause mortality to some BPPH and BPPs, it is assumed that this will be a temporary loss or partial mortality (for corals and sponges), as the underlying conditions supporting re-colonisation and/or recovery will be present after the activity has been completed.</p> <p>The significance of the residual impact on seagrass, algal</p>	<p>Given that the SAR assumes that the excavation and removal of substrate will directly impact the entire BLNG Precinct Port, the sediment deposition and turbidity footprint of the IMF and resultant impacts on benthic primary producers are included in the assessment presented in the SAR.</p>	<p>Impacts as assessed in SAR</p>

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	and filter-feeding communities is determined to be medium due to the relative abundance in the area. The significance of the residual impact on corals is determined to be low due to their low abundance in the area.		
Fish			
Physical presence of marine infrastructure	<p>Section 2.5.4.1 of Part 3</p> <p>The SAR describes the impacts to fish as a result of the physical presence of marine infrastructure to be associated with loss of connectivity between habitats (fragmentation), shading of surrounding areas and the provision of additional habitat. However, the impact assessment determines the significance of the residual impacts as being very low given the localised nature of the marine infrastructure associated with the BLNG Precinct, and it is likely that there will be no detectable impacts to fish communities or populations.</p>	The current conceptual layout for the Port and IMF does not vary significantly from any of the four potential layouts presented in the SAR, therefore it is expected that the predicted impacts on fish would not change from that discussed in the SAR.	Impacts as assessed in SAR
Marine site disturbance and excavation	<p>Section 2.5.4.2 of Part 3</p> <p>The SAR recognises that the direct burial and/or removal of benthic habitat by construction activities, including dredging and dredge spoil disposal will result in the permanent loss of habitat occupied by fish communities, within the footprint of the BLNG Precinct. Furthermore, the indirect impacts to marine fish from habitat loss are not likely to be significant, given that the habitats types are found to be extensive, both locally and regionally.</p>	The current conceptual IMF layout does not require any additional dredging beyond that considered in the SAR, nor has the location of the dredging changed. Therefore it is expected that residual impacts on marine fish resulting from marine site disturbance and excavation arising from construction of the current conceptual IMF layout would not differ from those described in the SAR.	Impacts as assessed in SAR
Sediment deposition and turbidity	<p>Section 2.5.4.3 of Part 3</p> <p>Impacts from sediment deposition and turbidity may be both direct via changes to fish physiological and behavioural patterns and indirect through loss of phytoplankton with flow on effects through the food chain impacting recruitment and from a loss of, or change to, benthic habitat.</p> <p>Fish within James Price Point coastal area are expected to be able to withstand periodic increases in suspended sediments as high as 30 mg/l, as seen during the wet season spring tides, with short peaks as high as 90 mg/l.</p>	The current conceptual IMF layout does not require any additional dredging beyond that considered in the SAR, nor has the location of the dredging changed. Therefore it is expected that residual impacts on marine fish resulting sediment deposition and turbidity arising from construction of the current conceptual IMF layout would not differ from those described in the SAR.	Impacts as assessed in SAR

