

# Chapter 16

## Impact Assessment Summary

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## 16.1 INTRODUCTION

Through the EIA process a number of positive and negative potential impacts of the Project have been identified and assessed in *Chapters 11- 13* of this EIA Report. This chapter provides a summary of the impacts from planned and unplanned Project activities and is structured as follows:

- *Section 16.2* - Summary of Predicted Impacts from Planned Project Activities
  - Summary of Offshore and Near Shore Environmental Impacts
  - Summary of Onshore Environmental Impacts
  - Summary of Socio-economic Impacts
- *Section 16.3* - Summary of Unplanned Events
- *Section 16.4* - Summary of Cumulative Impacts

## 16.2 SUMMARY OF PREDICTED IMPACTS FROM PLANNED PROJECT ACTIVITIES

### 16.2.1 Summary of Offshore and Near Shore Environment Impacts

An overview of potential environmental impacts to the Offshore and Near Shore environment associated with Project activities is provided in *Table 16.1*. The table outlines the pre-mitigation and post-mitigation (or residual) impact significance for each impact assessed in *Chapter 11*.

The sections below provide a summary of the key impacts to the Offshore and Near Shore environment.

#### *Offshore*

The drilling of the offshore production wells will be the primary activity likely to result in potential impacts to water quality and marine ecology (such as whales, dolphins and benthos) in the offshore area. With the implementation of mitigation measures, all residual impacts are predicted to be of NEGLIGIBLE and MINOR significance in the offshore marine environment.

Dispersion modelling of the deposition of treated cuttings and the sensitivity of offshore benthic fauna and flora indicates that impacts from physical inundation (burial and change in sediment grain size) will be of MINOR significance before and after mitigation. The deepwater reef structures and associated organisms, however, will be placed at risk of enduring acute effects. The recovery of reef structures is expected to take an appreciable amount of time due to generally slow growth rates of these organisms. Therefore the predicted impact to offshore reef communities may potentially

be of MODERATE significance, although it should be noted that both the high and low-relief structures observed in the deepwaters offshore largely comprise scattered rock and sediment, and do not apparently support high densities of fauna (see *Chapter 7*). With the implementation of mitigation, this will be reduced to MINOR.

Impacts on benthic marine organisms or those in the water column (ie plankton) from discharges of residual drilling muds (WBM and/or SBM) are predicted to be of MINOR significance because of low toxicities of the quantities and types of muds used/or discharged to the offshore environment. Impacts will be reduced to NEGLIGIBLE with the implementation of mitigation.

The impacts on marine ecology and/or marine ecological processes associated with the discharge of hydrotest water at depths of approximately 1,500m in the offshore gas fields during commissioning (ie the construction phase) will be NEGLIGIBLE. Similarly, potential impacts from vessel and helicopter noise, lighting and movements to offshore marine ecology (birds, fish, benthic fauna etc) with the exception of marine mammals will be NEGLIGIBLE. Effects of vessel collisions or disturbance on whales may be more severe due to their conservational importance and the associated impact is predicted to be of MODERATE significance however, mitigation measures outlined in *Chapter 11* specific to whales will ensure that vessel collisions with whales are avoided and thus impact significance is reduced to NEGLIGIBLE.

Changes to the character of the sea bed are likely to result from the addition of hard substrate (subsea infrastructure). This may result in changes to the benthic community structure (ie altered habitat may become colonisation by others organisms) considered to be of MODERATE significance, particularly where deep water reef structures with corals, tunicates and other sessile fauna are affected. Mitigation will result in restricting the residual impact to the apparently vast area of unconsolidated sediments in the offshore gas fields and therefore the impacts will be of NEGLIGIBLE significance during the construction phase.

#### *Near Shore*

Within the Near Shore Project Area, where construction activities are focused, there is likely to be disruption of seagrass, coral reefs and some loss of mangrove and estuary areas. These features play critical roles in ecological interrelationships and directly and indirectly support productivity and biodiversity in the Palma Bay area. The implementation of mitigation has helped to reduce the significance of such impacts but the potential remains for bay-scale productivity to be affected.

Pre-mitigation impacts to marine ecology from dredging activities in the Near Shore Project Area have been assessed to be severe, with a number of MAJOR significant impacts being identified. Examples of such impacts include the effects on seagrass, coral and associated biological communities from

increased turbidity in the water column, cutting a trench through coral reef and rock, depositing fine sediment on benthos and modifications to the seabed. The significance of these MAJOR impacts is largely reduced through mitigation. Key mitigation measures include changing the proposed dredging/cutting techniques and avoidance of areas considered particularly sensitive (ie corals along the pipeline route) and measures to reduce turbidity. However, the deposition of fine sediments from dredging activities can inundate seagrass beds and also bury corals or cover them with a veneer of sediment taking considerable time to recover. The re-suspension of sediment and subsequent deposition is unavoidable and subsequent effects to benthos and coral are likely to remain as MAJOR significance post-mitigation.

Dredge material discharged at head of the Afungi Canyon in Palma Bay will smother and possibly result in the death of benthos within the 1km<sup>2</sup> designated placement area. The impact will be of MODERATE significance within dredge placement area itself pre-mitigation, and MINOR post-mitigation. Benthos will however recover within 1-3 years after the cessation of dredging.

The installation of Near Shore infrastructure across the intertidal beaches and extending into the shallow subtidal zone will modify beach structure and dependant ecological processes. This is likely to result in a loss of parts of the productive sand beach and subtidal zones and areas of seagrass meadow. It will allow the establishment of hard substrate communities in the lower intertidal and corals, sponges and associated organisms in the subtidal and may also facilitate colonisation by alien and potentially invasive species. The impacts to the marine biotopes and associated communities within the bay will be MODERATE for the construction and operational phases. With mitigation, including design mitigation, these impacts will be reduced to MINOR significance.

