




# Environmental, Social and Health Impact Assessment in Block 10, São Tomé e Príncipe

*Non-technical Summary*

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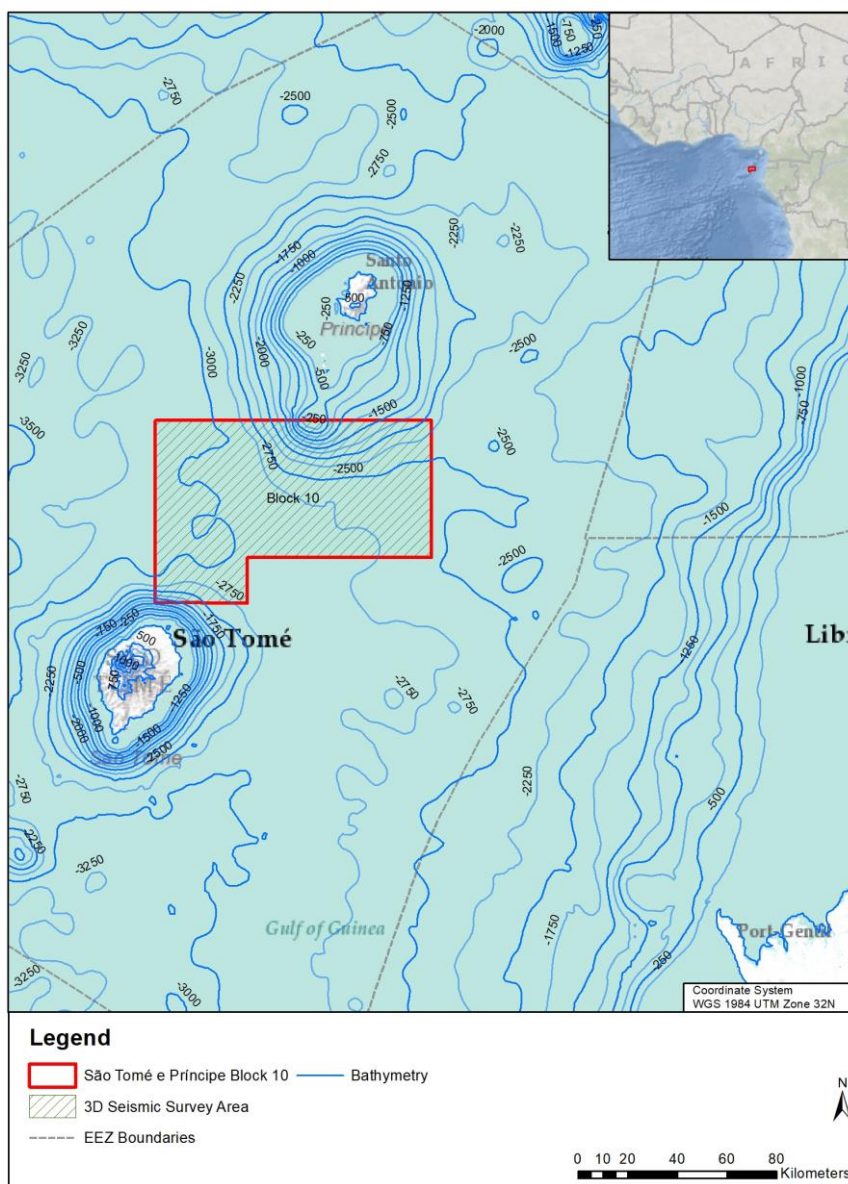
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## NON-TECHNICAL SUMMARY

This document presents the results of the Environmental, Social and Health Impact Assessment (ESHIA) undertaken for the 3-Dimensional (3D) marine seismic survey programme proposed by Kosmos Energy São Tomé e Príncipe and BP Exploration (STP) Ltd (hereafter referred to as “Kosmos” and “BP”) in Block 10, in São Tomé e Príncipe (also referred to as STP in the text). This document has been prepared by *Environmental Resources Management Iberia S.A* (ERM).

The proposed survey area lies approximately 9 km to the north of São Tomé Island, 40 km south of Príncipe Island and approximately 200 km west of Libreville (Gabon), in water depths varying between 190 and 3,150 meters. Kosmos and BP intend to acquire approximately 6,840 full fold km<sup>2</sup> of seismic data (see *Figure 0.1*).