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	Due to the immediate effects of flight response in most fish, the SAR predicted that fish will move away and adopt avoidance behaviour during dredging operations.		
Marine Mammals			
<p>Marine site disturbance and excavation</p> <p>Sediment deposition and turbidity</p>	<p>Section 2.6.3.2 of Part 3</p> <p>The most significant sediment deposition and turbidity generating activities will be the operations required to dredge access channels, turning basins and berth pockets and associated spoil disposal, including the propeller wash that may be caused by vessels manoeuvring in shallow areas close to sensitive habitats.</p> <p>There is no evidence that humpbacks navigate through the use of visual cues and thus an increase in turbidity associated with dredging is unlikely to cause behavioural responses.</p> <p>Similarly, dugongs are not likely to be impacted by a reduction in water quality associated with increased suspended sediments or sediment deposition as such species are well adapted to low visibility turbid environments.</p> <p>The SAR does not anticipate that any impacts associated with marine site disturbance and excavation activities (other than vessel movements) would affect humpback whales, as works are expected to be localised and largely contained within the BLNG Precinct Port area.</p>	<p>The current conceptual IMF layout does not require any additional dredging beyond that considered in the SAR, nor has the location of the dredging changed. Therefore it is expected that residual impacts on marine mammals resulting from marine site disturbance and excavation, and sediment deposition and turbidity arising from construction of the current conceptual IMF layout would not differ from those described in the SAR.</p>	<p>Impacts as assessed in SAR</p>
Marine Reptiles			
<p>Marine site disturbance and excavation</p> <p>Sediment deposition and turbidity</p>	<p>Section 2.7.3.2 of Part 3</p> <p>A review of published literature revealed no evidence that marine turtles are adversely affected by localised and short term increases in turbidity.</p> <p>The SAR determines that it is unlikely that increased turbidity generated during dredging and dredged spoil activities would have a direct impact on marine reptiles. There could be a temporary, localised, indirect impact on</p>	<p>The current conceptual IMF layout does not require any additional dredging beyond that considered in the SAR, nor has the location of the dredging changed. Therefore it is expected that residual impacts on marine reptiles resulting from marine site disturbance and excavation, and sediment deposition and turbidity arising from construction of the current conceptual IMF layout would not differ from those described in the SAR.</p>	<p>Impacts as assessed in SAR</p>

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	<p>reptiles associated with the loss of benthos, resulting in a reduction in foraging habitat. The significance of the residual impact is assessed as being low, given that the James Price Point coastal area does not support consistently high densities of turtles and direct and indirect impacts are unlikely to result in turtle population level effects.</p>		
Light emissions	<p>Section 2.7.3.4 of Part 3</p> <p>Artificial lighting associated with the construction and operation of the BLNG Precinct has the potential to impact marine turtles by decreasing nesting attempts on the beach, disorienting hatchlings emerging from nests and increasing hatchling exposure to predation.</p> <p>Direct lighting and light spill largely may potentially be visible from sections of James Price Point and Murdudun beaches. However, both beaches have had very low level nesting use recorded in surveys. Potential disruption to this nesting activity is considered to be insignificant in the context of more suitable regionally significant nesting grounds such as the Lacepede Islands.</p>	<p>It is anticipated that the change in direct lighting and light spill on James Price Point and Murdudun beaches would be minor, if at all. As the beaches have very low nesting use, it is expected that residual impacts on marine reptiles resulting from light arising from construction and operation of the current conceptual IMF layout would not differ from those described in the SAR.</p>	Impacts as assessed in SAR
Soils and Geomorphology			
Site disturbance and excavation	<p>Section 2.1.3.1 of Part 4</p> <p>Construction activities along the coastal dune system have the potential to affect sand movements patterns and dune stability. However, the SAR determined that the coastal dunes at James Price Point coastal area are well vegetated and relatively stable and it is considered unlikely that significance dune movement would occur.</p>	<p>As stated in the SAR, the construction of the Port area and marine facility would require the direct removal of up to 110 ha. The clearing footprint corresponding to the latest conceptual layout for the IMF is totally contained within this 110 ha allowance. No additional clearing of land (including monsoon vine thicket and drainage vegetation communities) is required beyond that discussed within the SAR.</p>	Impacts as assessed in SAR
Surface Water			
Site disturbance and excavation	<p>Section 2.2.3.2 of Part 4</p> <p>The SAR identifies that terrestrial site disturbance and excavation associated with the BLNG Precinct is likely to be associated with temporary and/or permanent alterations to catchment characteristics. Any residual impacts are determined to be localised and only minor</p>	<p>The clearing footprint corresponding to the latest conceptual layout for the IMF is totally contained within the Port Facilities footprint assessed within the SAR. Therefore no additional impacts on surface water due to site disturbance and excavation considered in the SAR are anticipated.</p>	Impacts as assessed in SAR