Impacts to fish, whales, dolphins and turtles from noise associated with pile driving in Palma Bay are predicted to be MODERATE significance although the extent of the effects differs among groups. Should a 'soft start' procedure be implemented prior to construction activities when megafauna are present in the bay, the impact will be reduced to MINOR.

If invasive alien species are transferred into Palma Bay via ballast water, effects on biodiversity and marine ecology, including seagrass and corals may be of MODERATE significance. The progressive adoption of developing ballast water control measures and processing techniques as and when sanctioned by IMO will further reduce the likelihood of release of non-indigenous organisms over time. However, due to the high magnitude of the effects that may arise should invasive species become established in northern Mozambique, the significance rating would remain as MODERATE.

Discharges from the proposed desalination and sewage treatment plants as well as from treated produced water and stormwater from the LNG Facility is are likely to have NEGLIGIBLE to MINOR significant impacts on near shore

water quality and marine flora and fauna in Palma Bay prior to mitigation. All impacts from sources of discharge post-mitigation will be NEGLIGIBLE.

The impacts on marine ecology resulting from the loss of the estuary and associated mangrove stand to the east of Afungi Project Site during the construction phase will be of MODERATE significance. The impact will remain as MODERATE significance post-mitigation given the loss of the multi-species mangrove stand.

The establishment of security (exclusion) zones around the LNG Facility and the Near Shore Project infrastructure during construction and operations will displace artisanal fishing effort and locally increase exploitation pressure on the fish community outside of the zones resulting in impacts of MINOR significance. No mitigation measures to help reduce such impacts have been identified.

Discharged solid and liquid wastes from marine vessels during any phase of the Project could potentially result in impacts of MODERATE significance through the proliferation of litter and compromised water quality harming marine organisms, seabirds and biodiversity in Palma Bay. With effective mitigation of waste with appropriate facilities impacts will be reduced to NEGLIGIBLE.

**Table 16.1 Summary of Pre-mitigation Impact Significance and Residual Impact Significance for Offshore and Near Shore Environment**

Assessment Section	Receptor/ Resource	Impact	Project Phase	Pre-Mitigation Impact Significance	Residual Impact Significance
Section 11.4	Offshore benthos and deep water reef organisms	Impact of Discharge of Drill Cuttings and Residual Muds on Offshore Benthos and Deep Water Reef Organisms	Construction	MINOR (benthos)	MINOR (benthos)
				MODERATE (reef organisms)	MINOR (reef organisms)
Section 11.5	Offshore water column, sea bed and marine ecology	Impact of Toxicity Effects on Water Column, Sea Bed and Offshore Marine Ecology from Discharged Drill Cuttings and Residual Muds	Construction	MINOR	NEGLIGIBLE
Section 11.6	Offshore water column, and marine ecology	Impacts of Discharge of Hydrotest Water on Offshore Water Quality and Marine Ecology	Construction	NEGLIGIBLE	NEGLIGIBLE
Section 11.7	Offshore marine ecology	Impacts of Increased Noise, Lighting and Vessel Movements on Offshore Marine Ecology	Construction	NEGLIGIBLE	NEGLIGIBLE
			Operational	(whales) MODERATE	NEGLIGIBLE
Section 11.8	Offshore sea bed	Impacts of Structures Modifying Habitats on the Offshore Sea Bed	Construction	NEGLIGIBLE	NEGLIGIBLE
Section 11.9	Near Shore marine ecology	Impacts of Dredging Induced Turbidity on Near Shore Marine Environment (Seagrass, Coral Reef and Associated Biological Communities)	Construction	MODERATE	MINOR
			Operational	MINOR	MINOR
Section 11.10	Near Shore marine ecology	Impacts of Turbidity Generated from the Cutting of a Trench Through Coral Reef and rock on Near Shore Marine Ecology	Construction	MAJOR	MINOR
Section 11.11	Near Shore marine ecology	Impact of Inundation of Sea Bed and Benthos by Depositing Fine Sediments from Dredging Activities on Near Shore Marine Ecology	Construction	MAJOR	MAJOR
			Operational	MINOR	MINOR
Section 11.12	Near Shore marine ecology	Impact of Dredging Remobilised Contaminants on Near Shore Marine Ecology	Construction	NEGLIGIBLE	NEGLIGIBLE
			Operational	NEGLIGIBLE	NEGLIGIBLE
Section 11.13	Near Shore marine ecology	Impact of Dredging Induced Sea Bed Modification on Near Shore Marine Ecology	Construction	MAJOR	MINOR
Section 11.14	Near Shore marine ecology	Impact of Disposal of Dredge Material at the Head of Canyon on Near Shore Marine Ecology	Construction	MODERATE	MINOR