**Figure 0.1** Location of São Tomé e Príncipe Block 10



Source: ERM, 2018

### *Legislation, legal and institutional framework standards*

In São Tomé e Príncipe, the main environmental institution is the Ministry of Infrastructure, Natural Resources and Environment (MINRE). It is the competent body responsible for aspects related to natural resources management, conservation and environment, including environmental management of in-country resources and approval of all sector Environmental Impact Assessments (EIAs).

The Project is compliant with key São Tomean regulations and legislation (e.g. related to environmental, hydrocarbons, emissions and health and safety), as well as international conventions signed by the São Tomé e Príncipe government authorities and international standards (e.g. The global oil and gas industry association for environmental and social issues “IPIECA”, the International Association of Oil and Gas Producers “IOGP” and the International Association of Geophysical Contractors “IAGC” ) relevant to the Project.

### *Project description*

#### *Principles of 3-D seismic survey*

An offshore seismic survey uses a vessel towing underwater acoustic energy sources to generate a low-frequency acoustic signal into the water column, by releasing compressed air bubbles into the water. This acoustic signal, also known as a “seismic pulse”, travels in the water as a sound wave and spreads through the water down to the seabed. The acoustic signal emitted in the column of water penetrates the seabed and is then reflected back by the rock and sediment layers in the sub-surface under the seabed. On its return, it can be recorded using submarine microphones, known as hydrophones, distributed along a set of cables known as streamers that are several kilometres in length towed from the vessel.

The 3-D acquisition technique requires one or more seismic sources and several streamers, placed in parallel and separated across from one another by up to 150m. Given the length of the towed equipment and the need for acquiring seismic data along pre-defined survey lines, the vessel towing this equipment must travel at regular speed, along predefined navigation lines. To make them visible to other vessel and marine users, each streamer is equipped with a tail buoy equipped with a radar reflector and a navigation light. The main survey vessel is supported by two chase vessels, in charge of liaising with third party vessels to reduce the potential for interference between the seismic survey and third party activities. A support/supply vessel is required to replenish the main survey vessel.

### *Schedule*

The proposed 3D seismic exploration survey is scheduled to begin in mid-March 2019. Depending on the equipment configuration and the weather conditions, the expected duration of the survey is approximately 95 days, running an uninterrupted schedule of 24 hours a day and 7 days per week.

### *Operational details on the 3-D seismic survey proposed by Kosmos*

The Project will be conducted following the conventional steps:

- Mobilisation of one seismic vessel, two chase vessels and one support/supply vessel to the Project area;
- Seismic acquisition campaign including the deployment of the seismic equipment (source and streamers) and data acquisition operations; and
- Demobilisation: once the seismic survey is performed, the seismic, chase and support vessels will leave the study area to navigate to their next assignment or back to the port of embarkation. No trace of the survey activity will be left in the study area after demobilisation.

The seismic vessel will navigate at a speed ranging from 4 to 5 knots, towing seismic sources at a depth of approximately 10-30 m. The hydrophones will be placed along 12 to 14 streamers of approximately 8 kilometres in length, also towed by the seismic vessel.

Before the start of the survey, the seismic vessel will berth in a yet-to-be-determined port where crew members and supplies will be taken onboard, and where they will be supplied with fuel, before sailing to the area where the seismic survey will take place. The support vessels will also berth in a yet-to-be determined port.

### *Alternatives to the Project*

3-D seismic acquisition is an essential step in the collection of the necessary geological data for evaluating the prospectively of hydrocarbon presence offshore. The technique and the equipment used for this survey can be considered to be necessary for the acquisition of quality data that will allow proper assessment of the hydrocarbon potential of the São Tomé e Príncipe Block 10. There are no alternatives methods available.

## *Description of the natural and social baseline environment*

### *Climate*

In the Gulf of Guinea, where São Tomé e Príncipe islands are located, the climate is typically equatorial and therefore sees little variation throughout the year with typically persistent high temperatures and frequent spells of high humidity.

The regional climate of São Tomé e Príncipe is driven by the northward and southward migrations of the Inter-Tropical Convergence Zone (ITCZ) associated with the south west monsoon and the Northeast Trade Winds, and leading to two main seasons, dry and wet.

The dry season in São Tomé e Príncipe islands occurs from December to February and from June to September, while the wet season takes place between March and May and from October to November.

Mean annual rainfall ranges from 1,000 mm in the northeast of São Tomé island to more than 4,000 mm in the southwest. Average annual temperatures range from a maximum of 30° to 33°C to a minimum of 18° to 21°C, with little seasonal variation and high humidity all year.