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	changes in sub-catchment surface water hydrology and flow regimes within the BLNG Precinct is expected.		
Physical presence of infrastructure	<p>Section 2.2.3.3 of Part 4</p> <p>The SAR recognises that construction of the Port Facilities, including the IMF, will cause changes to the existing catchment hydrology through the diversion of a natural drainage channel. However, the SAR determines that the significance of residual impacts is low because the majority of the impacts will be minimised or avoided through the design of infrastructure to manage surface flows. Any impacts would be localised and only a minor change in sub-catchment surface water hydrology and flow regimes is expected.</p>	The physical presence associated with the latest conceptual layout for the IMF is totally contained within the Port Facilities footprint assessed within the SAR. Therefore no additional impacts on surface water due to physical presence of the latest conceptual IMF layout are anticipated.	Impacts as assessed in SAR
Groundwater			
Physical presence of infrastructure Site disturbance and excavation	<p>Sections 2.3.3.1 and 2.3.3.2 of Part 4</p> <p>The SAR considers both direct and indirect impacts on groundwater from the construction and operation of the BLNG Precinct. For the purposes of the assessment it is considered that direct impacts would largely be confined to areas of direct disturbance within the BLNG Precinct.</p> <p>Detailed hydrogeological investigations and modelling are not presented in the SAR, due to site access issues.</p> <p>The SAR determines that any impacts on groundwater are likely to be localised and permanent. Furthermore, the SAR determines that whilst this may not be significant in a regional context, changes in superficial aquifers may impact sensitive vegetation communities, such as monsoon vine thicket and drainage basin vegetation and/or any springs of ecological/cultural significance.</p> <p>The SAR concludes that impacts on groundwater will be managed through the implementation of appropriate management and mitigation measures such as designing to minimise saltwater intrusion and potential impacts on groundwater dependent ecosystems, and implementing a groundwater monitoring program to monitor for potential</p>	<p>Although salt water intrusion resulting from the construction and operation of the IMF was not explicitly discussed in the SAR, impacts on groundwater as a consequence of the physical presence of the BLNG Precinct were discussed.</p> <p>With the current lack of certainty with respect to the hydrogeology underlying the IMF and the gaps in knowledge with respect to the level of dependence of monsoon vine thicket and drainage communities on groundwater, it is not possible to quantify the significance or likelihood of indirect impacts if saltwater intrusion does occur. If the selected IMF design includes excavation across the coastline to inland areas, the contractor will be required to demonstrate design measures to avoid saltwater intrusion, such measures are likely to include the construction of an impermeable barrier.</p>	Potential change in aspect due to saltwater intrusion, can be managed during design phase.

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	<p>impacts on groundwater, including saltwater interfaces.</p> <p>The SAR proposes that groundwater conditions within the James Price Point coastal area and the presence of groundwater dependent vegetation communities would be further investigated as part of future hydrogeological studies and modelling. However, evaluation of the likely level of groundwater dependence of the monsoon vine thickets and drainage basin vegetation communities has been delayed due to access restrictions preventing field investigations from occurring. When access is possible, detailed groundwater mapping will be used to inform a groundwater operating strategy for construction and operation.</p>		
Flora and Vegetation			
Vegetation and habitat clearing	<p>Section 2.4.3.1 of Part 4</p> <p>The SAR identifies that clearing of a maximum of 3,037 ha would be required to facilitate construction and development of the BLNG Precinct and associated infrastructure. This estimate includes 110 ha of land required to establish the Precinct port area (including the IMF).</p>	As stated in the SAR, the construction of the Port area and marine facility would require the direct removal of up to 110 ha. The clearing footprint corresponding to the latest conceptual layout for the IMF is totally contained within this 110 ha allowance. No additional clearing of land (including monsoon vine thicket and drainage vegetation communities) is required beyond that discussed within the SAR.	Impacts as assessed in SAR
Physical presence of infrastructure	<p>Section 2.4.3.5 of Part 4</p> <p>The SAR recognises that the physical presence of the BLNG Precinct (including the IMF) and subsequent alterations of minor drainage channels have the potential to degrade vegetation communities which are sensitive to surface water flows. Communities within the James Price Point which may be sensitive the surface water flows include the drainage basin habitat and the monsoon vine thicket habitat.</p> <p>The SAR determines that alterations to natural surface water flow regimes that may result from the physical presence of the infrastructure within the BLNG Precinct can be mitigated by implementation of measures</p>	The physical presence associated with the latest conceptual layout for the IMF is totally contained within the Port Facilities footprint assessed within the SAR. Therefore no additional impacts on flora and vegetation due to the physical presence of the latest conceptual IMF layout are anticipated.	Impacts as assessed in SAR