<b>Assessment Section</b>	<b>Receptor/ Resource</b>	<b>Impact</b>	<b>Project Phase</b>	<b>Pre-Mitigation Impact Significance</b>	<b>Residual Impact Significance</b>
<i>Section 11.15</i>	Near Shore marine ecology	Impact of Modification to Sand Beaches Generated by the Presence of Near Shore Project Infrastructure on Marine Communities	Construction	<b>MODERATE</b>	<b>MINOR</b>
<i>Section 11.16</i>	Near Shore marine ecology	Impact of Construction of Artificial Hard Structures on Near Shore Marine Ecology	Operational	<b>MODERATE</b>	<b>MINOR</b>
			Construction	<b>MODERATE</b>	<b>MINOR</b>
<i>Section 11.17</i>	Near Shore marine ecology	Impact of Project Generated Noise on Marine Organisms in the Near Shore	Operational	<b>MODERATE</b>	<b>MINOR</b>
<i>Section 11.18</i>	Near Shore marine ecology	Impact of Ballast Water Discharges from LNG Carriers and the Introduction of Alien Species on Near Shore Marine Ecology	Construction	<b>MODERATE</b>	<b>MODERATE</b>
			Operational	<b>MODERATE</b>	<b>MODERATE</b>
<i>Section 11.19</i>	Near Shore marine ecology	Impact Of Discharges from Desalination and Sewage Treatment Plants on Near Shore Water Quality And Marine Ecology	Construction	<b>NEGLIGIBLE</b>	<b>NEGLIGIBLE</b>
			Operational	<b>NEGLIGIBLE</b>	<b>NEGLIGIBLE</b>
<i>Section 11.20</i>	Near Shore marine ecology	Impact of the Discharge of Treated Produced Water into the Near Shore on Marine Ecology	Operational	<b>NEGLIGIBLE</b>	<b>NEGLIGIBLE</b>
<i>Section 11.21</i>	Near Shore marine ecology	The Impact of Episodic Stormwater Discharges from the LNG Facility on Near Shore Marine Ecology	Construction	<b>MINOR</b>	<b>NEGLIGIBLE</b>
<i>Section 11.22</i>	Near Shore marine ecology	Impact of Infilling an Estuary on Near Shore Marine Ecology	Operational	<b>MINOR</b>	<b>NEGLIGIBLE</b>
			Construction	<b>MODERATE</b>	<b>MODERATE</b>
<i>Section 11.23</i>	Near Shore marine ecology	Impact of Security/ Exclusion Zones on Fish Distributions in the Near Shore	Construction	<b>MINOR</b>	<b>MINOR</b>
<i>Section 11.24</i>	Near Shore marine ecology	Impact of Ship Operational Discharges on Near Shore Marine Fauna and Seabirds	Operational	<b>MINOR</b>	<b>MINOR</b>
			Construction	<b>MODERATE</b>	<b>NEGLIGIBLE</b>
			Operational	<b>MODERATE</b>	<b>NEGLIGIBLE</b>

### *Summary of Onshore Impacts*

An overview of potential bio-physical impacts resulting from Project activities to the Onshore environment is provided in *Table 16.2* below. The table outlines the pre-mitigation and post-mitigation (or residual) impact significance for each impact assessed in *Chapter 12*. The sections below provide a summary of the key impacts to the following:

- Air Quality;
- Greenhouse Gas Emissions/ Climate Change;
- Noise;
- Landscape, Seascape and Visual;
- Soils;
- Groundwater;
- Surface Water Ecology;
- Vegetation;
- Herpetofauna;
- Avifauna; and
- Mammals.

#### *Air Quality*

Air dispersion modelling undertaken indicates that during the operational phase of the Two-Train LNG Facility, there will be minimal impacts to human and ecological receptors outside the Afungi Project Site from changes to air quality. Impacts to receptors outside of the Afungi Project Site will be of NEGLIGIBLE significance for all pollutants modelled (NO<sub>2</sub>, SO<sub>2</sub>, TSP, PM<sub>10</sub> and PM<sub>2.5</sub>) pre- and post- mitigation with the exception of SO<sub>2</sub> which will be of MINOR significance prior to mitigation and NEGIGIBLE post-mitigation.

However, with the expansion of the LNG Facility to six trains, a potential impact of MODERATE significance may occur from increased levels of SO<sub>2</sub> pre-mitigation. Further consideration of the design of the LNG Facility (in terms of both stack height and turbine technology adopted) is recommended to avoid the potential of exceeding air quality standards during operations of a larger facility.

#### *Greenhouse Gas Emissions/ Climate Change*

Assuming Mozambique's GHG emissions will increase by 8 percent per year (based on World Bank GDP growth figures, see *Chapter 12*), emissions from the Project will increase the country's GHG emissions from 0.4 percent per year up to 10 percent per year, depending on the year and period of development (ie construction or operation). The pre-mitigation impact of the Project on Mozambique's national GHG emissions is likely be of MAJOR significance both during the construction and operational phases of the Project. Given the scale and nature of the Project, while good practice can be employed to reduce the GHG emissions, the overall significance of the impact is not expected to significantly change post-mitigation.

### *Noise*

Noise modelling has shown that during normal construction and operational activities noise levels will remain in compliance with Mozambican and IFC noise limits/standards at Noise Sensitive Receptors at night and during the day. Impacts are therefore predicted to be NEGLIGIBLE to MINOR significance pre-mitigation and similar post mitigation.

### *Landscape, Seascape and Visual*

Project activities during the construction phase, including the movement of vessels in and out of Palma Bay and the presence of highly visible equipment and machinery onshore, are likely to have a visual impact of MODERATE to MAJOR significance on Palma Bay Seascape Unit (ie in the coastal area of Palma Bay, see *Chapter 12*). During the operational phase this impact will increase to MAJOR significance, with the introduction and long term presence of the LNG Facility and associated infrastructure on Afungi Peninsula and within Palma Bay. Further south in the Afungi Peninsula to Cabo Nondo Seascape Unit, visual impacts experienced as a result of the Project will be of MINOR significance during construction and MODERATE during operations.

Visual impacts at a number of viewpoint locations considered to be particularly sensitive to change in the wider area are mainly expected to be of MINOR to MODERATE significance during construction. During operations when Project infrastructure is more visible, significance of visual impacts is likely increase to MODERATE to MAJOR, especially in nearby areas such as Palma town, Maganja and within Palma Bay. However, areas further removed from the Afungi Peninsula (Quiwia and the islands of Tecomaji and Rongui) visual impacts are expected to be of MINOR to MODERATE significance during operations. Vamizi Island and Olumbe are expected to have MINOR to NEGLIGIBLE visual impact during operation due to their distance from the Project.

### *Soils*

Impacts to soil and land capability will be predominantly felt during the construction phase during site clearance activities, and will include soil compaction and topsoil loss, water and wind soil erosion and alteration of natural drainage. Impacts of MODERATE significance will be reduced to MINOR with the implementation of appropriate mitigation measures. Spills or leaks of fuel are likely to have NEGLIGIBLE impacts to soil resources as procedures will be put in place to prevent, contain, clean-up and dispose of any spillage as outlined in *Chapter 12*.