### *Oceanographic conditions*

Water circulation in the Gulf of Guinea is dominated by the Guinea Current that runs parallel to the coast from Senegal to Nigeria and the South Equatorial or Benguela Current that flows northwards along the coasts of Gabon and then turns westward along the equator.

The predominant surface current in Block 10 is therefore the South Equatorial Current (Benguela Current) that flows westwards.

The continental shelf around São Tomé and Príncipe islands is characterized by being very narrow and limited to 5-10 km. The proposed seismic survey area lies in waters where depths vary between approximately 190 m in the southwestern edge of Block 10 and 3,150 m in its easternmost edge.

### *Marine ecological sensitivity*

The proposed seismic survey area in Block 10 is located within the Guinea Current Large Marine Ecosystem (GCLME), characterized by a water column overlying the West African continental shelf which is fed by seasonal upwelling of nutrient rich water, particularly during the rainy seasons as a result of offshore winds. This phenomenon supports high phytoplankton productivity that in turn supports a diverse marine ecosystem and associated fisheries.

The main fish groups encountered in the waters of São Tomé e Príncipe are pelagic and demersal fishes, many of them of commercial interest, as well as

26 species considered to be threatened according to the IUCN red list. The Project area is also important for many migratory species, especially marine mammals, marine turtles and birds.

The waters of São Tomé e Príncipe host up to 27 cetacean species. Three of them are assessed as endangered, the Blue whale (*Balaenoptera musculus*), the fin whale (*Balaenoptera physalus*) and Sei whale (*Balaenoptera borealis*), that could be present along the coasts of São Tomé e Príncipe during their annual migration, mainly in summer and early autumn. The sperm whale (*Physeter macrocephalus*), assessed as vulnerable by the IUCN, is also known to forage in the Gulf of Guinea. The Humpback whale (*Megaptera novaeangliae*) is known to use offshore areas of STP as part of their migration route, and nearshore areas of STP for calving. A baseline study is currently being undertaken by BP to better define the time-window when the Humpback whales arrive and leave. Information available suggests the presence of Humpback whales between July and November of each year.

The Gulf of Guinea serves also as an important migration route, feeding ground, and nesting site for sea turtles, where five species may be observed, all of them assessed as threatened on the IUCN Red list and protected by international agreements and STP legislation. Based on data from the nearby Island of Bioko and monitoring data from local NGOs, green (*Caretta caretta*), olive ridley (*Lepidochelys olivacea*), hawksbill (*Eretmochelys imbricate*), and leatherback (*Dermochelys coriacea*) turtles are considered to nest regularly on Santomean beaches, mainly between October and February; with Green turtles representing the major portion of these seasonal visitors.

Seabirds are abundant over the continental shelf and coastal areas of the islands, as well as in offshore islets where significant breeding populations of birds have been identified.

#### *Fisheries in the Project area*

Fisheries in São Tomé e Príncipe are exploited through artisanal, semi-industrial and industrial fleets. In the region, the fisheries sector provides a major source of protein, employment and foreign currency, and represented 4.7% of national GDP in 2012.

The area where the seismic survey is planned is used by both artisanal and commercial fishing fleets. Industrial fisheries target small pelagics such as the round sardine (*Sardinella aurita*), european anchovy (*Engraulis encrasicolus*) and jacks (*Caranx spp.*) as well as large migratory pelagic fishes such as tuna (*Katsuwonus pelamis*, *Thunnus albacores* and *T. obesus*). Other fisheries present with comparatively less fishing range are semi-industrial and artisanal fisheries that employ outboard motors and can travel up to 60 km offshore. They also capture a range of pelagic species, as well as various demersal fishes.

### Assessment of impacts

The proposed assessment methodology is in line with the ANP-STP 2015 guidelines on “Evaluation of the Environmental Impact Assessment for Offshore Seismic Surveys in the Economic Exclusive Zone (EEZ)” where potential impacts are evaluated in accordance with internationally accepted assessment criteria. Impact significance categories for potential environmental and social impacts are illustrated in *Table 0.2*. Significance is assessed as the combination of magnitude and receptor sensitivity/vulnerability/importance to evaluate whether an impact is, or is not, significant and if so its degree of significance. Potential impacts are then re-assessed against proposed mitigation measures and a residual impact significance is defined.

**Table 0.1**      *Significance matrix*

		Sensitivity / Vulnerability / Importance of Resource/ Receptor		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

Source: ERM, 2012.

The components of the Project taken into account in the assessment are:

- The seismic acquisition vessel and its operations;
- The chase/supply vessels and associated operations;
- Helicopter operations and
- Any non-routine or accidental events.