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	<p>described in the Ecological Surface Water Requirements Management Plan.</p> <p>Given the localised nature and scale of such impacts and the implementation of the management and mitigation measures, the SAR assesses that the significance of the residual impacts to be low.</p>		
<p>Site disturbance and excavation</p>	<p>Section 2.4.3.6 of Part 4</p> <p>The SAR recognises that monsoon vine thicket and drainage basin communities which are likely to be reliant on a combination of surface water flows, groundwater and superficial aquifers present within coastal dune systems, could experience a decline in condition and a 'retreat' in the extent of vegetation due to changes in groundwater regimes.</p> <p>The SAR determines that whilst this may not be significant in a regional context, changes in superficial aquifers may impact sensitive vegetation communities, such as monsoon vine thicket and drainage basin vegetation and/or any springs of ecological/cultural significance.</p> <p>The SAR concludes that impacts on groundwater will be managed through the implementation of appropriate management and mitigation measures such as designing to minimise saltwater intrusion and potential impacts on groundwater dependent ecosystems, and implementing a groundwater monitoring program to monitor for potential impacts on groundwater, including saltwater interfaces.</p> <p>The SAR proposes that groundwater conditions within the James Price Point coastal area and the presence of groundwater dependent vegetation communities would be further investigated as part of future hydrogeological studies and modelling. However, evaluation of the likely level of groundwater dependence of the monsoon vine thickets and drainage basin vegetation communities has been delayed due to access restrictions preventing field investigations from occurring. When access is possible,</p>	<p>Although salt water intrusion resulting from the construction and operation of the IMF was not explicitly discussed in the SAR, impacts on groundwater as a consequence of the site disturbance and excavation are discussed. The SAR determines that any impacts on groundwater are likely to be localised and permanent.</p> <p>With the current lack of certainty with respect to the hydrogeology underlying the IMF and the gaps in knowledge with respect to the level of dependence of monsoon vine thicket and drainage communities on groundwater, it is not possible to quantify the significance or likelihood of indirect impacts if saltwater intrusion does occur. If the selected IMF design includes excavation across the coastline to inland areas, the contractor will be required to demonstrate design measures to avoid saltwater intrusion, such measures are likely to include the construction of an impermeable barrier.</p>	<p>Potential change in aspect due to saltwater intrusion, can be managed during design phase.</p>

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	detailed groundwater mapping will be used to inform a groundwater operating strategy for construction and operation.		
Fauna			
Vegetation and habitat clearing	<p>Sections 2.6.3.1 and 2.6.3.3 of Part 4</p> <p>The SAR identifies that clearing of a maximum of 3,037 ha would be required to facilitate construction and development of the BLNG Precinct and associated infrastructure. This estimate includes 110 ha of land required to establish the Precinct port area (including the IMF).</p> <p>This disturbance is not expected to affect conservation significant fauna species as suitable habitat will continue to persist for these species both in the vicinity of James Price Point coastal area and elsewhere on the Dampier Peninsula.</p>	As stated in the SAR, the construction of the Port area and marine facility would require the direct removal of up to 110 ha. The clearing footprint corresponding to the latest conceptual layout for the IMF is totally contained within this 110 ha allowance. No additional clearing of land (including monsoon vine thicket and drainage vegetation communities) is required beyond that discussed within the SAR	Impacts as assessed in SAR
Site disturbance and excavation	<p>Fragmentation of fauna habitat resulting from clearing activities is likely to result in the isolation of a few individuals only, populations of these species, as well as other reptiles and ground-dwelling mammals, are unlikely to be significantly impacted.</p>		