### *Groundwater*

Potential impacts to groundwater will be predominantly felt during the early stage of the construction phase when groundwater will be the only source of water. Groundwater abstraction from the production water supply wells may

result in the lowering of groundwater levels (drawdown) in and around abstraction boreholes; however this is deemed to be of low magnitude potentially having a NEGLIGIBLE impact to community wells in the area adjacent to the production water supply wells. Additionally, water abstraction for Project use may have a NEGLIGIBLE impact on environmental receptors reliant on surface water.

### *Surface Water Ecology*

The loss of wetland and estuarine habitat within Catchments A, B, E and small areas of the aquatic wetlands of Catchment C during the construction phase have been assessed as being of MAJOR significance. This significance rating is due to the loss of the ecological functions provided by the wetlands and of important habitat for species of conservational importance. The reconfiguration of the Project layout will result in a much reduced area of wetland and estuarine habitat lost and this coupled with the additional mitigation proposed will reduce impact significance to MODERATE.

With the implementation of mitigation, all other impacts to wetland and estuarine flora and fauna are predicted to be MINOR, reduced from MODERATE in most instances, with the exception of impacts associated with increased turbidity and changes to sediment patterns. Increased turbidity in the wetland and estuaries is mainly likely to occur during the construction phase from onshore activities (eg removal of vegetation, site levelling, infilling of wetlands) and activities in the near shore (eg dredging). A change in sedimentation patterns may affect connectivity of the wetlands, primary production, benthic invertebrates, fish species etc. Impact significance could potentially be MAJOR <sup>(1)</sup> during this phase of the Project but reduced to MINOR to MODERATE with mitigation.

### *Vegetation*

Much of the existing vegetation within the Afungi Project Site has been altered from its natural state (eg for subsistence agriculture) and fragmented. Site clearance activities during the construction phase are expected to result in further fragmentation and the removal or disturbance of some sensitive vegetation units. Site clearance is expected to result in an impact of MODERATE significance. Given the mitigated Project Footprint layout, the areas of sensitive vegetation units to be lost will be reduced and impact significance is thus reduced to MINOR.

Impacts of MODERATE significance to ecological system functioning may occur from the introduction of undesirable plant species during the construction phase, although with appropriate mitigation outlined in *Chapter 12* such impact will be reduced to NEGLIGIBLE.

(1) Assuming that Catchments A, B and E will be reclaimed based upon the proposed Project Footprint Area, this impact is assessed in terms of Catchments C and D.

### *Herpetofauna*

The impact of site clearance activities, in particular the infilling of wetland areas within the Afungi Project Site will be of MODERATE to MAJOR significance to herpetofauna given the importance of freshwater wetlands in the functionality of their communities. However, the revised Project layout reduces the amount of wetland disturbance and reduces this impact to MINOR significance.

Other impacts to herpetofauna likely to arise during the construction and operational phases of the Project include mortality, disturbance and displacement from the development of access roads and similar linear structures. Changes in water quality of the wetlands within the Afungi Project Site and adjacent areas also present potential impacts of MINOR to MODERATE significance to herpetofauna. These impacts are reduced to NEGLIGIBLE to MINOR post-mitigation as summarised in *Table 16.2*.

The influx of people into the wider area as a result of the Project is expected to put pressure on herpetofauna population density through increased bush fires, killing of herpetofauna individuals, reduced water quality from poor sanitation, subsistence poaching and hunting. Such activities could potentially result in reduced breeding success and depleted local populations and impacts of MAJOR and MODERATE significance during the construction and operational phases respectively. Impacts to areas outside the Project's control are difficult to manage. However with the implementation of proper mitigation, the impact significance will be reduced to MODERATE and MINOR to MODERATE significance.

### *Avifauna*

Areas of important avian sensitivity are largely associated with estuarine salt marshes, freshwater wetlands, large intact forests and the inter-tidal zone and mangrove forests. Five IUCN listed bird species are known to occur within the Afungi Project Site and the loss of such avifaunal habitat is considered MODERATE to MAJOR in significance. However the revision of the Project layout avoids or minimises impact to these sensitive areas. This in conjunction with additional mitigation measures serves to reduce the significance of the impact to MINOR to MODERATE.

Population influx is likely to result in the introduction of domestic animals (livestock and pets) into the area; the introduction of feral animals (dogs and cats) is a likely consequence. Feral animals are likely to prey on avifauna and livestock is likely to reduce habitat quality. As a consequence, avian impacts of MODERATE to MAJOR significance are possible during construction (when workforce is greatest); the impact significance is anticipated to be reducing to MODERATE during operations. With the introduction of mitigation measures, the impact will be reduced to MODERATE and MINOR to MODERATE during the construction and operational phases respectively.

Other impacts to avifauna as assessed in *Chapter 12* are reduced to NEGLIGIBLE to MINOR post-mitigation.

### *Mammals*

Project activities likely to result in impacts of MAJOR significant to mammals are largely associated with site clearance activities. Burrowing mammals, tree dwelling species and smaller mammals are likely to be most affected as they are less able to escape construction equipment or vehicles than larger species. Impacts during the operational phase are likely to be MINOR to MODERATE. However with management through mitigation, impacts are reduced to MINOR significance during both development phases.

The presence of infrastructure including roads, fencing, trenches and pipelines cause loss or fragmentation of mammalian habitat. These may act as deterrents to mammals and have the potential to affect mammalian movements and cause disruption of mammalian migration. Impacts are assessed to be of MODERATE significance during both the construction phase and operational phase of the Project but reduce to MINOR with mitigation.