The main sources of impacts and receptors are summarized in *Table 0.3*.

Table 0.2 Summary of potential sources of impact and potential receptors

		Receptors		Biological							Socio-economical and Health				
		Air Quality and Climate Change	Sea Water Quality	Marine Flora/Plankton	Benthic Communities	Pelagic Fish and Invertebrates	Marine Mammals	Turtles	Seabirds	Protected Areas	Navigation, traffic and sea users	Fisheries	Local Population & Health	Infrastructure, Tourism and Cultural heritage	Ecosystem Services
Sources of Potential impact	<b>Routine activities</b>														
	Atmospheric emissions from Project vessels/helicopter	A1/A2													ES1
	Liquid discharges from project vessels		W1	P1		FA1	FA1	FA1	FA1	PA1			PH1	IT1	ES1
	Solid discharges from project vessels		W1	P1		FA1	FA1	FA1	FA1	PA1			PH1	IT1	ES1
	Underwater sound emissions			P2	B1	F1	M1	T1	SB1			FS2	PH1	IT1	ES1
	Physical presence of Project vessels/helicopter and equipment						FA2	FA2	SB2	PA1	NT1	FS1		IT1	ES1
	Artificial illumination			IL1		IL1	IL1	IL1	IL1	IL1					ES1
	<b>Accidental events</b>														
Hydrocarbon spillage/ discharge		AE1	AE1	AE1	AE1	AE1	AE1	AE1	AE1	AE1	AE1	AE1	AE1	AE1	AE1

A1/A2	Potential impacts on air quality and global warming due to the release of air pollutants	SB1	Potential impacts on seabirds due to the generation of underwater sound emissions
W1	Potential impacts on seawater quality due to the discharge of effluents and waste to the sea	SB2	Potential impacts on seabirds due to helicopter operations
P1	Potential impacts on plankton due to the change of seawater quality due to effluents and waste to the sea	PA1	Potential impacts on protected areas due to the Project activities
P2	Potential impacts on plankton due to the generation of underwater sound emissions	NT1	Potential impacts on Navigation and Traffic / Sea users
B1	Potential impacts on benthic communities derived from the generation of underwater sound emissions	FS1	Potential impacts on Fisheries due to presence of the vessels and seismic acquisition equipment
FA1	Potential impacts on fauna due to the change of seawater quality due to effluents and waste to the sea	FS2	Potential impacts on Fisheries due to the generation of underwater sound emissions
F1	Potential impacts on fish due to the generation of underwater sound emissions	PH1	Potential impacts on the local population and public health
IL1	Potential impacts on fauna due to artificial lighting	IT1	Potential impacts on coastal infrastructure, tourism and cultural heritage
M1	Potential impacts on marine mammals due to the generation of underwater sound emissions	ES1	Potential impacts on Ecosystem Services due to the Project activities
T1	Potential impacts on turtles due to the generation of underwater sound emissions	AE1	Potential impacts due to potential accidental events (hydrocarbon spills)
FA2	Potential impacts on marine fauna due to presence of the vessels and seismic acquisition equipment		

Source: ERM, 2018.



Table 0.4 presents a summary of the significance of impacts without mitigation (i.e. without implementation of mitigation measures, or “pre-mitigation”) and residual impacts (i.e. after implementation of mitigation measures, or “post-mitigation”) resulting from the 3D seismic acquisition survey planned by Kosmos and BP in São Tomé e Príncipe Block 10.