The most significant potential impacts to mammals remaining following mitigation are the indirect impacts associated with the influx of people into the area. These impacts are likely to be similar to those described for other species above. The various mitigation measures to be implemented by the Project are likely to reduce mammalian impacts to MODERATE during construction and MINOR to MODERATE during operations.

All other impacts to mammals will be reduced to MINOR post-mitigation.

**Table 16.2 Summary of Pre-mitigation Impact Significance and Residual Impact Significance for Onshore Environment**

Assessment Section	Receptor/ Resource	Impact	Project Phase	Pre-Mitigation Impact Significance	Residual Impact Significance
Section 12.2	Air Quality	Operational Phase Air Quality Impacts to Human Receptors	Operational	NEGLIGIBLE to MODERATE	NEGLIGIBLE
Section 12.2	Air Quality	Operational Phase Air Quality Impacts to Ecological Receptors	Operational	NEGLIGIBLE	NEGLIGIBLE
Section 12.3	Greenhouse Gas Emissions/Climate Change	Impact of Project GHG Emissions on Mozambique's National Emissions	Construction	MAJOR	MAJOR
Section 12.4.2	Noise	Impact of Noise from LNG Processing and Shipping on Off-site Noise Sensitive Receptors	Operational	MAJOR	MAJOR
			Construction	NEGLIGIBLE to MINOR	NEGLIGIBLE to MINOR
			Operational	NEGLIGIBLE to MINOR	NEGLIGIBLE to MINOR
Section 12.4.3	Noise	Impact of Noise from the Airstrip on Off-site Noise Sensitive Receptors	Construction	MODERATE	MINOR
Section 12.5.4	Landscape, Seascape and Visual	Impacts of the Project on the Palma Bay Seascape Unit	Operational	MINOR	NEGLIGIBLE
			Construction	-	MODERATE to MAJOR
Section 12.5.5	Landscape, Seascape and Visual	Impacts of the Project on the Wooded Inland Landscape Unit	Operational	-	MAJOR
			Construction	-	NEGLIGIBLE
Section 12.5.6	Landscape, Seascape and Visual	Impacts of the Project on the Quionga to Cabo Delgado Seascape Unit	Operational	-	NEGLIGIBLE
			Construction	-	NEGLIGIBLE
Section 12.5.7	Landscape, Seascape and Visual	Impacts of the Project on the Afungi Peninsula to Cabo Nondo Seascape Unit	Operational	-	NEGLIGIBLE
			Construction	-	MINOR
			Operational	-	MODERATE
Section 12.6.2	Soils	Impact of Site Clearance on Land Capability	Construction	-	NEGLIGIBLE to MODERATE
			Operational	-	NEGLIGIBLE to MAJOR
Section 12.6.3	Soils	Impact of Accidental Spills and Leaks of Fuel or Oil on Soil	Construction	MODERATE	MINOR
			Operational	MINOR	NEGLIGIBLE

<b>Assessment Section</b>	<b>Receptor/ Resource</b>	<b>Impact</b>	<b>Project Phase</b>	<b>Pre-Mitigation Impact Significance</b>	<b>Residual Impact Significance</b>
<i>Section 12.7.2</i>	Groundwater	Impact of Groundwater Abstraction on Community Groundwater Users	Construction	NEGLECTIBLE	NEGLECTIBLE
<i>Section 12.7.3</i>	Groundwater	Impact of Groundwater Abstraction on Surface Water Ecology Receptors	Construction	NEGLECTIBLE	NEGLECTIBLE
<i>Section 12.8.2</i>	Surface Water Ecology	Impact of Site Clearance and the Reclamation of Wetlands (Lacustrine and Estuarine) on Wetland Habitat and Ecological Functions provided by these Wetlands	Construction	<b>MAJOR</b>	<b>MODERATE</b>
<i>Section 12.8.3</i>	Surface Water Ecology	Impact of a Change in Water Quantity and Flow Regime on Wetland Habitat (Lacustrine and Estuarine), Functionality and Aquatic Ecology	Construction	<b>MODERATE</b>	<b>MINOR</b>
<i>Section 12.8.4</i>	Surface Water Ecology	Impact of a Change in Water Quality within the Wetlands (Lacustrine and Estuarine) on Aquatic Ecology	Operational	<b>MODERATE</b>	<b>MINOR</b>
			Construction	<b>MODERATE</b>	<b>MINOR</b>
			Operational	<b>MINOR to MODERATE</b>	<b>MINOR</b>
<i>Section 12.8.5</i>	Surface Water Ecology	Impact of Increased Turbidity and Change in Sedimentation Patterns on Biological Features of Wetlands (Lacustrine and Estuarine)	Construction	<b>MAJOR</b>	<b>MINOR to MODERATE</b>
			Operational	<b>NEGLECTIBLE</b>	<b>NEGLECTIBLE</b>
<i>Section 12.9.2</i>	Vegetation	Impact of Site Clearance on Loss and Fragmentation of Habitats	Construction	<b>MODERATE</b>	<b>MINOR</b>
<i>Section 12.9.3</i>	Vegetation	Impact of Invasion of Undesirable Plant Species on Ecological System Functions	Construction	<b>MODERATE</b>	<b>NEGLECTIBLE</b>
			Operational	<b>NEGLECTIBLE</b>	<b>NEGLECTIBLE</b>
<i>Section 12.10.2</i>	Herpetofauna	Impact of Site Clearance on Sensitive (Areas of High and Medium-High) Herpetofauna Habitat	Construction	<b>MODERATE to MAJOR</b>	<b>MINOR</b>
<i>Section 12.10.3</i>	Herpetofauna	Impacts of Mortality, Displacement and Disturbance of Herpetofauna Species from Project Activities	Construction	<b>MODERATE</b>	<b>MINOR</b>
			Operational	<b>MINOR</b>	<b>NEGLECTIBLE</b>
<i>Section 12.10.4</i>	Herpetofauna	Impact of Water Pollution on Herpetofauna	Construction	<b>MINOR to MODERATE</b>	<b>MINOR</b>
			Operational	<b>MINOR to MODERATE</b>	<b>MINOR</b>
			Operational	<b>MINOR to MODERATE</b>	<b>MINOR</b>
<i>Section 12.10.4</i>	Herpetofauna	Indirect Impacts Related to In-Migration of People on Herpetofauna	Construction	<b>MAJOR</b>	<b>MODERATE</b>

Assessment Section	Receptor/ Resource	Impact	Project Phase	Pre-Mitigation Impact Significance	Residual Impact Significance
Section 12.11.2	Avifauna	Impact of Site Clearance Activities on Sensitive (Areas of High and Medium-High) Avian Habitat	Operational	MODERATE	MINOR to MODERATE
			Construction	MODERATE to MAJOR	MINOR to MODERATE
				MAJOR	
Section 12.11.3	Avifauna	Impact of Project Activities on Sensitive Avian Species through Displacement and Disturbance	Construction	MODERATE	MINOR
			Operational	MINOR to MODERATE	MINOR
Section 12.11.4	Avifauna	Disruption of Flyways and Migration Corridors and Off-Site Avian Habitat from Project Activities	Construction	MINOR	NEGLIGIBLE
Section 12.11.5	Avifauna	Impacts of In-Migration of People on Avifauna	Construction	MODERATE to MAJOR	MODERATE
			Operational	MODERATE	MINOR to MODERATE
Section 12.12.2	Mammals	Impact of Habitat Loss on Mammalian Fauna	Construction	MINOR	MINOR
Section 12.12.3	Mammals	Impact of Site Clearance Activities and Road Traffic on Mammal Species by Direct Mortality and Disturbance	Construction	MAJOR	MINOR
			Operational	MINOR to MODERATE	MINOR
Section 12.12.4	Mammals	Impacts of Habitat Fragmentation and Disruption of Natural Migration Patterns on Mammals	Construction	MODERATE	MINOR
Section 12.12.5	Mammals	Indirect Impacts related to In-Migration of People on Mammals	Operational	MODERATE	MINOR
			Construction	MAJOR	MODERATE
			Operational	MODERATE	MINOR to MODERATE

### *Summary of Socioeconomic Impacts*

An overview of potential impacts to socioeconomic receptors resulting from Project activities is provided in *Table 16.3* below. The table outlines the pre-mitigation and post-mitigation (or residual) impact significance for each impact assessed in *Chapter 13*.

The section below provides a summary of the key impacts to the socioeconomic receptors (ie affected communities, tourism operators, socio-economic infrastructure, community health etc).

#### *Physical and Economic Displacement*

The Project expects that everyone residing within the Afungi Project Site will be permanently displaced resulting in loss of dwellings and infrastructure associated with the household, livelihood activities and community assets within the Afungi Project Site. Access to collective natural areas (eg forests, wooded grassland, flood plains/lowlands, dune shrub vegetation, fruit trees, and coconut plantations) will be permanently lost due to the acquisition of land required for the Project. In addition, fishing and sea-based transportation will be affected by Project activities in Palma Bay during the construction and operational phases of the Project due to increased vessel traffic and safety exclusion zones around Project infrastructure. The impacts associated with physical and economic displacement are expected to be of MAJOR significance both during the construction and operational phases. Following the implementation of the Resettlement Action Plan (RAP), the significance will be reduced to impacts of MODERATE significance.

#### *Tourism*

The tourism establishments situated on the islands of Tecomaji, Rongui and Queramimbi will be affected by the visual and noise impacts resulting from the construction activities as well as the presence of the Project and vessel traffic during the operational phase. The impact associated with the disruption and loss of attraction of tourism destinations is expected to be of MAJOR significance. This will be reduced to MODERATE with the implementation of mitigation measures including the design of facilities to minimise visual intrusion on the tourism receptors and through appropriate ongoing engagement with tourism operators.

The presence of the Project is likely to result in MODERATE positive impacts to tourism resorts as a result of increasing demand for accommodation and use of resorts for leisure purposes during both the construction and operational phases.

#### *Project Related In-migration*

A wide range of direct and indirect negative environmental, social, and economic impacts to the Project's host communities are associated with Project related in-migration, leading to a potential deterioration in the social context

in which the Project's host communities reside. These impacts are likely to be MAJOR. With appropriate mitigation, including engagement and coordination with relevant authorities impact significance will be reduced to MODERATE.

When properly planned, local communities and businesses may experience positive impacts such as access to improved infrastructure, opportunities for employment, improvement in living standards, increased local skills base and local labour pool as well as the development of new markets.

#### *Community Health*

Community health is likely to experience MAJOR significant impacts from the presence of Project workforce, Project related in-migration and diseases brought into the area (such as communicable diseases, vector related diseases and sexually-transmitted infections). Similarly, MAJOR significant impacts to community health may arise indirectly from Project activities or associated with Project related in-migration (such as increased demand on health infrastructure, food and nutrition related issues, accidents and injuries and soil, water and waste related diseases). With the implementation of mitigation measures, most impacts are reduced to MODERATE significance, and some MINOR. During the construction and operational phase, sexually-transmitted infections and high risk sexual practices may remain as MODERATE to MAJOR significance post-mitigation.

Enhancement measures to be implemented will promote community health benefits from the presence of the Project. MODERATE to MAJOR positive impacts on community health are anticipated particularly during the operational phase of the Project.

#### *Economy*

The Project will have a range of positive economic impacts at the local, regional, and national levels, including income growth (linked to employment and procurement opportunities), capacity development and increased government revenue. These will range from MINOR positive to MAJOR positive in significance and occur during both the construction and operational phases of the Project. The Project will implement measures to enhance these economic benefits.