**Table 0.3** *Summary of Residual Impacts*

Receptor	Potential Impact	Impact Significance (pre-mitigation)	Residual Impact (post-mitigation)
<b>Impacts from Routine Activities</b>			
<b>Air Quality</b>	Potential reduction in localized air quality and contribution to greenhouse gases.	<b>Negligible</b>	<b>Negligible</b>
<b>Seawater Quality</b>	Potential localized reduction in water quality, including increased turbidity and biological oxygen demand (BOD).	<b>Minor</b>	<b>Negligible</b>
	Potential introduction of alien invasive species from ballast water discharges.		
<b>Marine Flora</b>	Potential localized increase in organic matter.	<b>Minor</b>	<b>Negligible</b>
<b>Marine Fauna</b>	Potential disturbance to Marine wildlife due to sound emissions (behavior effects, physical impacts from temporary threshold shift (TTS) and potentially permanent threshold shift (PTS).	<i>Marine mammals and Turtles</i>	
		<b>Moderate</b>	<b>Negligible to Minor</b>
		<i>Fish</i>	
		<b>Negligible</b>	<b>Negligible</b>
	<i>Seabirds, invertebrates and plankton</i>		
	<b>Negligible</b>	<b>Negligible</b>	
	Potential disturbance to marine wildlife due to secondary effects from liquid and solid waste discharges on the water column.	<b>Negligible</b>	<b>Negligible</b>
	Potential disturbance to marine wildlife due to collisions with Project vessels/helicopter or with towed array equipment.	<i>Marine mammals and Turtles</i>	
		<b>Moderate</b>	<b>Minor</b>
		<i>Seabirds</i>	
<b>Negligible</b>	<b>Negligible</b>		
Potential disturbance to marine wildlife due to entanglement with towed array equipment	<b>Moderate</b>	<b>Minor</b>	
Potential impacts derived from the use of artificial lighting.	<b>Negligible</b>	<b>Negligible</b>	
<b>Protected Areas</b>	Potential impacts to biodiversity features of coastal protected areas.	<b>Negligible</b>	<b>Negligible</b>
<b>Artisanal and Commercial</b>	Temporary disruption or	<b>Minor to Moderate</b>	<b>Minor</b>

Receptor	Potential Impact	Impact Significance (pre-mitigation)	Residual Impact (post-mitigation)
Fishing	cessation of access to fishing grounds, interference of fishing boats or temporary fishery stock displacement.		
Marine Traffic and Navigation	Project vessel's movements may disrupt maritime traffic in the area.	Minor	Negligible
Local Population	Potential nuisance impacts and local socioeconomic conditions.	Negligible	Negligible (slightly beneficial in some cases)
Coastal Infrastructure, Cultural Heritage and Tourism	Potential impacts and or interference with coastal resources.	Negligible	Negligible
Ecosystem Services	Potential impacts on provisioning, regulating and cultural ecosystem services.	Negligible	Negligible
<b>Event-related impacts</b>			
Impact on water quality	Refueling operations at sea, collisions or vessel maintenance activities leading to accidental oil spills.	Negligible to Severe	Negligible
Impact on marine fauna			
Coastal area impact			

Source: ERM, 2018.

All the impacts from the Project, considering the implementation of mitigation measures were assessed as being *Negligible* or *Minor*. Conclusions on key identified impacts and associated mitigation are summarized as follows:

- **Potential disturbance from i) sound emissions and ii) presence of survey equipment on marine mammals and sea turtles (Negligible to Minor significance)**

The seismic survey is being planned to avoid the period when breeding / mother-calf Humpback whales are present offshore São Tomé e Príncipe and has been designed to reduce overall survey duration and minimization of acoustic energy. Should an overlap between seismic operations and times of sensitivity occur then additional mitigation will be implemented, for example, maximise spatial separation and shut down of seismic source. Additionally, the presence of a Marine Mammal Observer (MMO) on-board together with the installation of Passive Acoustic Monitoring (PAM) on the seismic vessel will ensure the proper application of the ESHIA requirements, including the JNCC guidelines (*Guidelines for minimising the risk of injury to marine mammals from geophysical surveys, 2017*) and the implementation of a 500m mitigation/exclusion zone and soft start procedures, all designed to minimize impacts on marine fauna due to sound emissions, that will reduce the significance of the potential sound impact on sea turtles and on marine mammals to Minor.

The reduction in the support and supply vessel's speed during transits from or to port together with the presence of marine fauna observers on the seismic

vessel will reduce the risk of collision between vessels and marine mammals and turtles. Similarly, the use of turtle exclusion devices will also reduce potential injury from entanglement to turtles.

- **Potential disturbance from the presence and movements of Project vessels on i) fisheries and ii) maritime traffic and navigation (Negligible to Minor significance)**

The Project will notify Naval, Transport and Port authorities, as well as commercial and artisanal fisheries and ferry companies about the seismic survey plans, timing and location of activities, that together with the direct information to other ships through Notice to Mariners and by periodic broadcasts on appropriate communication channels will ensure other marine users are aware of the activities and location of Project vessels. Prior to the start of the survey a Fishery information campaign will be undertaken. In addition, the presence of chase vessels and a Fisheries Liaison Officer will ensure the exclusion area around the seismic vessel is properly maintained and any incident is avoided. Given the presence of two chase vessels, together with the presence of sensitive marine fauna observers, and the mobile nature of the exclusion zone as the seismic vessel advances, the reduction in the risk of residual impacts derived from the physical presence of the seismic vessel and the presence of the exclusion zone on sea users is considered to range between Negligible to Minor.