There are high expectations associated with the Project including opportunity for employment and procurement of goods and services locally and regionally and general economic development. A potential negative impact is associated with unmet community expectations regarding these aspects and impact significance is expected to be MODERATE during all Project phases, even with the implementation of mitigation measures.

### *Shipping and Navigation*

Impacts to international maritime traffic and national and regional cabotage will range from NEGLIGIBLE to MODERATE significance from the presence of Project vessels and the designation of exclusions zones around Project infrastructure, construction areas and vessels. All impacts will be reduced to NEGLIGIBLE to MINOR once mitigation measures are implemented.

Commercial fishing activities are expected to experience impacts of MINOR to NEGLIGIBLE significance. These potential impacts will be confined to the construction phase of the Project and are most likely to occur in the deep water offshore. Temporary exclusions zones in the offshore gas field and pipeline corridor may impede access to commercial fishing grounds. Impacts are expected to be NEGLIGIBLE post-mitigation.

### *Archaeology*

Impacts to onshore archaeology and cultural heritage are expected to be of MODERATE significance during site clearance and construction activities. However impacts will be reduced to MINOR significance with the implementation of the proposed mitigation. During the operational phase impacts will be NEGLIGIBLE.

Impacts to offshore archaeology and cultural heritage are expected to be MINOR during the construction and operational phases prior to mitigation and NEGLIGIBLE following the implementation of the mitigation measures.

**Table 16.3** *Summary of Pre-mitigation Impact Significance and Residual Impact Significance for Socioeconomic Environment*

<b>Assessment Section</b>	<b>Receptor/ Resource</b>	<b>Impact</b>	<b>Project Phase</b>	<b>Pre-Mitigation Impact Significance</b>	<b>Residual Impact Significance</b>
<i>Section 13.2.2</i>	Communities to be physically resettled	Loss of Land and Physical Infrastructure	Construction	<b>MAJOR</b>	<b>MODERATE</b>
<i>Section 13.2.3</i>	Communities that lose access to natural resources Communities that lose access to natural resources	Loss of Collective Natural Areas (Communal Natural Resources) Disruption/Loss of Land-based Subsistence Livelihoods	Operational	<b>MAJOR</b>	<b>MODERATE</b>
			Construction	<b>MAJOR</b>	<b>MODERATE</b>
			Construction	<b>MAJOR</b>	<b>MODERATE</b>
			Operational	<b>MAJOR</b>	<b>NEGLIGIBLE (salt pans)</b> <b>MODERATE</b> <b>NEGLIGIBLE (salt pans)</b>
<i>Section 13.2.4</i>	Fishing and sea transportation	Disruption of Marine-Based Economic Livelihoods (excluding Commercial Fishing)	Operational	<b>MAJOR</b>	<b>MODERATE</b>
<i>Section 13.3.1</i>	Tourist operators	Disruption and Loss of Attraction of Tourism Destinations	Construction	<b>MAJOR</b>	<b>MODERATE</b>
			Construction	<b>MAJOR</b>	<b>MODERATE</b>
<i>Section 13.3.2</i>	Tourist operators	Increased Demand for Tourism Facilities (Accommodation and Leisure)	Operational	<b>MAJOR</b>	<b>MODERATE</b>
			Construction	<b>MODERATE (+)</b>	<b>MODERATE (+)</b>
<i>Section 13.4.1</i>	Palma District socio-economic infrastructure	Impacts related to PIIM	Operational All Phases	<b>MODERATE (+)</b> <b>MAJOR</b>	<b>MODERATE (+)</b> <b>MODERATE</b>
<i>Section 13.5.1</i>	Community health	Communicable Diseases Linked to Overcrowding and Poor Environmental/ Socio-Economic Conditions	Construction	<b>MAJOR</b>	<b>MINOR</b>
<i>Section 13.5.2</i>	Community health	Vector Related Diseases	Operational	<b>MAJOR</b>	<b>MODERATE</b>
			Construction	<b>MAJOR</b>	<b>MODERATE</b>
<i>Section 13.5.3</i>	Community health	Soil, Water and Waste related Diseases	Operational	<b>MAJOR</b>	<b>MODERATE</b>
			Construction	<b>MAJOR</b>	<b>MODERATE</b>
<i>Section 13.5.4</i>	Community health	Sexually-transmitted infections and high risk sexual practices, including HIV/aids	Operational	<b>MODERATE</b>	<b>MODERATE</b>
			Construction	<b>MAJOR</b>	<b>MODERATE to MAJOR</b>
<i>Section 13.5.5</i>	Community health	Food and Nutrition-related Issues	Operational	<b>MAJOR</b>	<b>MODERATE to MAJOR</b>
			Construction	<b>MAJOR</b>	<b>MODERATE</b>

<b>Assessment Section</b>	<b>Receptor/ Resource</b>	<b>Impact</b>	<b>Project Phase</b>	<b>Pre-Mitigation Impact Significance</b>	<b>Residual Impact Significance</b>
<i>Section 13.5.6</i>	Community health	Accidents / Injuries	Operational	<b>MAJOR</b>	<b>MAJOR (+)</b>
			Construction	<b>MAJOR</b>	<b>MODERATE</b>
<i>Section 13.5.7</i>	Community health	Social Determinants of Health	Operational	<b>MAJOR</b>	<b>MODERATE</b>
			Construction	<b>MAJOR</b>	<b>MODERATE</b>
<i>Section 13.5.8</i>	Community health	Health Care Services and Infrastructure	Operational	<b>MAJOR</b>	<b>MODERATE (+)</b>
			Construction	<b>MAJOR</b>	<b>MODERATE</b>
			Operational	<b>MAJOR</b>	<b>MODERATE to MAJOR (+)</b>
<i>Section 13.5.9</i>	Community health	Health Programmes and Systems	Construction	<b>MINOR</b>	<b>MINOR</b>
			Operational	<b>MINOR</b>	<b>MODERATE (+)</b>
<i>Section 13.6.1</i>	Mozambique economy	Increased Government Revenue	Construction	<b>MAJOR (+)</b>	<b>MAJOR (+)</b>
			Operational	<b>MAJOR (+)</b>	<b>MAJOR (+)</b>
<i>Section 13.6.2</i>	Local economy	Employment, Training and Skills Development	Construction	<b>MODERATE (+)</b>	<b>MODERATE (+)</b>
			Operational	<b>MODERATE (+)</b>	<b>MINOR (+)</b>
<i>Section 13.6.3</i>	Local economy	Procurement of Local Goods and Services	Construction	<b>MINOR (+)</b>	<b>MODERATE (+)</b>
			Operational	<b>MODERATE (+)</b>	<b>MODERATE (+)</b>
<i>Section 13.6.4</i>	Local communities	Unmet Community Expectations for Employment and Procurement Opportunities	Construction	<b>MODERATE</b>	<b>MODERATE</b>
			Operational	<b>MODERATE</b>	<b>MODERATE</b>
<i>Section 13.6.5</i>	Local economy	Economic Diversification	Construction	<b>MODERATE (+)</b>	<b>MODERATE (+)</b>
			Operational	<b>MODERATE (+)</b>	<b>MODERATE (+)</b>
<i>Section 13.7.1</i>	Maritime traffic	Impact of the Project Vessels and Activity on International Maritime Traffic	Construction	<b>NEGLIGIBLE</b>	<b>NEGLIGIBLE</b>
<i>Section 13.7.2</i>	Commercial fishers	Disruption of Commercial Fishing Activities	Operational	<b>MINOR</b>	<b>MINOR</b>
			Construction	<b>MINOR</b>	<b>NEGLIGIBLE</b>
<i>Section 13.7.3</i>	Maritime traffic	Impact of the Project Vessels and Activity on National and Regional Cabotage	Operational	<b>NEGLIGIBLE</b>	<b>NEGLIGIBLE</b>
			Construction	<b>MODERATE</b>	<b>MINOR</b>
<i>Section 13.8.1</i>	Onshore cultural heritage	Impact of Disturbance of or Damage to Archaeological and Cultural Heritage Sites	Operational	<b>MINOR</b>	<b>MINOR</b>
			Construction	<b>MODERATE</b>	<b>MINOR</b>
<i>Section 13.9.1</i>	Offshore cultural heritage	Impact of Offshore and Near Shore Construction and Operational Activities on Marine Archaeology and Cultural Heritage	Operational	<b>NEGLIGIBLE</b>	<b>NEGLIGIBLE</b>
			Construction	<b>MINOR</b>	<b>NEGLIGIBLE</b>
			Operational	<b>MINOR</b>	<b>NEGLIGIBLE</b>

An unplanned event is defined as 'a reasonably foreseeable event that is not planned to occur as part of the Project, but which may conceivably occur as a result of Project activities (eg accidents), even with a low probability. Unplanned events can occur at any phase of the Project onshore and offshore.

The consideration of unplanned events in *Chapter 14* has focused primarily on the risks of:

- large volume spills of chemicals or hydrocarbons; and
- failure of subsea infrastructure (such as well blowout <sup>(1)</sup> or pipeline failure).

Such events are unlikely to occur, however should large volumes of hydrocarbon spill in the marine environment the potential consequence to biophysical and socioeconomic receptors could be MAJOR. Sensitive habitats (such as corals and mangroves), local communities dependent on fisheries, as well as tourism operators in the vicinity would likely be adversely impacted by such an unplanned event. Impacts associated with the release of large volumes of natural gas in the marine environment (from failure to or damage of subsea infrastructure) will be less significant.

During the FEED process the Project will identify, assess, mitigate and manage health and safety hazards and risks associated with the Project through a Safety Case/ Risk Assessments. The findings of which will inform decisions related to the design and layout of the Project to reduce the likelihood of unplanned events occurring. The representative Emergency Response Plan (ERP) in *Annex H* sets out response and preparedness measures and incorporates an Oil Spill Contingency Plan (OSCP). These measures serve to reduce the likelihood, extent and duration of adverse impacts if an unplanned event occurs.

Vast quantities of natural gas have been discovered in gas fields offshore in the Rovuma Basin. It is likely that a number of Mozambique's offshore natural gas resources will be exploited for gas in the coming years resulting in rapid growth in Cabo Delgado Province as a result of the hydrocarbon industry. The cumulative impacts in the region, both positive and negative, as a result are likely to be significant over the life of the Project and beyond. The following have been considered in *Chapter 15* as 'reasonably defined' future developments that could act together with the Project to cumulatively affect the environment:

(1) A well blowout is an uncontrolled flow of reservoir fluids into the wellbore and sometimes to the surface.

- establishment of an IDZ by the Government of Mozambique in the vicinity of, or incorporating, the Afungi Project Site.
- future phases of exploration and development of hydrocarbon resources by AMA1, eni and others.

Each of these developments alone has the potential to cause positive and negative biophysical and socio-economic impacts. Cumulatively, the developments will result in significant economic development of the Cabo Delgado Province and the country. The primary negative cumulative impacts would result from the gradual transformation of the relatively undeveloped area; impacts associated with ecological functioning of some ecosystems may result.

The establishment of the IDZ may result in direct and indirect environmental and social impacts at the local level, but in the long term, consolidating the Project and other operators within the IDZ will serve to confine impacts to one area and ideally allow for easier management of such impacts. If managed properly, the IDZ could have an overall positive impact on both biophysical resources and on socio-economic receptors at the regional level given that the Mozambican hydrocarbon resources in this region will undoubtedly be developed. Strategic spatial planning by the Government of Mozambique and its agencies at this early stage is important to promote sustainable development in the region.