- **Accidental Hydrocarbon Spill (Negligible to Minor Significance)**

The core mitigation applied during the planning and contractual phase was to use low sulfur Marine Gas Oil (MGO) fuelled vessels and not Heavy Fuel Oil (HFO) with notably higher potential impacts. The most sensitive areas within Block 10 that may be subject to oiling are the Tinhosas Islands Ramsar/IBA<sup>1</sup> site in the North and the São Tomé coastline in the southwest. Thus, offshore refuelling areas will be conducted as far away as practicable from the São Tomé e Príncipe shoreline and recognized sensitive environments. Kosmos will ensure all vessels meet international requirements through contract requirements, and will audit the vessels prior to the beginning of the seismic survey. The seismic acquisition vessel will have a plan and procedures to implement in case of any accidental spillage of hydrocarbons (or other pollutants) at sea (also known as the SOPEP - Shipboard Oil Pollution and Emergency Plan), that meets the requirements of the International Marine Organisation. This plan will be supported by the patrolling of chase vessels which will reduce the possibility of a collision; and Kosmos and BP will ensure that their contracts with Oil Spill Response Ltd are in place and will work with a number of local and government bodies in the unlikely event of a spill event.

Considering the implementation of mitigation measures, the likelihood of a large Diesel spill would be significantly reduced, and should it occur its

<sup>1</sup> Ramsar - site protected by Ramsar Convention (1971), an international treaty aimed at maintaining the ecological status and sustainable use of designated Wetlands of International Importance. IBA - "Important Bird and Biodiversity Areas" as designated by BirdLife International organization.

spatial and temporal consequences limited. The potential impacts on the marine environment of a spill of diesel as a consequence of an unforeseen loss of part of a vessel's fuel inventory are predicted to be Negligible, considering that the loss of the complete inventory would be highly unlikely.

### *Environmental and Social Management Plan*

In this ESHIA, no impacts were identified that could not be minimised to acceptable levels through the application of the proposed mitigation measures detailed in the impact assessment chapter and further described in the project's Environmental and Social Management Plan (ESMP). The ESMP will ensure that all the mitigation measures provided for in the ESHIA are implemented while the Project is carried out, in accordance with the commitments made by Kosmos and BP. The ESMP is to be considered a dynamic document that may be continuously revised as part of an on-going environmental management and improvement process.

The objectives of the ESMP are:

- To provide the mechanism to ensure compliance with STP legislation, Kosmos HSES and BP HSEQ policies, management system and procedures, international law and standards, and Oil & Gas industry best practices;
- To ensure that all the mitigation measures and all the commitments made by Kosmos and BP and identified in the ESHIA report are taken into account during the survey planning and operation phases;
- To provide a framework for mitigating impacts that may be unforeseen or unidentified;
- To establish an environmental surveillance and monitoring programme so that the ESMP can be updated and improved as the survey progresses.

Based on the key identified impacts, specific operational controls and mitigation procedures have been considered for the following environmental and social aspects:

- Sensitive marine fauna protection: In addition to project schedule avoiding the main humpback whale season and its design reducing overall acquisition time and acoustic energy, the project will adopt the Joint Nature Conservation Committee (JNCC, 2017) "*Guidelines for minimising the risk of injury to marine mammals from geophysical surveys*". These guidelines will further protect other marine fauna such as turtles through the use of: marine mammal observers (MMO), visual monitoring and seismic source operation protocols (i.e. soft start, restart procedures) and Passive Acoustic Monitoring (PAM) technologies. In addition the project will include a seismic source shut down procedure if whales enter the established 500 m mitigation zone.
- Oil pollution emergency procedures: in order to ensure effective management of refuelling operations a Shipboard Oil Pollution

Emergency Plan (SOPEP) and Bunkering Procedures will be in place before commencement of operations.

- Waste management procedures: the development of a Waste Management Plan (WMP) in accordance with MARPOL 73/78 (Annex V) and other relevant Conventions and guidelines for the storage, collection and disposal of all identified waste streams, and especially with regards to hazardous substances.
- Liaison with ships (including ferry companies) and fisheries: through an effective communications plan, the Seismic Contractor and Kosmos will implement proposed protocols at the pre-survey stage (information to Fishing and Port authorities and associations) and Fisheries Liaison Officers (FLOs) will implement mitigation during operational stages (chase vessel investigation and warning actions).
- The ESMP further establishes the procedures set forth to effectively implement all proposed actions, relevant information to be communicated and change management procedures when modifications of the ESMP may be warranted.